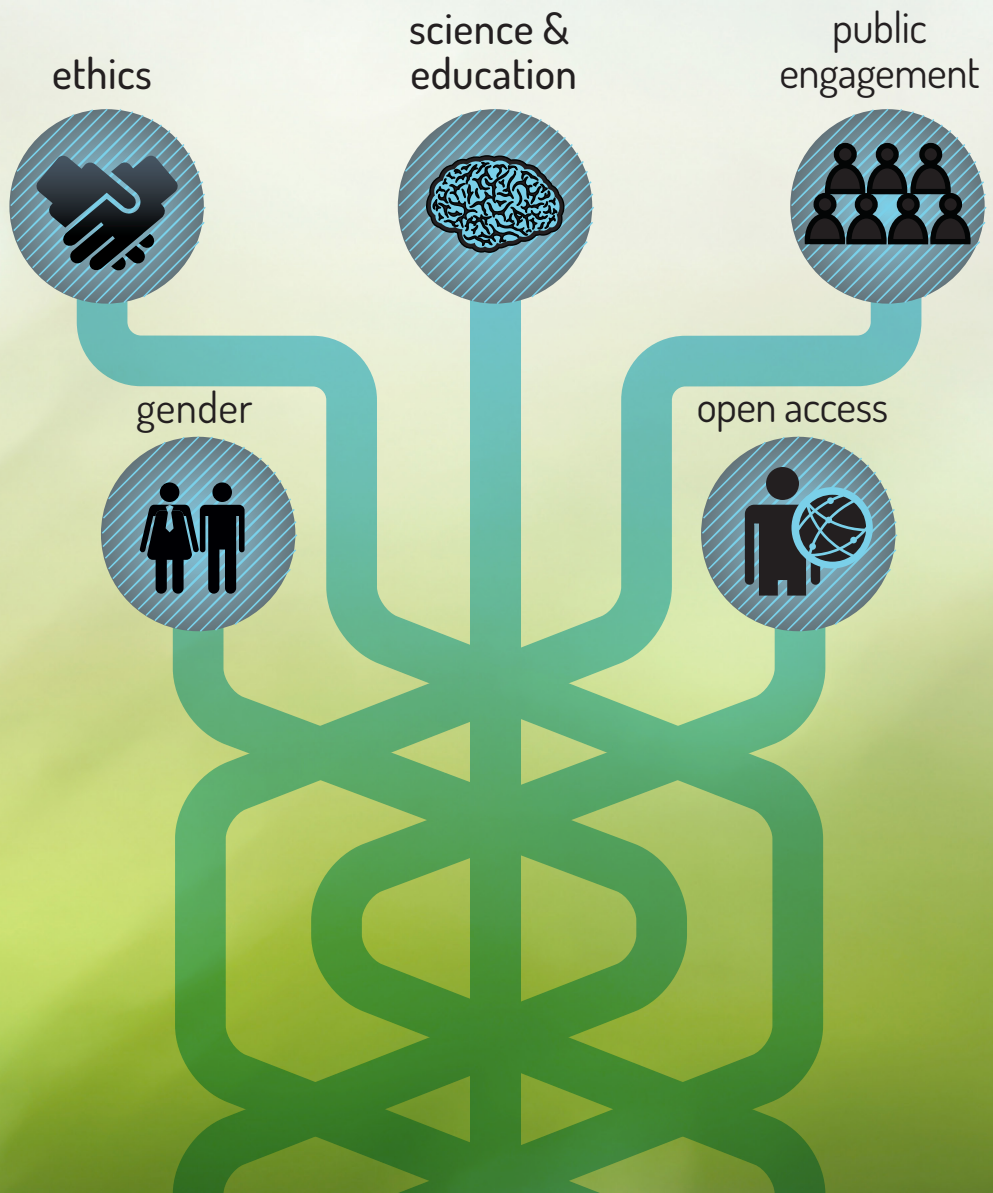
JERRI

JOINING EFFORTS FOR RESPONSIBLE RESEARCH AND INNOVATION

SYNTHESIS ON EXISTING RRI PRACTICES

DELIVERABLE D1.1



JERRI – Joining Efforts for Responsible Research and Innovation

Deliverable D1.1

Synthesis on existing RRI practices

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PURPOSE

As Deliverable 1.1 of the project Joining Efforts for Responsible Research and Innovation (JERRI), this report documents attitudes and practices at the Fraunhofer-Gesellschaft, TNO and other European RTOs that can be attributed to Responsible Research and Innovation (RRI). The identification and analysis of these practices was carried out in Task 1.1 of the JERRI project. The report provides the further work packages with relevant basic information and a common understanding and appraisal of existing RRI-related practices to engage into the next piloting and institutionalisation steps (WPs 2 to 7) at the Fraunhofer-Gesellschaft and TNO.

EXECUTIVE SUMMARY

The project Joining Efforts for Responsible Research and Innovation (JERRI) is orchestrating a deep RRI transition process within the two largest European Research and Technology Organizations (RTOs), the German Fraunhofer-Gesellschaft and the Netherlands Organization for Applied Scientific Research (TNO). The process is conceptualised as an intense mutual learning process between the two organizations, a wider circle of RTOs and Research and Innovation (R&I) stakeholders across Europe.

Intention and structure of this report

As Deliverable 1.1 'Synthesis on existing RRI practices' of the project Joining Efforts for Responsible Research and Innovation (JERRI), this report aims at capturing and comparing the empirical realities of practices related to Responsible Research and Innovation (RRI) at the Fraunhofer-Gesellschaft, TNO and other European RTOs. A particular emphasis is placed on five RRI key dimensions as defined by the EC: Ethics, Gender, Open Access, Public Engagement and Science Education.

Basic conceptual reflections and the analytical framework are described in section 1 'Introduction'. Section 2 'Methodology' outlines the methods used to gather the empirical insights on which the analysis is based. Sections 3, 4 and 5 are dedicated to a structured documentation of RRI-related practices at the Fraunhofer-Gesellschaft, TNO and other European RTOs. In section 6, a cross-organizational synthesis presents commonalities, factors influencing institutional transformation towards RRI, and exemplary good practices; concluding remarks are provided in section 7.

Methodology

Insights were gathered via an analysis of key documents at the focal RTOs, a series of qualitative interviews within the focal RTOs, and workshop discussions at the JERRI kick-off meeting (State of the art meeting). A qualitative analysis of RRI-related aspects was carried out along the categories 'organizational rationale and goals', 'current RRI-related practices' and 'institutionalisation of RRI-related practices', i.e. how practices are actually embedded in the organizations as a whole. To capture all relevant initiatives, organizational functions, guidelines and routines, a broad working definition of responsible research and innovation was used, conceptualising it as a process of aligning the orientation and effects of R&I to societal needs and values.

Results

The analysis of existing RRI-related practices at the Fraunhofer-Gesellschaft, TNO and other European RTOs uncovers several commonalities among the organizations. In each or at least many of the RRI key dimensions Ethics, Gender, Open Access, Public Engagement and Science Education, RTOs already show systematic and coordinated activities. What is more, responsibility is often part of further, older discourses such as sustainability, Corporate Social Responsibility, scientific integrity, or the establishment of organizational codes of conduct. However, individual framings of the key dimensions vary although official definitions exist in many cases, e.g. in written policies. At the Fraunhofer-Gesellschaft and TNO, no organization-wide discourses on the concept of RRI as such can be observed. Moreover, institutionalisation in several areas is lagging behind ambitions.

Some factors seem to facilitate institutional transformations towards RRI in all of the analysed RTOs. Besides organizational rationales, missions and cultures, long-standing experiences with ethics and sustainability increase the receptiveness for RRI-related practices. Single groups or leaders are often decisive to promote RRI-related topics, and indicators such as Key Performance Indicators (KPIs), or indicators applied in monitoring or evaluations can help embedding them in the organization. Looking at the Fraunhofer-Gesellschaft and TNO, several RRI-related 'highlights' are potentially suited for mutual learning, even though their suitability for an adoption by other RTOs remains to be shown. These practices include:

- *Ethics*: Establishment of an Integrity Officer leading and overseeing an integrity programme
- *Gender*: Set-up of an integrated HR management and reporting system; formulation of a diversity action plan, facilitating networks e.g. to connect women in the organization; provision of a female leadership programme
- *Open Access*: Provision of an Open Access repository; provision of comprehensive services to support publication processes
- *Public Engagement*: Places to jointly develop future visions and projects that are open for the public; presentations that can be understood by representatives of the civic society, e. g. argument maps
- *Science Education*: HR marketing instruments to spark the interest of young people in science

DELIVERABLE REPORT

1 Introduction

The objective of the project Joining Efforts for Responsible Research and Innovation (JERRI) is to make a substantial contribution to deeply institutionalising practices and attitudes of Responsible Research and Innovation (RRI) in the European Research Area (ERA)[1]. For this purpose JERRI is orchestrating a deep RRI transition process within the two largest European Research and Technology Organizations (RTOs), the German Fraunhofer-Gesellschaft (in the following called Fraunhofer) and the Netherlands Organization for Applied Scientific Research (TNO) that is covering all five established RRI dimensions. The process is conceptualised as an intense mutual learning process between the two organizations, a wider circle of RTOs and Research and Innovation (R&I) stakeholders across Europe.

As part of Work Package 1 'State of the art', Task 1.1 aimed at identifying and analysing existing good RRI practices at Fraunhofer, TNO as well as in a number of additional European RTOs[2]. As a result of this task, Deliverable 1.1 characterises the state of the art on good RRI practices in the form of a good practices report, consisting of two major parts: A first part describes the RRI state of play at Fraunhofer and TNO from the perspective of the actors involved. A second part documents the insights gained from the analysis of other similar research institutions.

The European Commission (EC) defines RRI as '[…] an approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation, with the aim to foster the design of inclusive and sustainable research and innovation.'[3] RRI is specified and promoted in the Horizon 2020 Work Programme by the following key dimensions (European Commission 2014, 2 f.): Public Engagement, Gender Equality, Science Education, Open Access, Ethics, and RRI Governance.

Following the logic of the JERRI project, this report contains an analysis of RRI-related practices in the focal RTOs along the lines of the first five key dimensions. In line with

1 as set out in the Description of Work

2 as set out in Task 1.1 of the Description of Work

3 https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation

the EC's conceptualisation of the key dimension Governance[4], the intra-organizational governance is addressed as an overarching aspect. Against the background of the above-mentioned formal goals, the scope of this analysis was broadened in two ways: First, not only the structures and organizational behaviours which can be described as 'good practices' for responsible research and responsible innovation were included, but also barriers, pitfalls and challenges to its institutionalisation that exist in the respective RTOs. This provides the JERRI consortium with valuable orientating knowledge to engage in the goal and action plan development (Work Packages 2 to 5). Second, the EC's concept of RRI was broadened for analytical reasons: Allowing the identification of various forms of 'de-facto RRI'[5] in terms of practices that relate to responsible research and innovation but reach beyond the key dimensions or are framed otherwise, the following working definition[6] was used (Lindner, Kuhlmann 2016, p. 22): 'Responsible research and responsible innovation aim at aligning the orientations and effects of R&I to societal needs and values.' Moreover, a special focus was put on the RTOs' individual understanding of responsible research and responsible innovation, as well as of the key dimensions. Accordingly, the basic analytical framework which is also reflected in the interview guideline (cf. section 2 and Annex I), consists of three components:

- The organizational rationale and goals for each dimension
- The current RRI-related practices
- The institutionalisation of these practices, i.e. how they are actually embedded in the organizations as a whole

Results of the analysis will be presented in sections 3 to 6 of this report.

2 Methodology

This section provides information on the methods that were used to gather the relevant data and information for the state of the art analysis.

4 according to one representative from the Directorate General Research & Innovation (DG RTD) who was interviewed as part of this analysis (see section 2)

5 Randles et al. 2016b

6 For further concepts of responsible research and innovation see for example Schomberg 2012; Jacob et al. 2013, p. 78, and Owen et al. 2013.

2.1 Desk research

As one of the primary information sources, desk research was carried out on existing RRI-related documents (e.g. annual reports, official guidelines, etc.) and on further electronically available information. The respective RTO's websites and - in the case of Fraunhofer and TNO - intranets served as main repositories for the information needed. In addition, open web-based searches were carried out. The search process was based on information collected in personal interaction and on iterative searches employing several relevant keywords. This approach ensured that the information available on each aspect of interest could be gathered prior to / form the basis for the respective interviews.

2.2 Interviews

In sum, 42 persons were interviewed in 40 interviews[7] by phone or face-to-face; 14 at Fraunhofer, 18 at TNO and 9 at other European RTOs. In addition, one interview with a representative of the EC's DG RTD was carried out in order to reflect findings against the current RRI discourse at EU institutions. The analysis of practices related to Public Engagement at Fraunhofer drew on further interviews carried out in an earlier case study (Goos, Lindner 2015).

Given the limited resources available for the analysis of the other European RTOs in this Work Package, a comprehensive study of all European RTOs was neither feasible nor desirable. Hence, a set of criteria was established to guide the selection of six to eight RTOs:

- Membership in the European Association of Research and Technology Organizations (EARTO),
- Institutional funding should not exceed 50% of an RTO's overall income,
- Full-time staff should not be lower than 800 employees,
- The RTO should share a common identity and branding.

These criteria were established with the aim to guarantee a certain level of institutional coherence and size across the different organizations. Within these guiding criteria, the actual selection of the RTOs had the objective to capture a broad range of institutional

7 Three interviews were carried out with two interviewees at the same time.

settings and national contexts. The existence of contacts to representatives of RTOs was an additional selection criterion driven by research economical considerations. RTOs that were selected to be included in this analysis are:

- AIRI - Associazione italiana per la ricerca industrial (http://www.airi.it/associazione/contatti/)
- AIT – Austrian Institute of Technology (http://www.ait.ac.at/)
- IJS - Institut 'Jožef Stefan' (https://www.ijs.si/ijsw/V001/JSI)
- SINTEF - Stiftelsen for industriell og teknisk forskning (http://www.sintef.no/en/)
- technalia (http://www.tecnalia.com/en/)
- VITO - Vlaamse Instelling voor Technologisch Onderzoek (https://vito.be/en/about-vito)
- VTT - Teknologian tutkimuskeskus VTT Oy (http://www.vttresearch.com/)

Drawing on the RRI-related concepts provided by the University of Manchester[8], a semi-structured interview guideline (cf. Annex I) was developed to capture additional facts and individual judgements on RRI-related rationales, organizational goals and practices. The guideline served to structure the interviews according to the information needed; at the same time it allows for a 'grounded' logic, i.e. to be open for new information outside the current analytical framing. To make sure results are comparable, similar versions of this guideline were used for all RTOs[9], all comprising the following sections:

- Section 1 'The interviewee and its organizational context', to acquire background information on the interviewee and her / his organizational context, to analyse her / his statements against this background

8 The prior conceptual work on which the guideline relied comprises concepts from the scientific discourse on RRI as well as neo-institutional theories of organizational behaviour, e.g. 'de-facto responsible research and innovation', 'deep institutionalisation', '(de-)institutionalisation and institutional change' and 'institutional entrepreneurship'.

9 Guidelines were translated into the respective languages German, Dutch and English. The guideline used in the interviews at the 'further RTOs' is a slightly modified version of the guideline applied in the interviews with representatives of Fraunhofer and TNO. Given the limited number of interviews per RTO (maximum of two), the modifications were made with the aim to receive insights into as many RRI-related activities as possible.

- Section 2 ‘De-facto responsible research and innovation’, to acquire information on the interviewees’ individual understanding of ‘responsible research’ and ‘responsible innovation’, and how organizations already enact this understanding
- Section 3 ‘RRI practices’, to acquire information on existing RRI practices specific to the respective RRI key dimension
- Section 4 ‘Issues for the institutionalisation of RRI’, to identify the qualities and challenges to RRI institutionalisation within the respective organization

Interviewees at Fraunhofer and TNO were selected according to their responsibilities related to one of the key dimensions, or related to responsible research and responsible innovation in general. For the selection of Fraunhofer interviewees, a ‘snowball system’ was applied; i.e. interviewees were identified by the help of previous interviewees, in order to discover additional relevant persons which – given the size of the organization – wouldn’t have been identified otherwise. At TNO, most of the key dimensions are dealt within the working groups/steering committees (Integrity Committee, Diversity Committee, the Steering Committee for Corporate Social Responsibility, and the Open Access Working Group, cf. section 4). In consultation with these working groups an initial ‘long list’ of 25 interviewees was drawn up, from which 18 were actually selected. After the selection of the other RTOs in seven different European countries, individual representatives of these institutions were identified to be interviewed. Names of potential interviewees were collected from different sources, including suggestions from members of the research team, colleagues, own contacts and institutional websites. After first contacts with interviewees were made, they were asked to nominate additional potential interviewees within their organizations. Due to various reasons on the side of the RTOs, only one interview per organization was conducted with representatives of AIRI, IJS, and VTT. Despite several attempts, no interview could be arranged with a representative of SINTEF.

The final selection of interviewees consists of 22 female (10 at Fraunhofer, 8 at TNO, and 4 at the other RTOs) and 20 male (4 at Fraunhofer, 10 at TNO, 5 at the other RTOs, and one at EC DG RTD) persons. Besides the typical biases in qualitative interviews (cf. (Gläser, Laudel 2009), especially the interviews carried out at Fraunhofer should be interpreted in the light of a possible ‘centrality bias’, i. e. as many interviewees hold central functions, their perspective on the degree of actual institutionalisation may overweigh in the final analysis.

Interviewees were approached between June and October 2016, and performed from July to October 2016. Interviews were either carried out by phone or – where judged economical – face-to-face. Interviews were recorded (in two cases not successful) and notes were taken. In one case, the interview responses were returned in writing due to personal circumstances of the interviewee. Audiotapes were used to extract the relevant information and word by word transcriptions[10] of quotes into a set of excel-based tables. This raw data feeds into Task 1.2 'Deep institutionalisation of RRI' as well. At TNO, the findings (i.e. this report) from the interviews were sent to the individual working groups/committees for approval and consent. Findings from the interviews at other RTOs are complemented by prior desk research analysing RRI-related policies of the 97 members of EARTO (see Annex II).[11]

2.3 Group work at the JERRI State of the art meeting

Intermediate results on the RTOs' state of the art were summarised in a briefing document that was sent to the participants of the JERRI State of the art meeting. The meeting took place on September 29th, 2016 at the Fraunhofer Institute for Systems and Innovation Research ISI in Karlsruhe, and comprised 22 participants from the JERRI consortium institutions and the EC. At the meeting, intermediate results related to the key dimensions were discussed and commented on in group work. Results of this group work were included in this report as well. Going well beyond the scope of Work Package 1 'State of the art', RRI-related long-term issues at Fraunhofer and TNO, and issues to be tackled in the course of the project were identified as well.

3 Fraunhofer-Gesellschaft

Instead of providing comprehensive and detailed information on Fraunhofer's departments, institutes and activities, this section highlights the characteristics considered to be relevant in order to understand the RRI-related practices and attitudes at Fraunhofer identified in Work Package 1.

10 According to the EU directive on data protection, all information was made anonymous. For more information on how JERRI complies with the protection of personal data cf. Deliverable D12.2 POPD – Requirement No 2.

11 http://www.earto.eu/about-earto/list-of-members.html. The systematic desk research on these RTOs was conducted by Anne Joignant, TNO.

3.1 The Fraunhofer-Gesellschaft: Basic organizational facts

The Fraunhofer-Gesellschaft was founded in 1949. With a staff of 24.000 and 67 institutes and research units, Fraunhofer is Europe's largest RTO today[12]. Fraunhofer covers a very broad range of research fields, namely Health and Environment, Security and Protection, Mobility and Transport, Production and Supply of Services, Communication and Knowledge, Energy and Resources. Besides the multitude of technology-oriented institutes, some few are carrying out socio-economic research as well (GWK 2016, 248 f.).

Via its headquarters, the organization holds several line functions[13] (cf. Figure 1) whose purpose is to provide an efficient strategic orientation and administrative support. Institutes are organized in seven thematic working alliances ('groups'). Together with the Executive Board, the chairmen of these alliances form the Presidential Council, which decides upon the organization's business strategy. The Senate appoints the Executive Board and decides upon Fraunhofer's basic science and research policy. It 'is made up of eminent figures from the world of science, business, industry, and public life, plus representatives of national and regional government, and members of the Scientific and Technical Council.'[14]. The Scientific and Technical Advisory Board, consisting of directors and senior management of the institutes, as well as one staff representative of each institute, provides advice with regard to research and human resources policy.

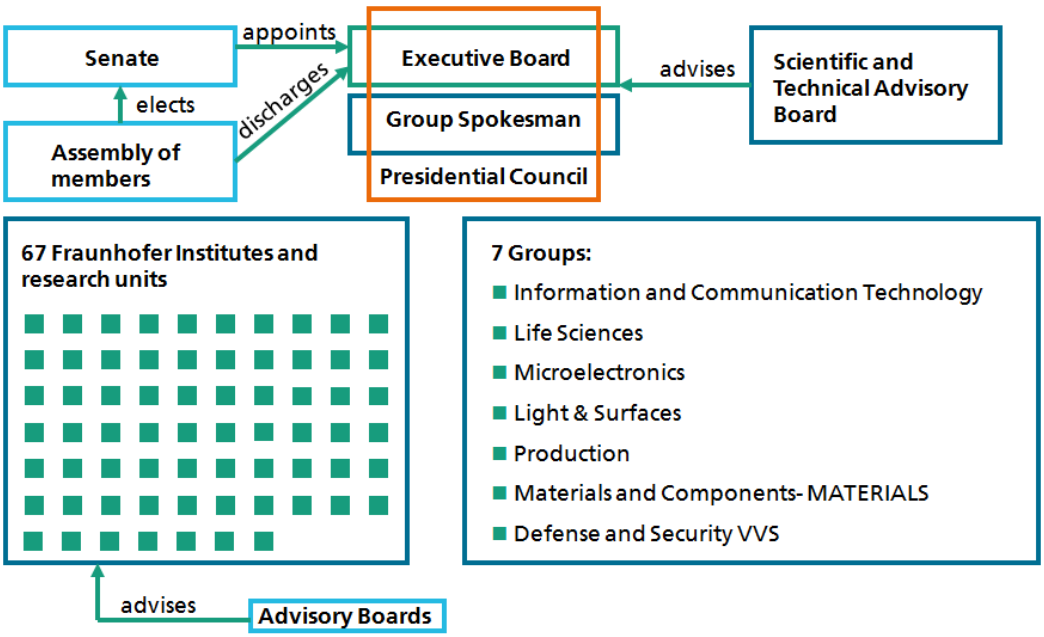
Besides the sheer size of its organization, further characteristics that seem particularly relevant to understand Fraunhofer's existing RRI-related engagement are (1) the high share of contract research, (2) the mission to benefit society and (3) the decentralised organizational structure.

12 https://www.fraunhofer.de/en/about-fraunhofer.html

13 https://www.fraunhofer.de/en/about-fraunhofer/structure-organization.html

14 https://www.fraunhofer.de/en/about-fraunhofer/structure-organization/fraunhofer-senate.html

Figure 1: Structure and organization of the Fraunhofer-Gesellschaft



- *Contract research*: Organic growth has recently been strongest in the area of contract research. Of the annual research budget of over 2.1 billion euro, more than 1.8 billion euro derives from contract research (GWK 2016). Contract research at Fraunhofer can be split into two categories[15]:
    - research conducted under contract to customers in industry and the service sector
    - publicly financed research projects
- *Mission to benefit society*: Listed in the official register of non-profit organizations (Fraunhofer-Gesellschaft 2010, 2016a, 2016a, p. 25), Fraunhofer states in its mission that, with its applied research, it 'transform[s] original ideas into innovations that *benefit society* and strengthen both the German and the European economy'[16].
- *Decentralised organizational structure*: As the 67 institutes are the place where Fraunhofer actually carries out its research, and as they account for the lion's share of the Fraunhofer staff, the organization can be characterised as being

15 https://www.fraunhofer.de/en/about-fraunhofer/profile/facts-and-figures.html

16 https://www.fraunhofer.de/en/about-fraunhofer/profile/guiding-principles.html

highly decentralised. As Fraunhofer states on its website: ‘An undertaking of this size and significance needs a decentralized organizational structure […]’[17].

3.2 Responsible research and responsible innovation at Fraunhofer

Against the background of the above-mentioned working definition of responsible research and responsible innovation, responsibility in terms of aligning research and innovation to societal needs and values is part of the organization’s self-concept. This becomes not only apparent in the mission statement (see above). The notion of ‘responsibility’ itself can also be found in Fraunhofer’s official statement on Corporate Social Responsibility[18]. In this statement, the ‘principle of responsibility’ is related to the interaction with customers and cooperation partners, staff and suppliers, and to all hierarchical levels. The statement emphasises that Fraunhofer develops systemic solutions as a reaction to societal challenges, thereby taking over a transfer function in the German research system. Moreover, ‘Corporate Responsibility’ is attributed to a staff-oriented HR policy, economical use of resources, environment protection, societal engagement ‘in the region’, and compliance to social and environmental standards in the supply chain. As the official EC definition of RRI, the alignment of research to society is central to this understanding of responsibility. The main difference is that several values are already specified rather than relating to the different fields of action (such as the key dimensions) in which this alignment is expected to take place.

Besides this statement, the notion of responsibility can be found in the Fraunhofer Guiding Principles as well:

> ‘Through our research we contribute to the sustainable development of an ecologically sound environment, and an economically successful and socially balanced world. We are strongly committed to this ***responsibility***.’[19]

The most recent statement on responsibility can be found in the Fraunhofer Code of Conduct. Under the heading of ‘social responsibility’, three fields of responsibility are mentioned:

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17 https://www.fraunhofer.de/en/about-fraunhofer.html

18 https://www.fraunhofer.de/de/ueber-fraunhofer/profil-selbstverstaendnis/corporate-responsibility.html

19 https://www.fraunhofer.de/en/about-fraunhofer/profile/guiding-principles.html

- *Scientific responsibility and ethics*: 'We are aware of our responsibility in dealing with freedom of research and research risks and therefore encourage the responsible handling of research. We participate actively in political and social discussions concerning scientific fields in which we operate or to which we can contribute with our expertise.' (Fraunhofer-Gesellschaft 2016a, p. 23)
- *Responsibility for the environment*: 'We adhere to the requirements for environmental protection and support the pursuit of the sustainable design of society, the economy and the environment. We contribute to these objectives by means of the responsible implementation of new technologies as well as through research and studies for public contracting authorities.' (Fraunhofer-Gesellschaft 2016a, p. 24)
- *Responsibility with respect to financial resources*: 'As beneficiaries, we are subject to strict financial legal constraints and the prohibition of favouritism (Besserstellungsverbot). We comply with the requirement concerning the economic and efficient use of funds. We handle our resources carefully and economically.' (Fraunhofer-Gesellschaft 2016a, p. 26)

As already observed by Goos, Lindner 2015, no organization-wide elaborated discourse about responsible behaviour at Fraunhofer has been established yet. This seems to be confirmed by the very diverse individual perceptions of interviewees as to the question of what is actually meant by responsibility: Interestingly, responsibility is very often attributed to different qualities of research itself rather than to its effects: For some interviewees, it meant delivering high quality to customers, others defined it primarily as complying with the principles of good scientific conduct. With the exception of 'ethics', interviewees wouldn't have thought of the RRI key dimensions before. Responsible research and responsible innovation in terms of 'ethics' is often associated with the setting of ethical boundaries, e. g. avoiding harm to humans or the environment. Nevertheless, the official RRI concept with its key dimensions seems reasonable to interviewees, some stated that it broadens their initial perspectives.

Decision makers seem to be increasingly aware of RRI (Goos, Lindner 2015), but at the level of Fraunhofer as a whole and at the level of single institutes there are hardly any systematic activities on RRI as such so far. One exception can be found in the Fraunhofer Center for Responsible Research and Innovation (CeRRI), attached to Fraunhofer IAO, which is particularly active in the development of new approaches for Societal Engagement, but also in the Gender dimension (see sections 3.3.2 and 3.3.4). With regard to the alignment of research to societal needs and values, however,

several single projects and initiatives can be observed: At both headquarters and institute level, Fraunhofer engages in a strategic exchange with representatives of society, in dialogues with citizens (such as an online-survey on Big Data by Fraunhofer SIT), or in the preservation of cultural heritage (GWK 2016, p. 286) (for more examples see section 3.3.4). Activities in the field of sustainability have many facets (cf. the Sustainability Report 2015, (Fraunhofer-Gesellschaft 2016b); an example can be found in the Sustainability Centre Freiburg[20]. Beyond these kinds of engagement, various activities on single aspects that can be attributed to one or several of the RRI key dimensions can be identified (cf. section 3.3). Top-down processes and decentralised initiatives are yet to be brought together in a comprehensive manner.

3.3 State of the art on RRI-related practices at Fraunhofer

3.3.1. Key dimension 'Ethics' at Fraunhofer

Ethics rationale and goals at Fraunhofer

The RRI dimension *ethics* differs a lot from the other four RRI dimensions, therefore it is necessary to start with a clarification of the broader context in order to understand the Fraunhofer situation concerning RRI-ethics.

The ethics rationale is probably the most underdetermined of the RRI dimensions. That is because ethics as a discipline or discourse of values and conventionalities deals with different concepts of responsibility and their justifications and effects among many other topics. As an RRI dimension ethics is grasped as a sub-perspective of a (research and innovation) responsibility framework. This seems like a Möbius strip or a Klein bottle where one entity (dimension, side/surface) is simultaneously both the outside and the inside of the figure. That is to say: RRI – as a responsibility concept where *do's and don'ts*, values and restraints of research and innovation are negotiated – is part of the general ethical endeavour of answering the 'What should I do?' question. In the RRI context ethics was grasped as one of five sub-dimensions, whereas RRI again is a subtopic of the general ethical endeavour; thus it seems as if ethics were a subcategory of responsibility whereas it is philosophical consent that responsibility is a subcategory of ethics (what was to be demonstrated: *ethics of responsibility*).

20 http://www.leistungszentrum-nachhaltigkeit.de/en/

This explains partly the confusingly varying understandings of 'ethics' in the context of RRI. 'Is it right to exclude certain groups from accessing scientific data and results?' 'Should I pay women the same salary as men for the same work?' 'Should I allocate more resources to scientific education, defence research, or pensions?' 'Should I engage non-researchers in scientific processes and why?' These and many other questions in the RRI discourse are genuinely ethical questions, yet following the RRI concept they would be addressed in the dimensions *Open Access*, *gender equality*, *science education* or *social engagement*.

A rising interest and need awareness of explicit ethical considerations with a focus on handling security-relevant research can be seen in the last years especially at institutions like Max-Planck-Gesellschaft[21], Deutsche Forschungsgemeinschaft DFG[22], Leopoldina[23] and many others that call for an active positioning of Fraunhofer as well. Figure 2 shows a structural analysis of several ethics guidelines[24] with typical attempts to link several types of responsibility, values and principles (including value trade-offs and conflicts), competences and negative outcomes of conduct within an ethical framework.

A deeper analysis of this content cannot be provided here but several aspects can be briefly highlighted. All the guidelines directly or indirectly come to 'universal moral principles' or 'important goods' that form the basis for ethical judgement – alas: there is no generally agreed catalogue of such basic 'universal' values and principles. That is why there are trade-offs and conflicts about the orienting axiology. Some guidelines position themselves ranking humans higher than nature, human rights higher than benefits, public interests higher than individual ones etc..

A crucial aspect is that responsibility depends on competence and knowledge of the research matters as well as of ethical matters. A great variety of responsibility concepts is mentioned and enabling the individuals' ethical competence falls under the duty of institutional responsibility.

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21 https://www.mpg.de/en

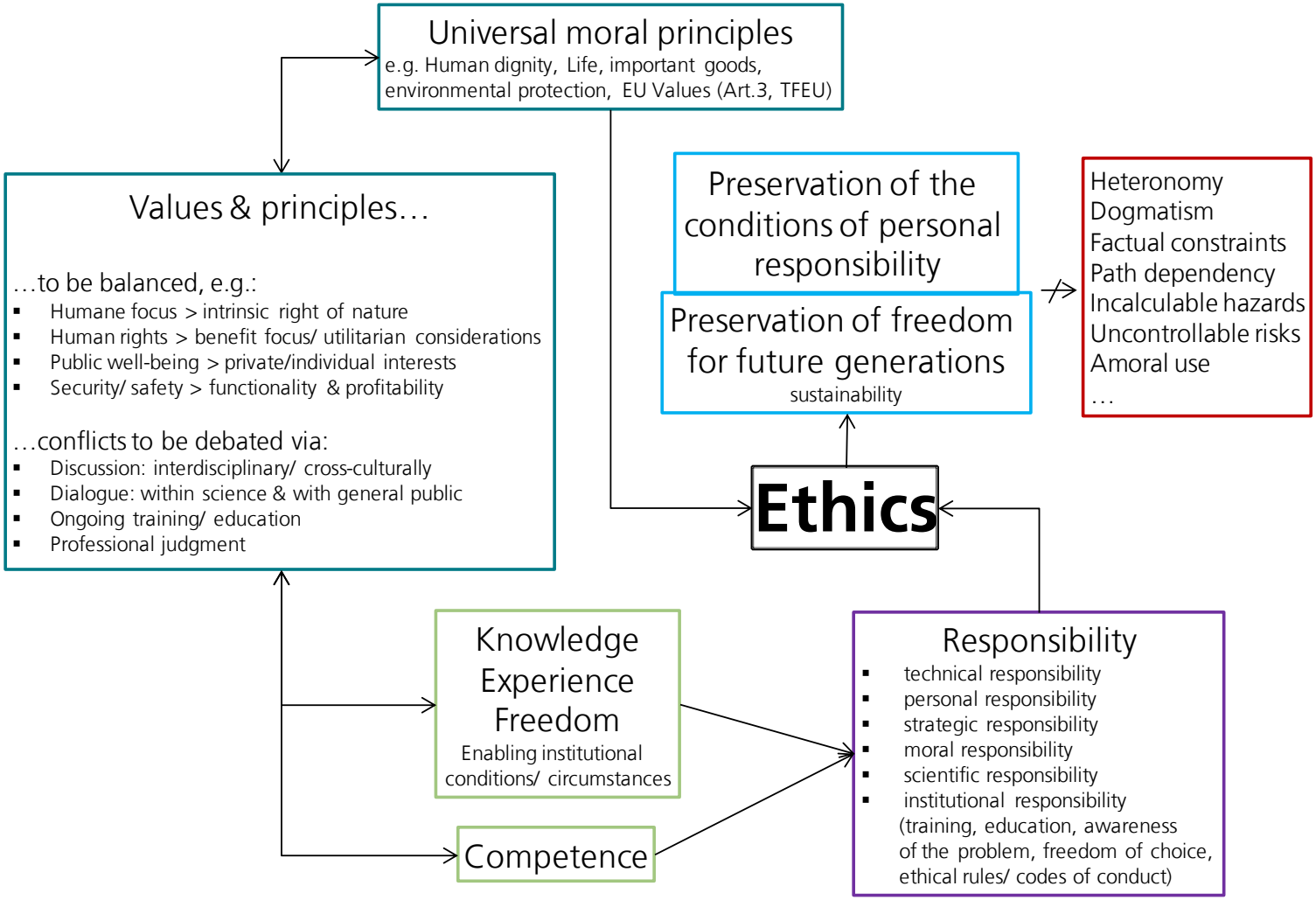
22 http://www.dfg.de/en

23 https://www.leopoldina.org/en

24 The following guidelines were taken into consideration: VDI 2002; Deutsche Forschungsgemeinschaft, Deutsche Akademie der Naturforscher Leopoldina e.V. 2014; Bundesärztekammer 1994-2013; Social Research Association 2003; Gesellschaft für Informatik e. V. 2015)

In short: Ethical research and innovation practices are a) based on basic debatable values and principles, b) addressed towards the preservation of freedom for future generations and the preservation of the conditions of personal responsibility, c) thus avoiding heteronomy, path dependencies etc., and d) have to be conducted by individuals that are free and experienced but rely on institutional support and enabling.

Figure 2: Ethics Guidlines Overview



It comes as no surprise that the ethics dimension unlike the other RRI dimensions is not explicitly developed at Fraunhofer, apart from rather special codes of conduct that have ethical foundations[25] like *export control* or *principles of cooperation*. Perspectives on an ethical rationale can be found, for instance, in the Guiding Principles of Fraunhofer (see also section 3.2). Mission, vision and guiding principles of Fraunhofer refer only to *environmental sustainability* and *social balance*. Apart from these two statements there is no reference to ethical considerations. Among the Principles of Cooperation only one refers to responsibility and ethics and tackles *environment protection* (again), *freedom of research,* and *responsible handling of research.*

The four Principles of Cooperation are:

1) Respect and fairness in dealing with business partners
2) Respect and fairness in dealing with employees
3) Quality and professionalism in performance and cooperation
4) Social responsibility

One subtopic of *Social responsibility* says: '*Scientific responsibility and ethics*: We are aware of our responsibility in dealing with freedom of research and research risks and therefore encourage the responsible handling of research. We participate actively in political and social discussions concerning scientific fields in which we operate or to which we can contribute with our expertise.' (Fraunhofer-Gesellschaft 2016c, p. 8)

Ethics practices at Fraunhofer

At Fraunhofer ethics is implicitly present in the mission, vision, principles, and guidelines but not explicitly tackled as a Fraunhofer wide topic. Ethical aspects are currently mainly addressed in terms of legality, transparency and fairness but do not yet play a prominent role in Fraunhofer research practices or planning.

External ethics councils: Fraunhofer Institutes regularly consult external ethics councils according to their needs and topics – especially in medical research, animal experimentation and/or defence research.

Ethics helpline: The Fraunhofer Headquarters offer an ethics helpline (mail and phone) that can be anonymously used for ethical advice or further engagement.

25 The ethical foundations are among others like profitability or security, which are rationalized in turn by basic ethical considerations like human dignity, personal integrity, or equality.

There are some planned and starting initiatives at Fraunhofer[26], e.g. *Awareness rising for ethical responsibility* of every single employee; a) integration of 'Scientific responsibility and ethics' in selected training programs, b) internal communication and sensitisation measures and counselling services c) integration of ethical considerations in selected 'Internal Founding Programs' (2017/18).

Institutionalisation of 'Ethics' at Fraunhofer

Executive Board, *Headquarter and institutes*: The Presidential Council authorised 2014 some representatives in the headquarters with the development of an action plan for Fraunhofer to foster discourse on ethical considerations and thereby raise the attention on ethics. Since 2016 ethics is an explicit issue of the Executive Board for certain research fields, thus contributing to ethical considerations for organization-wide initiatives or decisions. Exemplary projects and processes are designed for the next years to demonstrate the integration of ethical considerations beyond statutory norms – as broader experience for a successful implementation is still needed.

On the other hand some institutes with special needs are solving their partial ethical problems (e.g. with external medical ethics councils) but ethical considerations are not a main issue in any institute. However, EU obligatory ethics deliverables, ELSI (Ethical, Legal and Social Implications), focus in many national funding agencies and ministries and pioneering activities within other German research organizations (esp. DFG and Leopoldina) lead to increased awareness and higher acceptance of ethical considerations within some Fraunhofer Institutes, parts of the headquarters and of the Executive Board. Fraunhofer internal processes, such as a Fraunhofer-wide online dialogue for the formulation of the Guiding Principles, or employee surveys support this development.

Guidelines and starting activities: Concerning responsibility there are several statements and guidelines and initiated processes provided by the headquarters[27] (see also section 3.2), yet their promotion and integration into everyday Fraunhofer research is hardly realized.

26https://www.fraunhofer.de/de/ueber-fraunhofer/profil-selbstverstaendnis/nachhaltigkeitsbericht-2015/verantwortung/ethik-und-wissenschaftsverantwortung.html

27 Guiding Principles, Ethics and Scientific Responsibility, Compliance and Code of Conduct, Scientific Integrity

Some quotes from the interviews may illustrate nonetheless a basic diagnosis for Fraunhofer concerning the role and weight of ethics: There is no significant institutionalisation of ethical consideration in the current Fraunhofer structures.

> 'We are just beginning and still struggling. Concerning ethics Fraunhofer for sure is not exemplary.'

> 'Concerning gender and education we are doing fairly well at Fraunhofer, other than that not so much. [...] We need a shift in the basic mindsets, maybe by integrating ethical education in engineering classes. And then we need from the institutional side open structures that allow for that new mindset to be lived.'

> 'Fraunhofer has rising problem awareness. However, the central commitment [meaning in the Executive Board] would need a broad response within the institutes – which is not the case now as an institutional understanding of 'ethics" is not yet established.'

3.3.2. Key dimension 'Gender'[28] at Fraunhofer

Gender rationale and goals at Fraunhofer

Within Fraunhofer, two different functions that are dealing with gender-related issues widely shape the meaning of 'gender' in the work context at Fraunhofer: The Equal Rights Officers (Beauftragte für Chancengleichheit, BfC) that are elected at / for each institute, and the diversity management as a function of the central human resources development. In line with these functions, interviewees state that gender at Fraunhofer is mainly understood as either 'gender equality', or as one of several dimensions of diversity among the Fraunhofer staff.

The policy of equal opportunities of Fraunhofer '[...] is committed to a policy of equal opportunities for men and women, and supports efforts to create an equitable work life balance. […] [It] is committed to bringing more women into applied research. It aims to increase the proportion of female scientists in all areas where they are currently underrepresented.'[29] The policy supports all personal, organizational and social measures concerning (1) equal rights of women and men, (2) reconciliation of work and

28 Following an open conceptual approach, the state of the art analysis referred not only on equality-related issues, as the official RRI key dimension 'Gender Equality' might suggest.

29 https://www.fraunhofer.de/en/jobs-and-career/equal-opportunities.html

private life, and (3) the protection against sexual harassment at the workplace[30]. These efforts are closely linked to the Fraunhofer Diversity Management, which Fraunhofer defines as follows:

> ‘Fraunhofer research teams are composed of a well-balanced mix of members. This enables them to exploit the creative potential of both sexes and a variety of different age groups, cultural backgrounds and scientific disciplines, and thus improve the quality of their results.’[31]

The interview series carried out at Fraunhofer did not allow identifying additional or different dimensions in the definitions of what gender at Fraunhofer is or should be in a comprehensive manner. According to one interviewee, the gender topic should not only be reduced to questions of equality. Moreover, another interviewee states that it is important not to lapse into dichotomies such as 'What do men need?' versus 'What do women need?‘ but to focus on the question of 'What do individuals need?‘ instead.

Gender practices at Fraunhofer

Over the last years, the central human resource management of Fraunhofer has gradually increased its efforts for gender equality in the Fraunhofer career system[32]. In 2012, Fraunhofer launched a strategic project in order to establish an integrated HR management and reporting system, covering gender-related aspects as well. In this context, staff surveys were carried out and requirements were analysed in an internal project[33].

The Fraunhofer HR management, and its diversity management in particular, draws on HR development concepts to increase the share of female researchers, and to sensitise executives and staff to the reconciliation of work and family life, to a gender equal employee selection, and to a gender-equal language. As the interviewees state, Fraunhofer engages in a whole series of centrally coordinated equality-related activities, particularly guidelines for gender-equal employee selection, a support program for female scientists which addresses three career levels, detailed human

30 https://info.fraunhofer.de/zusammenarbeit/netzwerke/bfc_netzwerk/Seiten/default.aspx

31 https://www.fraunhofer.de/en/jobs-and-career/equal-opportunities.html

32 https://www.fraunhofer.de/de/jobs-und-karriere/arbeitgeber/chancengleichheit.html

33 Title of the project: ‘Chancen und Hürden beim Gewinnen, Halten und Entwickeln von Wissenschaftlerinnen bei Fraunhofer’.

resource controlling and evaluation systems, HR development and advanced training concepts, and yearly standardised reports[34].

Among other rights and functions, the central Equal Rights Officer, executing her function as a full-time job, has a right to information and a right to be heard towards the Executive Board, and promotes the reconciliation of work and family life. The local Equal Rights Officers at each institute are independent but formally part of the institute's management, not part of the work councils or the HR departments.

Fraunhofer has been engaged in a series of gender-related (research) projects, mainly carried out by the Fraunhofer Institutes, e.g.:

- *STAGES: Structural transformation to Achieve Gender Equality in Science* (2012-2015), in which action plans in the strategic areas 'women-friendly environment', 'gender-aware science', and 'women's leadership of science in four countries'. The project supported the Equal Rights Officers by capturing data on gender situation, to foster exchange among the Fraunhofer Institutes, and to develop a Gender Diversity Toolbox
- *Gender Chances: Exploiting the Potentials of Women in the Innovation System* (2007-2009)
- *WHIST: Women's careers hitting the target: gender management in scientific and technological research* (2009-2011) to strengthen the capacity and orientation of S&T research institutions to promote and manage gender diversity
- *Gender in Knowledge and Technology Transfer* (2013-2014), a project of CeRRI, which aims at improving knowledge and technology transfer via better integration of the dimension of gender
- *EFFORTI: Evaluation Framework for Promoting Gender Equality in R&I* (2016-2019) which 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
- *Changing Company Cultures - Avoiding Career Breaks* (2010-2012) developed new approaches on the basis of a comprehensive root cause analysis to avoid

34 In these reports, the Equal Rights Officers analyze where Fraunhofer stands in terms of gender equality. Measures are developed together with the directors. A central report is always developed out of the single reports. Positive examples and critical issues are highlighted.

career breaks among women in management positions.
As part of this, the project illustrated the importance of company culture for women's career opportunities.

- *Discover Gender: Gender aspects in research* (2004-2006)
- *Innovating Scientific Careers* (2013-2015), where a number of leading German scientific organizations (four research societies and five technical schools) seek to expand the range of feasible career pathways in science and research, to foster both career and family life opportunities for both men and women scientists, and to promote scientific careers to both men and women.

For the near future, the central functions are planning to broaden Fraunhofer's gender equality engagement: It is to be shown how the 'unconscious bias' effects decisions at Fraunhofer, e.g. management and project decisions, and to promote structures to neutralise its effects, e.g. in the fields of personnel evaluation, employment contracts or leadership trainings. More women are to be brought into leading positions and different bodies / committees.

Furthermore, Fraunhofer was a pioneer in setting up the topic of Gendered Innovations at the national as well as the European scene (Schraudner, Lukoschat 2006; Bührer, Schraudner 2006). Despite this pioneering work, however, there is no central knowledge about how broad and deep Fraunhofer tackles gender issues in research and innovation content. As one interviewee states, there are many research topics at Fraunhofer that should address gender aspects, such as in the field of medicine.

Institutionalisation of Gender at Fraunhofer

The scientific advisory board of the STAGES project (see above) came to the conclusion that Fraunhofer is doing a lot compared to other institutions, especially in the field of reconciliation of work and family life (e.g. flexible working hours) as well as many programs (e.g. re-entry after parental leave). The women's share among Fraunhofer's scientific, technical and administrative staff is 31.5%, the women's share among the scientific staff 21%[35]. At first sight these numbers seem to be relatively low. However, if one considers the women's share in Fraunhofer's widely male-dominated research fields, the organization is above average, i.e. the women's share is higher than in the respective study courses.

35 https://www.fraunhofer.de/de/jobs-und-karriere/arbeitgeber/chancengleichheit.html

One reason for this may be that flexible working hours are relatively well-developed at Fraunhofer. Moreover, the above-mentioned strategic project to set up an integrated HR management and reporting system may already have unfolded positive effects: As one interviewee states, requirement analyses, controlling and evaluation systems are very well developed compared to other RTOs[36]. Further success factors indicated by the interviewees are financial incentives for the 'reconciliation of work and family life', and the TALENTA program.

According to interviewees and participants of the state of the art meeting, the share of female researchers in leading positions, which is at 13.4%[37], is still one of the main weaknesses, despite existing measures that aim at increasing this number. One of the main reasons is seen in the relatively low awareness of the gender bias in leadership. Another challenge is differences among institutes in the field of gender equality: As one interviewee states: ‘Much depends on single persons.’ Institutes carrying out research in male-dominated fields are mostly perceived to be sceptical about flexible working hours or teleworking. Institutes with a higher share of women are in turn perceived as more engaged for gender equality. Finally, the lack of coordinated measures to promote gender issues in research content underlines the fundamental barriers in this field which are hardly overcome.

When asked about the further transformations they like to see, interviewees name the following aspects:

- Greater awareness for gender equality at the institutes
- Realisation of gender equality in all research fields and in all levels of hierarchy.
- More female directors and researchers in leading positions, also in the field of 'leadership with part-time jobs'

36 with reference to the ‘Alliance of Equal Opportunities Officers in Non-University Research Organisations (AGBaF)’

37 https://www.fraunhofer.de/de/jobs-und-karriere/arbeitgeber/chancengleichheit.html

3.3.3. Key dimension 'Open Access' at Fraunhofer

Open Access rationale and goals at Fraunhofer

Drawing on the well-established concept of Open Access, Fraunhofer's understanding of Open Access leaves little room for ambiguity: In its Open Access Policy (Fraunhofer-Gesellschaft 2008, p. 1), it sets out that

> '[...] the Fraunhofer-Gesellschaft makes every effort to ensure that full-text versions of all papers and articles written by its employee are made freely available in the international digital media. [...] The aim is to allow these publications to be read, searched, printed, distributed or utilised in any other conceivable legitimate manner without any financial, technical or legal restrictions. This does not affect the author's legal right to be identified as the copyright holder of such works.' (Fraunhofer-Gesellschaft 2008, p. 1)

Initiatives on the level of the European Commission, such as the European Open Science Agenda (European Commission 2016a) or the High-Level Expert Group on the European Science Cloud (European Commission 2016a) set Open Access into the wider vision of Open Science, in which *all* research content is digital, searchable, freely accessible, traceable and reusable. With regard to the Open Science discourse and the increasing relevance of publication data, interviewees highlight especially the growing need for a central Research (Open) Data infrastructure at Fraunhofer.

The Fraunhofer Open Access Strategy, which was adopted in 2015, reflects this vision, as it 'pursues and promotes the goal of making science and its results more easily accessible to a greater number of people.' (Fraunhofer-Gesellschaft 2015b) As set out in this strategy, the superior objectives of Open Access at Fraunhofer are:

- Social responsibility – science as public property
- Creating value through knowledge transfer
- Reproducible results
- Greater efficiency as information is assumed to be spread more promptly and efficiently
- Optimised cost by developing cost-transparent models
- Alignment with the political framework at EU, German national and regional levels

These objectives are operationalised in several ambitious goals: Until 2020, at least every second paper is to be freely available via Open Access. Of these papers, at least every third is to be published via the gold road. Additional measures are planned to foster Open Access of the underlying and related research data. The concrete arrangement of Open Science for Fraunhofer, particularly Open Data, has yet to be defined.

Open Access practices at Fraunhofer

The in-house provider Fraunhofer-Online, located at the Fraunhofer Information Center for Planning and Building IRB, provides a central Open Access infrastructure as well as central Open Access services to support Open Access publication processes at the institutes. Open Access publications are made available in the institutional repository 'ePrints'[38], which is compatible with the OpenAIRE infrastructure. Amongst other services, Fraunhofer-Online offers comprehensive assistance and launches an Open Access Blog[39]. In addition, librarians and technical information managers at the institutes provide services and advice to researchers. Each author at Fraunhofer has the possibility and support to publish Open Access via the green and gold route if she or he wants to. As the gold route bears significant costs on the authors, it is planned to set up a central publication fund for the golden route.

According to the interviewees, the Fraunhofer Information Center for Planning and Building IRB develops 'Open Access' and 'Open Science' further with its expertise, the latter in collaboration with the Fraunhofer Department for Corporate Strategy. The Fraunhofer EU Office Brussels facilitates networking and dissemination of the Fraunhofer activities. Via the European Association of Research and Technology Organizations (EARTO), Fraunhofer is represented in the European Open Science Policy Platform (European Commission 2016b). Together with other research organizations, Fraunhofer has also signed an expression of interest that aims at transforming 'a majority of today's scholarly journals from subscription to OA publishing'[40]. On 'Open Science', an internal multi-level group of actors has joined forces to operationalise the concept for Fraunhofer. Complementary to Fraunhofer

38 http://publica.fraunhofer.de/starweb/ep09/en/index.htm

39 http://www.openaccess.fraunhofer.de/

40 https://www.mpg.de/openaccess/oa2020

ePrints, it is planned to set up a data repository named 'Fraunhofer-Fordatis' with interfaces to transfer metadata to other repositories, e.g. OpenAIRE (EU).

Institutionalisation of Open Access and Open Science at Fraunhofer

To compare the realisation of Open Access between research organizations, quantitative benchmarks do not yet exist as they are just in development. For a qualitative assessment of how well Open Access is institutionalised at Fraunhofer as a whole, three distinctions seem yet to be important:

- A distinction between centralised activities and practices at the institute level
- A distinction between the provision of infrastructures and services and their actual use
- A distinction between Open Access and the much broader vision of Open Science

In the field of Open Access, several interviewees consider Fraunhofer as a first mover, not only as it was the first research organization in Germany with an Open Access strategy, but also due the ambitious goals that are envisaged until 2020. As the reasons for this leading position in terms of strategy development, interviewees name bottom-up processes in strategy formulation, and the high relevance of Open Access at EU level institutions. Infrastructures and services are well advanced and being further developed.

Interviewees perceive the general awareness of Fraunhofer researchers of the possibility to publish Open Access relatively high. Between the different Fraunhofer Institutes, however, considerable differences can be observed in terms of Open Access publications: Among the Fraunhofer Institutes with the most Open Access publications between January 2013 and July 2016, their number varies between 20 and 80 within this period[41]. With about 15% of all scientific publications in 2015, the relative number of Open Access publications at Fraunhofer is still relatively low[42]. Overall, interviewees as well as participants of the JERRI State of the art meeting consider Open Access as still not very well embedded at the level of the single institutes. Different reasons are

41 According to unpublished calculations of Fraunhofer IRB based on the Web of Science Core Collection. Note: There is a time lag between the publication of papers and articles and their record in the Web of Science Core Collection.

42 according to unpublished calculations of Fraunhofer IRB

indicated: The contract research for industry requires privacy, which is, according to several interviewees, often at odds with Open Access. Another reason may be the lack of a data sharing culture, and not least the lack of a publication fund so far. It remains to be seen what change will go along with the introduction of the planned central publication fund.

In the development of Open Data infrastructures and practices, EU level institutions are regarded as the main 'push factor' as well, particularly the European Open Science Strategy and the Science Cloud. Fraunhofer-specific solutions remain yet to be developed in terms of technical infrastructure (i.e. work flows, data structures, classifications, Digital Object Identifiers for research data, records of research data in Fraunhofer Publica) and service / processes (consulting in the context of EU projects, central processes, consulting and training for publication managers at the institutes, need specification). In order to establish this infrastructure and services, the 'FORDATIS'-project started in June 2016. Accordingly, interviewees consider the realisation of the Fraunhofer Fordatis data repository as a complex and challenging issue, where research and publication cultures may also be a big barrier that needs to get overcome. This includes the challenge to develop Fraunhofer-specific competences. As one interviewee states: 'I think we would be ready much earlier, if we would have the manpower [in the institute / department]. This is not easy to push, as at Fraunhofer, many things depend on the single scientist.'

3.3.4. Key dimension 'Societal Engagement'[43] at Fraunhofer

Societal Engagement rationale and goals at Fraunhofer

While part of the last mission statement of Fraunhofer pointed to its societal responsibility, understood as sustainability, scientific independence, profitability and the contribution to the dialogue between science and society, the new mission statement, adopted in 2016, does not include an explicit focus on dialogue activities. According to the current mission of Fraunhofer, they 'partner with companies to transform original ideas into innovations that benefit society and strengthen both the German and

43 Following the common understanding of the JERRI consortium, based on the terminology of the Call ISSI-5-2015 , activities at Fraunhofer and TNO in the field of Public Engagement were observed and analyzed using the term „Societal Engagement'.

European economy'[44]. Neither the Fraunhofer vision, nor the related principles focus explicitly on societal engagement.

However, in the Fraunhofer sustainability report, first presented in 2014 and related to activities of the sustainability network (a bottom up initiative in which 20 Fraunhofer Institutes cooperate), it is stated that 'as an application-oriented research organization, it's particularly important for us to stay in touch with politics, science and society. That's why we voice our opinions and maintain an active dialogue with our interest groups. What's more, we try to communicate our findings in an accessible way so that we can kindle enthusiasm for research.' (Fraunhofer-Gesellschaft 2014, p. 16) According to the sustainability report of 2014, activities that are particularly related to the societal dimension are 'public communication', 'active dialogue' and 'programs that appeal to young people'.

In the most recent sustainability report, published in autumn 2016, it is stated that Fraunhofer increasingly seeks the dialogue with societal groups in order to absorb societal needs and to make research results socially effective. That means precisely to involve societal actors in innovation processes, policy consulting based on research, development cooperation and the communication of research results to a broader public (Fraunhofer-Gesellschaft 2016b). The explicit objectives regarding 'society' are to conduct stakeholder dialogues across the institutes, active participation in the creation of a national and European research area together with actors of the science system and the establishment of a Fraunhofer business unit 'Fraunhofer for development' (Fraunhofer-Gesellschaft 2016b, p. 37).

Based on these official institutional statements and the interviews conducted with Fraunhofer employees, it became apparent that understandings of 'societal engagement' are very divers, its meaning covers a broad range of topics, such as citizen involvement, science communication, CSO involvement, stakeholder dialogues, policy consulting, cooperation with businesses, engagement for refugees or programs that appeal particularly younger people. Similarly, underlying rationales vary and can be found in substantial and instrumental argumentations, for instance as part of sustainability goals, as legitimation of public funding, to foster market uptake or to follow personal beliefs.

44 https://www.fraunhofer.de/en/about-fraunhofer/profile/guiding-principles.html

Societal Engagement practices at Fraunhofer

With regard to actual societal engagement practices, a variety of activities on different levels are taking place at Fraunhofer. Besides some activities initiated by Fraunhofer as a whole, some institutes particularly stand out, such as Fraunhofer UMSICHT or Fraunhofer IAO. Admittedly it can be perceived as a challenge to overview and present all relevant activities within Fraunhofer, simply because of the fact that societal engagement practices are mainly conducted in a decentralised manner. Nevertheless, as follows, a number of selected activities are presented.

Practices initiated by Fraunhofer are for instance the founding membership of 'Wissenschaft im Dialog', a non profit organization, founded in 1999, which aims at encouraging the dialogue between science and society by organising dialogue sessions and exhibitions, and by developing new formats of science communication.[45] In addition, Fraunhofer is a founding shareholder of the 'Futurium', a place to present and discuss science, research and development (to be opened in Berlin in 2017).[46] Currently, an internal project on the effects of participatory technology development on the development process is carried out. Furthermore, the Fraunhofer Inhaus[47], a cooperation of several Fraunhofer Institutes, is a creative space where innovative products are developed. Various group tours through their application labs, the Living Labs, are offered there. With regard to the already mentioned sustainability reporting schemes, their own development processes are noteworthy, as the reports have been flanked by internal and external stakeholder dialogues. Participatory foresight processes are developed and carried out by Fraunhofer ISI. Further activities where various Fraunhofer Institutes are involved and which fall under the heading 'dialogue with society' in the sustainability report 2015 are[48]:

- *Bonner Dialog für Cybersicherheit (BDCS)*:[49] arena for the exchange between science, industry, authorities and citizens.

45 http://www.wissenschaft-im-dialog.de/

46 http://www.hausderzukunft-deutschland.de/

47 http://www.inhaus.fraunhofer.de/

48 https://www.fraunhofer.de/de/ueber-fraunhofer/profil-selbstverstaendnis/nachhaltigkeitsbericht-2015/gesellschaft.html

49 https://www.fkie.fraunhofer.de/de/startseite/Veranstaltungen/uebersicht-bdcs.html

- *CityServer3D (Lebendige Stadtentwicklung)*[50]: a tool which can manage two- and three-dimensional geographic data and therefore allows to generate and present 3D-Models of cities.
- *Visualisierung politischer Prozesse NOMAD*[51]: Nomad's vision is to provide decision-makers with fully automated solutions for content search, acquisition, categorisation and visualisation that work in a collaborative form in the policy-making arena.
- *Essbare Innovationen*[52]: aim of this study is to investigate the consumers' perception of technical innovations and develop recommendations for and increased acceptance of food-related innovation.
- *Citizens dialogue Big Data*[53]
- *Kinderstadtteilforschung*: children explore their environment in the role of experts.
- *New Governance FUPOL*[54]: FUPOL provides a new approach to traditional politics building on major innovations like multichannel social computing, crowd sourcing and simulation.
- *Research on and promotion of fab labs* (e. g. Fraunhofer UMSICHT, Fraunhofer LBF)

On the level of individual institutes, besides others, two outstanding examples are worth mentioning: first, the Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT is comparatively active in the field of societal engagement. Their understanding of societal engagement is strongly related to sustainability, sustainability is not possible without societal engagement, according to one of the interviewees from UMSICHT, societal engagement is a 'necessary element, if one takes sustainability reporting serious at all'. In line with this idea, numerous societal engagement practices are in place, both focusing on the development of methods of societal engagement and

50 http://www.cityserver3d.de/en/

51 http://www.nomad-project.eu/

52 http://www.fcm.fraunhofer.de/de/presse/studie-essbare-innovationen.html

53 https://www.sit.fraunhofer.de/de/buergerdialog-big-data/

54 http://www.fupol.de/de

societal engagement itself. As follows, examples for practices, where UMSICHT is involved, are listed (list is not exhaustive).

- *DEZENTRALE*[55]: The DEZENTRALE is a place to commonly develop future visions and projects, open for the public.
- *Innovative Citizen*[56]: Festival with workshops, presentations, concerts, and performances, where citizens' innovations can be presented and made available for sustainable research.
- *Societal engagement* in the context of UMSICHT sustainability reporting: Stakeholder involvement[57]
- Stakeholder dialogues
- *Gmünder Tunneldialog*[58]: public dialogue with scientists, politicians and citizens about an infrastructure project in Schwäbisch Gmünd.
- *Forschungsdialog Zukunftsstadt Oberhausen 2030*+[59]: together with the citizens of Oberhausen visions for the city of the future are developed.

The second Fraunhofer Institute which is also very active with regard to societal engagement is the Fraunhofer Institute for industrial engineering IAO, in particular the Fraunhofer Center for Responsible Research and Innovation CeRRI, which is formally part of IAO. CeRRI perceives itself as a provider of participatory methods for internal Fraunhofer related purposes as well as for external needs. The aim of CeRRI is to develop and implement new methods of participatory foresight processes and to 'foster technology transfer, [...] defined [...] as the exchange of ideas, findings, and methods of production and management among research institutions, industry, and the public with the purpose of making scientific and technological advances accessible and appealing to a wider range of potential users such as consumers and licensees.' (Schraudner, Wehking 2012). One project currently conducted by CeRRI is for instance 'Shaping Future'[60], which is a new approach for participatory demand oriented technology

55 http://dezentrale-dortmund.de/

56 http://innovative-citizen.de/festival2016/

57 https://www.umsicht.fraunhofer.de/en/sustainability.html

58 https://www.umsicht.fraunhofer.de/de/presse-medien/2016/ergebnis-tunneldialog-bestaetigt.html

59 https://www.umsicht.fraunhofer.de/de/presse-medien/2016/forschungsdialog-zukunftsstadt.html

60 http://www.cerri.fraunhofer.de/en/projekte/shaping-future.html

foresight. In a multi-staged process, laypersons and specialists develop and articulate ideas about prospective human-machine cooperation. Further already finished projects focusing on user involvement were 'Discover Markets'[61], 'Akrobatik@Home'[62] or 'MyRehab'[63].

Institutionalisation of Societal Engagement at Fraunhofer

Questions concerning the institutionalisation of societal engagement at Fraunhofer are not straightforward to answer, but rather multifaceted and multidimensional. The different levels which are worth having a look at are the general strategic orientation defined by the Management Board of Fraunhofer, the level of the institutes and the individual researchers. Regarding the Fraunhofer-Gesellschaft as a whole, no coherent, systematic top-down societal engagement strategy exists yet. What did happen so far is societal engagement on a rather occasional basis, for instance in relation to the sustainability reporting, which has been accompanied by stakeholder workshops. It seems that the Fraunhofer headquarters is aware of the trend towards increased societal engagement in the realm of RRI, but still uncertain about how and if to institutionalise it (Goos, Lindner 2015). In general, it remains to be open if the existence of a systematic strategy prescribed from the higher institutional level is a necessary condition for successful implementation of engagement activities at all. What can be observed is that, resulting from bottom up initiatives, a change in individual institutes is possible. Fraunhofer UMSICHT or CeRRI, for instance, are two examples where intrinsically motivated actors initiated transformation towards taking societal engagement activities more seriously and implemented engagement practices. In fact, regarding practices of societal engagement, these two examples are outstanding - nonetheless, this is not representative for the whole Fraunhofer-Gesellschaft and does not conceal the fact that it also is a contested topic, opinions differ within departments and within institutes.

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61 http://www.cerri.fraunhofer.de/en/projekte/discover-markets.html

62 http://www.cerri.fraunhofer.de/en/projekte/akrobatikathome.html

63 http://www.cerri.fraunhofer.de/en/projekte/myrehab.html

3.3.5. Key dimension 'Science Education' at Fraunhofer

Science Education rationale and goals at Fraunhofer

The concept Science Education as understood by the European Commission is only partly present in Fraunhofer's organizational structure and task, just as in the perception of the interviewees. The definition particularly states that 'the language and tools of science need to be available to everyone.' (European Commission 2014) In the field of boosting the interest of children, youth and students for science in general and the STEM professions in particular, Fraunhofer' HR marketing engages in a series of activities[64]. The primary goal of these activities is to counteract the shortage of personnel, particularly in the field of IT, and to bring more women into research at Fraunhofer.

As one interviewee states, Fraunhofer also recognizes its 'moral duty' to let everyone participate in research. A wider engagement that would explicitly aim at a science-literate society as a whole, however, cannot be identified. Implicitly, the Department of Communications provides relevant information to the general public that potentially would allow societal actors to participate in the research and innovation process. Interviewees agree that these activities are not understood as an active empowerment of citizens, as this is neither formally defined nor informally considered being part of Fraunhofer's mission.

Science Education practices at Fraunhofer

As indicated above, Fraunhofer employs several instruments to compete for talents as a part of its HR marketing[65]. Among the target groups of these instruments, Fraunhofer distinguishes between preschool, primary school, teens and youth. One of the main nuclei of this engagement is targeted to recruit young talents in the STEM professions. Related activities comprise:

- The *Fraunhofer Talent School*, organized at several institutes on a yearly basis

64 https://info.fraunhofer.de/personal/personalmarketing-und-recruiting/personalmarketing/Seiten/personalmarketing.aspx
65 https://info.fraunhofer.de/personal/personalmarketing-und-recruiting/personalmarketing/Seiten/personalmarketing.aspx

- *Talent Take Off*, a program to offer information on STEM study courses and professions to students
- The *European Talent Academy*, a summer school for particularly talented students
- *'myTalent'*, a recruiting portal in which a pool of candidates for research assistants and junior researchers is being set up
- *'kids kreativ!'*, a kindergarten competition to inspire the exploratory spirit of children

Further instruments comprise:

- Central support of the institutes to participate in career fairs and recruiting events by the Department of HR marketing
- A career fanpage on facebook, directed to students
- Central support of the institutes in marketing directed towards future apprentices

The communication towards the general public is an explicit part of the Fraunhofer communication strategy (Fraunhofer-Gesellschaft 2015a). Fraunhofer takes part in the societal discourse via several agenda-setting instruments. However, the mission that guides these activities sets the primary focus on positioning Fraunhofer as an innovation driver rather than pursuing citizen empowerment as an end in itself.

Institutionalisation of Science Education at Fraunhofer

According to the interviewees, the functions of HR marketing and Communications are well developed. Given the wide range of HR marketing / recruiting activities, not only at the level of the headquarters, but also within the institutes, one interviewee asks if even more engagement wouldn't rather be 'the job of research and education policy'. As regards the core tasks set out in the Fraunhofer communication strategy (Fraunhofer-Gesellschaft 2015a), no need for greater transformations is articulated either. One interviewee, however, likes to see more communication on the big challenges Fraunhofer addresses, instead of communicating science as solutions to partial problems on a project level, which in turn would require a 'cultural change'. In sum, the traditional functions HR marketing and Communications are considered to need only partial and incremental improvements rather than greater transformations.

This may be also due to the fact that the broad understanding of Science Education, which is inherent to the EC's definition, has not (yet) become a major discourse at Fraunhofer. When explicitly asked about the vision of empowered citizens participating in research processes, interviewees name two major barriers: First, participation in some research topics would require specialised knowledge that is not easy to obtain. Second and partly related to the first argument, baseless fears could lead to the rejection of projects that would otherwise be appreciated.

When explicitly talking about Science Education as moving towards a science-literate society, participants of the state of the art meeting identified a number of issues. These issues include making the collaboration with citizens part of the incentive structure, empowering citizens to replace 'dissemination' by 'engagement', and establishing links to other RRI key dimensions, especially to Societal Engagement and Open Access. Moreover, another sub-dimension of Science Education would be are more systematic inter- and transdisciplinary combination of technical knowledge with social scientific knowledge. It can be assumed that moving to such a broadened understanding would require bigger transformations on the level of the organization.

4 TNO

In this section we describe the TNO organizations, its organizational model and its governance structure. This helps to show how TNO is embedded in society and how TNO is including its stakeholders in organizing its activities. This is followed by more detailed information linked to specific RRI key dimensions.

4.1 Mission and vision of TNO

TNO - The Netherlands Organization for Applied Scientific Research – was established by Act of Parliament in 1932. As a semi-public organization, it is expected to maintain an independent position while developing knowledge to support government, industry and society. TNO's work can be summed up in two words: 'targeted innovation'.

The mission of TNO is to bring together people and knowledge to create innovations that will strengthen the competitive ability of Dutch industry, bolster the national economy and benefit society at large. This mission is the basis to achieve economic and societal impact. TNO is a 'not-for-profit' knowledge organization.

In close cooperation with stakeholders, TNO has identified five 'transitions' that form the focus of its activities. These transitions, or themes, reflect the ambitions of the Top

Sectors (those identified by government as making a particularly significant contribution to the national economy) as well as the major societal challenges facing the Netherlands and Europe (TNO 2016, pp. 5–6).

4.2 TNO: Organization and internal governance

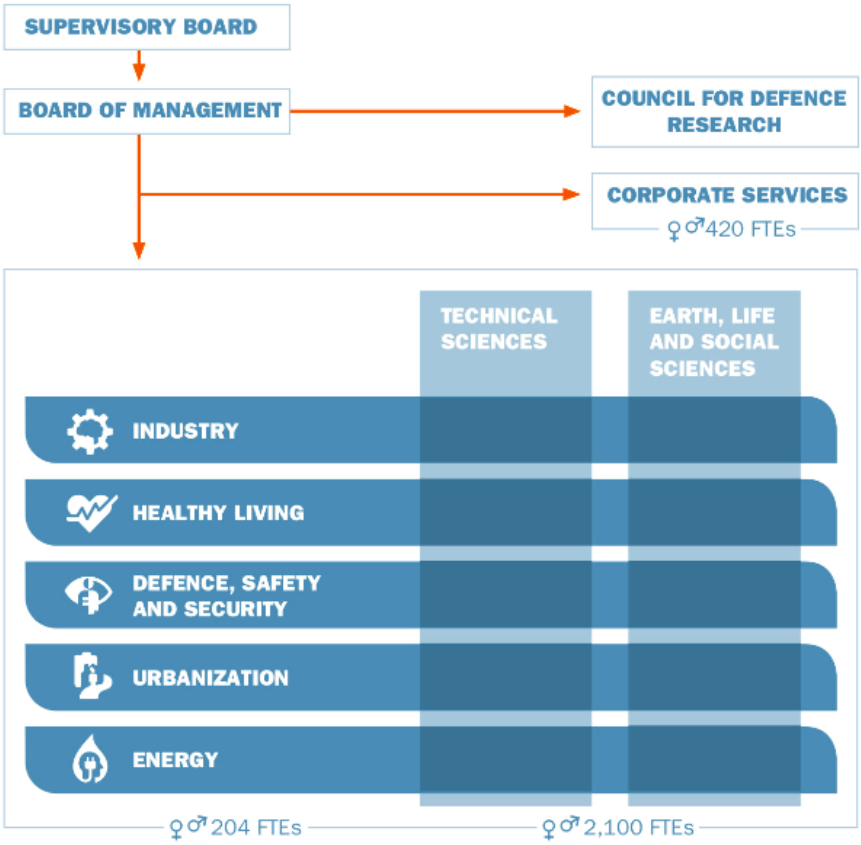
TNO is, since 2010, a matrix organization which is structured along two axes, as shown in Figure 3. Along the vertical axis, the researchers, consultants and project managers are divided between two expertise categories: Technical Sciences, and Earth Life & Social Sciences (comprising 2.100 FTE's)[66]. On the horizontal axis are the five societal transitions, or themes, on which TNO bases its activities (comprising 204 FTE's).

The matrix organization is a result of TNO's Strategic Programme 2015-2018 (and earlier Strategy documents). TNO's Strategic Programme is an offer to society and the Dutch Ministry of Economic Affairs, who partially funds TNO.

The Standing Orders of the Board of Management, the Supervisory Board and the Strategic Advisory Councils, together with the Mandate document, form the statutes of the TNO organization. The Mandate document defines the authority of the various officers in order to ensure that an effective system of checks and balances is in place. It further requires an external auditor to assess compliance with the mandate on an annual basis.

66 'FTE' stands for 'Full-Time Equivalent', i.e. the equivalent of a 40-hours work week job. For example, 100 FTE can refer to 100 people with 40-hours contracts, or to 125 people with 32-hours contracts, or to any combination, e.g., 80 people with 40-hours contracts plus 25 people with 32-hours contracts.

Figure 3: Organizational structure of TNO



The mandate names several boards and councils:

- The *Board of Management* – responsible for the day-to-day management of the TNO organization, and for defining and pursuing the corporate objectives, policy, strategy and results.
- The *Supervisory Board* – oversees the policy and performance of the Board of Management, to which it provides advice as appropriate or necessary
- The *Council for Defense Research* – The policy of the defense research departments of TNO is established by the Council for Defense Research
- *Strategic Advisory Councils* – For each above-mentioned theme or transition, there is a Strategic Advisory Council that supports decision-making with regard to the priorities and spearheads of research, as well as the form and content of the relevant programmes. It monitors external developments and draws those of significance to the attention of the research theme's management. The

members are prominent experts drawn from the public sector, industry and knowledge infrastructure (TNO 2016, pp. 38–39).

If TNO has to achieve the desired social and economic impact, ongoing dialogue with stakeholders is vital. This ongoing stakeholder dialogue enables TNO to coordinate the research and innovation agendas with those of the government, private sector and TNO's fellow knowledge institutes.

TNO's main stakeholders[67] are (in no particular order):

- TNO employees, including management co determined bodies;
- Government and its agencies;
- Clients, especially strategic clients, often large internationally operating companies;
- The Supervisory Board (https://www.tno.nl/en/about-tno/organization/supervisory-board/)
- Knowledge partners, e.g., universities and other knowledge institutes, e.g., fellow members of EARTO;
- Civic organizations, e.g., not-for-profit organizations or NGO's (TNO 2016, p. 49).
- Strategy Advisory Boards; five in total, one for each Theme, each with approx. 10 people, from industry, government, academia and civic organizations;

TNO's stakeholders are invited to comment and make suggestions about the organization's long term strategy and roadmaps, direct it by prioritising specific goals and ambitions and give feedback about past performance.

4.3 Responsible research and responsible innovation at TNO

The RRI concept as officially defined by the EC is currently not explicitly embedded in TNO's organizational structure. However, most of the RRI dimensions are addressed within four active working groups/steering committees:

67 In this context, stakeholder concept refers to what TNO considers to be its most relevant stakeholders, independent from the concepts which can be found in the literature (cf. for example Freeman 1984), Mitchell et al. 1997), and Achterkamp, Vos 2007)).

- Integrity Committee (Ethics);
- Diversity Steering Committee (Gender Equality);
- Corporate Social Responsibility (CSR) – Steering Committee[68];
- Open Access working group – (Open access).

The committees and working groups are set up to help the organization to concentrate its effort on a specific topic.

In these committees/working groups a selection of content-owners/specialists, together with high-level management, discuss actual questions, challenges and if necessary create or update new (internal) policies, laws and regulations on a regular basis. These committees/ working groups are often presided over by a board member of TNO.

The relevant policy documents at TNO that can be attributed to responsible research and responsible innovation are:

1) TNO Code of Conduct;
2) Statement of policy Corporate Social Responsibility;
3) Policy document on laboratory animals and animal experiments;

TNO Code of Conduct (TNO n.d.)

To ensure integrity and transparency, TNO has a 'TNO Code', containing amongst others a formal complaints procedure and 'whistleblower' scheme. All are based on the codes of governance applicable to public sector, private sector and the research field, such as the Netherlands Code for Good Public Governance, the Corporate Governance Code and the Scientific Integrity Code.

This corporate code establishes what TNO stands for and should serve as a guide for employees and managerial behaviour. It is also a document that has legal consequences. People may be held accountable for their actions, based on its contents.

68 Note that as part of the JERRI project the RRI dimension of Societal Engagement and Science Education are as of now included in the CSR working group.

Statement of policy Corporate Social Responsibility (TNO 2011)

TNO connects people and knowledge to create innovations that sustainably boost the welfare of society and the competitiveness of industry. On the basis of that mission TNO aims to make a significant contribution to sustainability in the Netherlands and beyond, with the five themes of transition on which the innovations are focused. Social responsibility is one of the key values of the TNO organization and is formalised in a Statement of policy Corporate Social Responsibility. In line with the principle 'preach what you practice, practice what you preach', TNO emphasises sustainability in its own operations.

This policy statement presents an overview of the way how TNO deals with the 'people, planet, profit' concepts and is intended for TNO's customers. A subdivision is made into the chapters 'Ethics', 'Labour', 'Health and safety' and 'Environment'.

Policy document on laboratory animals and animal experiments (TNO 2015)

This TNO Policy Document on Laboratory Animals and Animal Experiments 2015 is the sixth version since 1985 and the first to be produced jointly with Triskelion BV., a TNO Company. It is a part of TNO's Corporate Social Responsibility policy. In line with this policy TNO takes sustainable, animal-friendly and preferably laboratory-animal-free development as the guiding principle.

This policy document serves as a guideline for management and staff in:

- Designing and conducting high-quality animal experiments based on the principle of the Refinement, Reduction and Replacement of animal experiments (3Rs);
- The ethical treatment of animals before, during and after experiments;
- The continuing professional training and development of the staff involved;
- Contributing to the development, acceptance and implementation of alternatives to animal experiments and alternatives inside and outside TNO.

On a daily basis the Public Affairs section, in cooperation with Marketing & Communication, manage the external positioning of TNO, the TNO communications strategy and the dissemination of TNO knowledge and reports. This is done in close cooperation with the Theme organization.

4.4 State of the art on RRI-related practices at TNO

4.4.1. Key dimension 'Ethics' at TNO

Ethics rationale and goals at TNO

Instead of repeating the definitional pitfalls related to the distinction between ethics, responsibility and ethics as an RRI dimension, this section describes the various facets in the individual understanding of the concept at TNO.

Most interviewees use the word 'ethics' to refer to the organization of a *process* of conscious ethical deliberation and decision making, e.g., to discussions of different values of different stakeholders and to decisions regarding the execution and scoping of a project – 'Will we do this project?', 'What will we do?', 'And what not?'. Some use the word 'ethical' to refer to the *outcomes* of deliberation and decision making: whether the outcomes are (ethically) good or bad. In line with the common usage in academia (van de Poel, Royakkers 2011), TNO proposes to use the word 'ethics' to refer to the *process* of deliberation and decision making. Also in line with academia, TNO acknowledges that the *outcomes* of these processes are context-dependent; the decisions that are made, and whether we experience them as 'ethical' or 'unethical', depend on the values that were taken into account and the ways in which these were balanced.

'Ethical' refers to something else than 'legal'. TNO always aims to stay within legal boundaries. This aim requires little ethical deliberation, whereas ethical issues—including questions about how to interpret legal matters or how to balance legal matters with other concerns - will require ethical deliberation. In short, ethics goes beyond staying within legal boundaries: 'It is no longer only about compliance to rules, but also about taking ethical responsibility' (quote from one interviewee).

Ethics occur whenever somebody asks: 'What would be the right thing to do in this situation?' Ethical deliberation and decision making occur in specific situations and with the aim to move from uncertainty towards clarity and action[69]. With this understanding in mind, TNO sees from the interviews that the interviewees have a relatively high level of awareness about the ethics inherent in their work. Interviewees frequently made

69 This is a pragmatic approach to ethics, as developed by pragmatist philosopher John Dewey (e.g. Dewey 1938; see also Hickman 1998, Pappas 1998; Steen 2013).

statements about concepts such as ‘values’, ‘deliberation’ and ‘conscious decision making’.

Based on the results of the interviews, we can distinguish between ethics at the *individual level* (one’s personal ‘ethos’), e.g., one’s scruples against working on a specific project (e.g., for a customer in a country with little democracy) or task (e.g., to develop tools for detecting child pornography); and ethics at the *organizational level* (the organization’s ‘ethos’), e.g., norms for what is considered ‘good’ or ‘bad’ (e.g., ways to balance opposing values, like quality versus speed in conducting a project, or doing independent research versus serving a specific client)[70].

Moreover, there are *overlaps between ‘Ethics’ and ‘Societal engagement’*: the ways in which people engage in (ethical) deliberation and decision making have very practical and very clear relationships to the ways in which they engage with, e.g., stakeholders in the process of understanding and solving societal challenges.

Interestingly, many people at TNO are socially engaged and have social motives to work at TNO; they want to solve societal issues and develop technologies that benefit society. ‘Their intentions are good’, remarked one Director. This is also the case for a member of the Corporate Social Responsibility Steering Group: ‘I believe life is not only about economic benefits and shareholders’ value. That is why I always aimed my work at creating value for customers and for society’. Additionally, one can argue that ethics is especially relevant for organizations that are active in innovation: ‘Since TNO is an innovative organization, ethics plays an important role, e.g., in cases where technologies are not yet socially accepted’ (quote from one interviewee).

Ethics practices at TNO

Examples for ethics practices include the following:

- *Integrity Officer*: A primary example is the establishment of an Integrity Officer, who leads and overseas the organizations integrity programme ;
- *Scruples and confidants*: There are processes for TNO employees to express their (religious or otherwise) scruples against working on specific projects or

70 This understanding is in line with the topics found a review of other RTOs’ practices (see Annex II): Quest of truth; Academic freedom; Quality; Voluntary informed consent; Confidentiality; Impartiality; Integrity; Good reference practice; Collegiality; Institutional responsibility; Availability of results; Social responsibility; Global responsibility; and Laws and regulations.

tasks. Practically, they can object to working for specific clients, e.g., for clients in countries with malfunctioning democracy, or projects for the military or for intelligence agencies;

- *Selecting clients and scoping projects*: There are processes for deliberation and decision making for choosing to (not) work for a specific client, e.g., assessing their past conduct, for specific topics, e.g., for socially or politically contested topics. In addition, there are similar processes in place for defining and scoping a project, i.e. to clarify what TNO will (not) do in the project, and what can (not) be done with the project's results. Such discussions occur in collaboration between Theme Director, Business Developers, Corporate Communications, and relevant experts;
- *International engagement*: A policy exists, for decisions regarding foreign customers and for participation in international trade missions, involving asking four key questions: *'*a) Which country? b) Which product or service are we offering? c) To which customer? d) What is the current situation? If there are four 'red lights' then we should definitely not do it. If there are four 'green lights' then we can do it. Anything in-between, it depends. Defence and security is more sensitive than health and food. Energy can be sensitive as well.*'* states a director;
- *Framing as 'quality'*: Questions about integrity can sometimes be difficult to discuss; people will shy away from calling something or somebody un-ethical. Such questions can often be framed more productively as questions regarding quality, according to the Integrity Officer: *'*In many cases it is hard to demonstrate un-ethical behaviour; in such cases, one can, however, discuss whether some behaviour was sloppy, clumsy or silly—which is more related to quality*'*;
- *Animal testing*: TNO does conduct animal testing, following a 'conscientious' policy (only 'if this is prescribed by law and if there are no reliable alternatives available' (https://www.tno.nl/en/about-tno/tno-and-its-social-role/animal-testing-policy/), and actively contributes to the development and application of alternatives to animal testing (Refine, Reduce, Replace). Interestingly, some people associate TNO with research into primates. Since 1994, however, this work is done by an independent organization that is no longer part of TNO: the

Biomedical Primate Research Centre, which is a not-for-profit organization for non-human primate research, the largest of its sort in Europe[71].

Institutionalisation of 'Ethics' at TNO

A prime example of institutionalisation is the establishment of the role of the Integrity Officer, since 2013. This role involves giving advice to managers concerning integrity, supporting the implementation of the 'TNO code', and developing other policies for integrity. More specifically, it involves the following:

- *Secretary of the Integrity Commission*, which mainly involves TNO directors and has its goal to improve ethical awareness and ethical action in TNO - the Integrity Commission reports to the Board of Directors. This Commission meets 4 times per year and aims to provide guidelines for business integrity, scientific integrity, and correct work floor conduct, to inform employees on the availability of trained counsellors, and to help employees who struggle with ethical issues.
- *Giving advice in case of problems*, e.g., when an employee perceives a lack of integrity in the conduct of a co-worker or manager;
- *Being the 'point of contact' for 'whistle-blowers'* - any employee can contact the Integrity Officer to report questions or issues regarding integrity.
- *Being confidant for people* at the first, second and third management levels, and coordinator of ten other (decentralised) confidents within TNO; they support employees e.g., in scientific and commercial integrity;
- *Code of Conduct* (see also in section 4.3): TNO has a Code of Conduct, based on four core values: integrity; independence; professional conduct; and engagement with society (TNO n.d.). The Code of Conduct also elaborates on how these values can be realised in practice, e.g., in legal matters, in doing business, in science and research, in society, and within TNO;
- *TNO Dilemmas*: This Code of Conduct is made practical also in the form of a series of Dilemmas (developed in 2014 by the Integrity Officer): examples of situations which require ethical deliberation and decision making. These Dilemmas are discussed in workshops or training sessions within TNO.

71 http://www.bprc.nl/en/faq-about-bprc/

The cost price and the market

An employee of a new customer approaches you, as a director roadmap. You know this employee from the time she worked for another customer. She has an assignment for your department of approximately € 200,000. It quickly becomes clear that this potential new client could provide access to a new market and therefore offers interesting possibilities for the future. The employee indicates that she does not need to be convinced of the qualities of TNO, but that she will have to convince her current employer who is not familiar with TNO yet. Especially since there are no positive experiences with TNO yet, the company is very keen on keeping the costs low and there are limited financial resources available for this assignment, if she's able to convince her management.
You offer the customer a quotation just above cost price, because you expect to otherwise not make a chance. In the quotation you included necessary expenses for unforeseen costs and a modest profit margin. The customer indicates that they can only pay an amount € 10,000 below our cost price, and otherwise there will be no assignment. The customer indicates that they see the importance for TNO – the access to a new market segment – and that if the assignment goes well, they will probably assign more work to TNO.

Are you going to ensure that this assignment agreement is concluded for the amount just below the cost price?

Example of a dilemma

'Integrity is seen as the basis of TNO', summarises one interviewee. He sees the following challenges to the institutionalisation of ethics:

- TNO needs to communicate more openly and transparently about socially sensitive topics like energy (fossil 'versus' renewable; fracking; carbon capture and storage, etc.); 'a downside [of such open communication] may be that TNO makes itself vulnerable - however, vulnerability can also be powerful'.
- TNO needs to comply with the broader scientific community; TNO does that, e.g., by adopting the code of the KNAW[72].
- TNO will need to find ways to work with different terms and conditions, e.g., when a specific customer requires that TNO follows the customer's Terms and Conditions. A similar challenge is related to employees who combine jobs at different organizations, which have different terms and conditions.
- Interestingly, 'Ethics' is seen by some (e.g., a Director) as 'not scientific, but intuitive and context-dependent; you arrange it as a society. It concerns expectations about people's actions; and, as we know, the context of actions can change rapidly. Ethics or ethical dimensions work in standard situations or

72 Royal Netherlands Academy of Arts and Sciences: https://www.knaw.nl/en/topics/ethiek/wetenschappelijke-integriteit/overzicht?set_language=en

in steady state situation, when there are rules. Ethics is not about absolute norms but it is relative. If things get tense or in case of large discontinuities, or when stakes are at play, then the decisions can turn out differently.' This quote illustrates the perception of ethics as context-dependent and as searching for answers in unclear situations[73].

4.4.2. Key dimension 'Gender' at TNO

Gender rationale and goals at TNO

TNO continues to pursue its existing diversity policy which devotes specific attention to the 'gender split'. Achieving equal opportunity for men and women will continue to be a key objective in the years ahead. TNO has set a target of having at least 30% female representation within the organization as a whole and in each of the various grades. TNO would like to focus on gender balance in research teams and remove barriers to career progression of female scientists within the organization. The focus for the coming years will therefore be implementation of career advancement through all levels to reach at least 30% in all lines of expertise (researchers, project managers, consultants) and staff departments.

Most interviewees agree that it is good to encourage awareness among women to develop their careers. This is especially evident in female colleagues with young children, who experience that it is still difficult to combine a career and family life. As one director states: 'the basic principle is that men and women should have equal opportunities to go through the same growth in their careers. Although equality between men and women is paramount, it is a fact that women and men act from a different perspective. For example; I experience that I must approach women more proactively to encourage them to make a career move.'

The shared view at TNO is that more women in the organization (as a whole[74]) is desirable, however, the actors involved feel that this should not be achieved by the provision of a quota. As one director puts it: 'I am a strong supporter of women in the organization, but against trying to organize this through a quota which stigmatises

73 This is totally in line with classical ethics of, e.g., Aristotle and pragmatic ethics of, e.g. Dewey 1938.

74 Some parts of TNO contain already a large contingent of female staff for instance the expertise group Child Health.

women.' According to one research manager, '[…] on the Gender Equality plan we must not put such quotas, or other things like that. I think it is mainly a task for the managers to select the right person for a job.' It is stated that diversity has a positive effect on the personnel and the results of the organization in the longer term, because diverse teams show greater variety in devising solutions and make better decisions. Gender equality is considered to be a part of a broader diversity that is desired within TNO. A director was quoted as saying: 'a variety of cultural backgrounds, nationalities and worldviews are dimensions that I would like to see reflected in the diversity of TNO's research teams. I wonder what mix we need for well-functioning teams.' It is generally known that women perform better under different conditions than men, which is a serious reason to change traditional male oriented conditions and approaches. The same director continues: 'I am sure to organize mixed teams; it takes longer to start, but once they start performing they often perform better than 'unmixed' teams. The same applies to people with a different cultural background; therefore we have to approach them differently than the 'standard' TNO employee. To support diversity, including gender equality, there should be greater attention paid to different ways of interacting.'

Gender practices at TNO

TNO is committed to the 'Charter Talent to the Top' with the aim that by the end of 2018 the top of TNO consists of 30% women. These ambitions are monitored by the Leadership Development section and are also part of TNO's recruitment policy and strategic workforce planning for all departments of TNO. TNO has a specific Diversity Steering Committee (see also section 4.3), which has to ensure that we achieve our ambitions. The EU expects TNO to take conscious account of gender diversity in its research, the composition of research and project teams and advisory boards. For example; in Horizon 2020 Gender is a cross-cutting issue and is mainstreamed in each of the different parts of the Work Programme, ensuring a more integrated approach to research and innovation.

As one director stated: 'In our recruitment policy, we ensure that at least one female candidate is part of our interview procedure. Of course, this person must have the capabilities that are required for the function. Internally it often happens that we proactively approach women to apply, if we think they have the capacity to operate successfully in the position. This requires extensive knowledge of people within our

organization; Management and the leadership development committee know all potentially suitable candidates and their skills.'

Another good practice is the internal TNO network called Woman at TNO (W@T). This network supports women with their careers at TNO by:

- Connecting women in the organization by networking activities
- Providing opportunities for mentoring
- Providing a female leadership programme, together with the human resource department, management and the Steering Committee Diversity. The purpose of this being to: empower a group of women within TNO and contribute to the dialogue on the importance of diversity

Institutionalisation of Gender at TNO

TNO has installed the Steering Committee Diversity, which is committed to promote diversity at TNO and to create the necessary learning and working environment. They have drawn up the action plan diversity 2015-2018, which stimulates the anchoring of diversity at different levels within the organization. These levels are:

- *Strategic level*: communicate new policy through dialogue, focus on gender and internationals
- *Management level*: embed diversity in strategic workforce planning, diversity in the selection (and flow), diversity within projects
- *Instruments and interventions*: Women@TNO, Gender (Female Leadership Program & Coaching, Internationals (Plan & Coaching)
- *Communications and role models*: start dialogue on diversity policies and creating attentions for role models.

TNO is still facing a lot of challenges to reach the 30% goal in all the grades especially in the area of career advancement. Although TNO's efforts in diversity in our management levels are paying off (25% on board level and 20% on management level (coming from 16% on management level in 2011)), TNO as an organization is struggling in the advancement of women in scientist levels (junior-medior-senior and principal scientist).

It is felt that for the recruitment of female employees, TNO should also search in a more international context. In the Netherlands, the proportion of women graduating in technical / scientific studies is often below 25%[75] [76] (cf. also (VhTo n.D.)), which is an important reason why it can be more difficult to recruit skilled women. Striving for more international diversity means being able to fish from a larger (international) pool of female talent.

4.4.3. Key dimension 'Open Access' at TNO

Open Access rationale and goals at TNO

TNO has adopted an Open Access policy that is focused, by and large, on the topic of research publications. As a public legal entity, TNO has been assigned a number of public tasks by the government of the Netherlands. This involves e.g. the collection and storage of geo-data, which is subject to the EU Inspire Directive that imposes an Open Access policy on such data. However, TNO is a mixed-funded applied research organization, which is both publicly and privately financed, covering a wide scope of activities ranging from pure contract research for private enterprises; security-related research requiring a specific access regime, to EU funded collaborative R&D projects. The nature of these activities is so divergent that a single publication policy would not be practical.

As stated earlier one of TNO's '*raisons d'être*' is to create societal impact, both domestically and internationally. From this basic ground rule it follows that, wherever possible, TNO is prepared to share its research publications wherever and whenever reasonably possible. Although TNO already put efforts into Open Access policies and activities, the actors involved consider it important that TNO improves its sharing of research data and results, and its Open Innovation practices.

Open Access practices at TNO

In principle the news of relevant projects and outcomes are shared with society through the TNO website. In close collaboration with the Technical University of Delft, TNO has set up a repository that contains TNO reports and publications that are cleared for

75 http://www.vhto.nl/cijfers-onderzoek/cijfers/cijfers-wo/instroom-wo-en-wo-natuurtechniek/

76 http://www.vhto.nl/cijfers-onderzoek/cijfers/cijfers-wo/gediplomeerden-wo-en-wo-natuurtechniek/

sharing with the public. Such clearing, of course, requires the permission of all stakeholders in the project that generated the results[77]. Projects funded by the European Commission are generally accessible via the EU-portal or through other dedicated websites. Concisely put, TNO reports and publications are: 'open where possible, and closed when needed'. In 2012 a central working group was established to formulate a basic TNO-wide Open Access policy that should apply where no other legislation or regulation is in place (H2020 OA policy, Inspire and Public Sector Information directives, etc.). This policy was adopted in March 2014. This working group is still active and working to make the archive of TNO publicly accessible.[78]

Several examples were mentioned in the interviews regarding how actors see good Open Access practices within TNO. For instance, one research manager mentioned that his department publishes over a 100 freely accessible publications each year, which is also an advantage to the scientific world, as it contributes to research in this field.

An intriguing question is about the next issue: *Will the publisher with whom we made the original publication agree to the Open Access principles?* A small internal working group started to handle this problem with some managers of TNO three years ago. A *decision tree* that they produced should be implemented. As a research manager quoted: 'Today, we have around 15% or 20% of what we produce (reports) that could be published directly in the public domain. It is a wish that we increase this percentage, but it is also a complex problem. We developed this decision tree for the simple reason that my department could check whether the authors agree before putting it on Open Access. This resulted in that authors usually find it too complex to decide. The safety valve is that we will not publish a report for fear of making a mistake. This is a system that I would like to break, and we are on the way, for example, by using this decision tree.'

Institutionalisation of Open Access at TNO

It appears that Open Access is a subject that evokes conflicting feelings and practices. Below we describe the main issues and dilemmas mentioned in relation to Open Access.

77 http:/repository.tudelft.nl/help/tno

78 Parts of this paragraph were already mentioned in the Description of Action of the JERRI project.

- *The use of open data:* More and more stakeholders and clients require the use of open data as a transparent basis for our research projects. As one head of unit puts it: 'At H2020 programs we see more and more the requirements from the EU to use open data sets within research projects. I notice that because of these requirements, the projects are becoming more complex because we must accurately determine which data we can use. This takes a lot of time and coordination with other partners and stakeholders.' The use of open datasets is also often difficult because of *privacy* legislation. For example, data that is collected for Open Access publications has to be gathered and processed through a system of 'informed consent'. Due to legislation, the data that is gathered can only be used for the specific context for which consent is given, which makes Open Access challenging in practice. The general picture is that legislation and the ownership of data is an obstacle, therefore privacy issues (especially in health) are at odds with data sharing. In addition, the quality of data plays an important role as it represents much value. The complexity is that there are not always generic principles that can be applied. In practice the use of Open Access principles are expensive and seem to be possible only with the support of public money (provided that privacy is well regulated).
- From the *societal role TNO* has (and stakeholders perceptions of this), it sounds logical that TNO shares its research publications wherever and whenever reasonably possible. Besides publications, TNO also produces a lot of other valuable output. One head of department states: 'Our knowledge and expertise are 'regulated' open; our mission (stemming from the TNO law), is to improve the competitiveness of the Netherlands; full disclosure is therefore not on the agenda. We are not a public trust that may give away its knowledge for the public benefit. In TNO we have different business models in order to deal with this.' Since the financing structures of TNO have been changed, the general expectancy is that TNO functions financially independently. It is a dilemma whether TNO consciously decides in favour of Open Access in terms of Open Access to our knowledge, research data and results. One research manager states: 'We receive about 20% to 25% percent financing from the government, the rest we have to organize ourselves. This creates a situation where we feel compelled to try, on one hand, to control those aspects in our assignments that carry intrinsic value, and not necessarily go for ownership (IP), but sell this to our client. On the other hand we have to remain attractive to our clients so that they are willing to pay for our expertise.'

- *Open access and the TNO business model:* TNO is neither a business nor a government party. Issues around market prices, state aid and business are important for TNO. As one director states: *'Open access is a fine principle, but particularly complex in our business model in which knowledge is worth money. This is at odds with free access to knowledge. Access to data and knowledge is often a practical obstacle. I see a clash between the principles of Open Access and the business model used by TNO. So there is a big difference between what should be and what it is.'*
- *Internal organization:* Trends such as digitisation, informatisation and globalisation, accelerate the demand for Open Access. One Research Manager stated: 'Open Access is an important development that should be embedded in our organization. The reason we are behind is because most of our research here is confidential, such as defence funded research. I think we are on the right track, but must first get cooperation of the IT department, and then we need to find more solutions in our company. This is a broader phenomenon, including in the whole society, to thrive for the Open Access and Open Data. These are areas that have not yet been crystallised. We must stay alert.' For traditional institutions and structures (policies, regulation, legislation), it seems difficult to respond to Open Access in a concerted manner. The actors involved also experience a mismatch between Open Access practices and internal TNO processes. One research manager says: 'We are sometimes approached for a high level exclusive assignment, where our knowledge will become royalty-free available "worldwide unlimited". However, this creates legal and administrative problems because we cannot commit under such conditions. The paradox is that, apart from all internal administrative problems, TNO as an organization is very proud of the fact that we act on such a high international level.'

Another research manager says that she is surprised by the fact that a client has to be pay for knowledge that will be published as a free Open Access publication: 'This gives inequality in the sense that one need to have money, and be willing to pay, to share information for free. This should be properly solved with an Open Access system.'

A major challenge in the light of Open Access seems to give substance to the role that fits the mission and vision of TNO. It was indicated that one would like to see that TNO makes its social relevance more prominent. This probably requires different business and funding models where Open Access plays an important part. As quoted by a

research manager: ‘TNO should not make that choice alone, but must deal with its stakeholders.’

4.4.4. Key dimension ‘Societal Engagement’ at TNO

Societal Engagement rationale and goals at TNO

Societal Engagement is seen as one of the *‘raisons d’être’* of TNO. It is not surprising therefore, that ‘Most work [of TNO] contributes to societal goals [and] to environmental goals’ (Director). She advocates seeing Corporate Social Responsibility (‘MVO’) in a broad sense, i.e. beyond ‘turning off the lights when leaving’ and ‘collecting broken mobile phones’. According to her, this requires TNO staff to be conscious of what a project entails and the decisions about TNO’s involvement and role. Moreover, she advocates communicating ‘This is our vision; this is the impact we create; and to communicate this as evidence’, e.g., by letting TNOs experts tell their stories in a personal way, and by communicating ‘fact-based’ results.

There is a growing need, e.g., from the government, to clarify the impact of research and innovation projects on society, sustainability and wellbeing. In that context, TNO produced a booklet (‘Impact’, September 2015) that highlights ten innovations in which TNO had a key role, and that had positive, real-world impact, e.g.: developing algae for food, improving bridges’ and viaducts’ maintenance, and balancing energy supply and demand.

In short, careful and effective positioning of TNO, as an institute for *independent applied research* and as *facilitator of societal transitions,* is key to Societal Engagement. These societal transitions are aimed at the following areas:

- *Industry*: from economic stagnation to growth in high-technology industry;
- *Healthy Living*: from illness and treatment to health and behaviour;
- *Defence, Safety & Security*: from a wide range of threats to controllable risks;
- *Urbanisation*: from urbanisation bottlenecks to urban vitality;
- *Energy*: from conventional sources to sustainable energy systems.

These topics and transitions are in line with the challenges and ambitions of the Dutch Top Sector policy and social themes in The Netherlands[79].

Within TNO, Social Engagement is often understood as Stakeholder Engagement, i.e., as facilitating two-way communication with various stakeholders[80]: TNO aims to *learn about needs in society* so that TNO can integrate these in its vision and strategy; and TNO aims to *influence stakeholders in society* so that they support this vision and strategy. For TNO it is critical to understand and balance key stakeholders' interests and concerns, and to develop and communicate its vision and strategy to these stakeholders. Corporate communication is therefore key to Societal Engagement, to facilitate two-way communication: 'going externally on a regular basis, to talk to stakeholders' and 'bringing-in the outside world', e.g., in Business Development meetings with clients or via Strategic Advisory Boards.

Another recurring topic is the balancing of (longer term) *vision and strategy* on the one hand and (short term) *commercial and practical* concerns on the other hand. TNO has a vision on the transformation that is needed to move from fossil energy to renewable energy and aims to play a key role in this transformation. But TNO also has knowledge on fossil energy that current customers are willing to pay for - and sufficient revenues are needed for the continuity of TNO. In such a situation, TNO sees an intermingling of Societal Engagement, Ethics (both personal and organizational) and Corporate Communication: decisions need to be made in order to balance conflicting concerns, and these decisions need to be communicated carefully.

Societal Engagement practices at TNO

Examples of good practices include the following:

- The organizing of a range of (regular, planned) interactions with key stakeholders, on various management levels, in making strategies and policies, e.g., choosing topics to focus on:
    - Theme: for each Theme, there is a Strategy Advisory Board, with external stakeholders, e.g., of key clients or ministries;
    - Demand Driven Programs (Vraaggestuurde Programma's);

79 https://www.tno.nl/en/about-tno/mission-and-strategy/

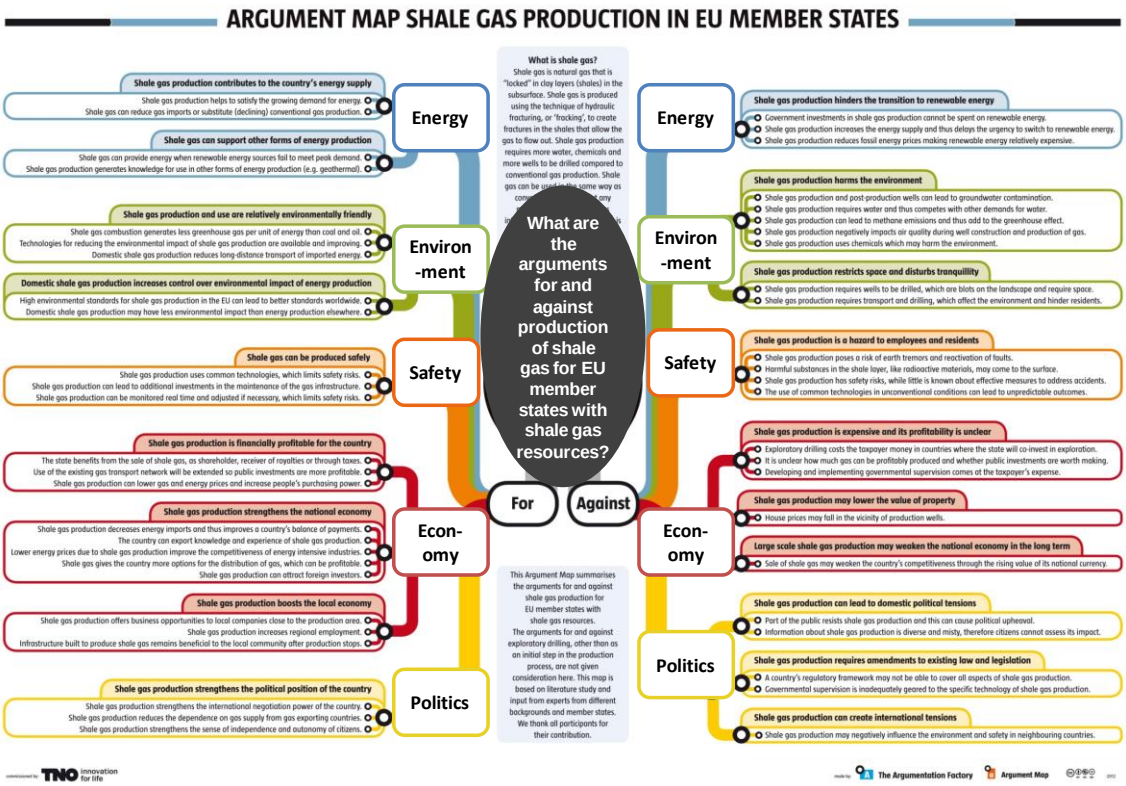
80 Societal Engagement can be understood as a type of Open Innovation (Chesbrough et al. 2006), where the former types of activities can be labelled as 'outside-in' and the latter as 'inside-out'.

- Early Research Programs;
- Top Sectors (https://www.topsectoren.nl/);
- Joint Innovation Programs (https://www.tno.nl/en/collaboration/partners-of-tno/).

– Interactions with specific stakeholders around specific topics. E.g., around ‘sensitive dossiers’, like shale gas (a type of fossil fuel), Dieselgate (fraud in emissions measurements), ultra-fine particulate matter (e.g., around Schiphol Airport), CO2 storage (‘instead of reducing CO2’) or natural gas extraction (and earthquakes and damages to houses) in Groningen. TNO has learned to cope with such dossiers.

– A good practice was the development of an Arguments Chart (see Figure 4) about shale gas, objectively listing its pros and cons. TNO translated this technical dialogue into an arguments chart that can be understood by representatives of the civic society.

Figure 4: Argument map, plotting systematically various pros and cons



The current policy for 'sensitive dossiers' is as follows: identify the vision and strategy that TNO wants to follow (in the roadmaps of a specific theme); collaborate with Corporate Communication; develop a clear message (based on facts, not choosing sides, 'no politics'); and communicate that message clearly and consistently. This policy is meant to mitigate the risk of the press using the topic for its own interests (not in TNO's interest, since TNO seeks to collaborate with stakeholders in finding solutions) or the risk of one specific stakeholder hi-jacking TNO's findings to serve its particular interests - TNO is about balancing interests of different stakeholders.

Institutionalisation of Societal Engagement at TNO

A prime example is the effort TNO puts into collaborating with stakeholders in strategic agenda setting:

- Every four years, in close collaboration with its stakeholders, TNO writes a strategic plan for pursuing its mission, as a 'proposal to society'. The 'strategy is a reflection of the trends we observe in society and technology'. (TNO 2014);
- Another example is the Innovation for Development program (since 2006), which combines technology, business concerns and social good in sustainable ways - inclusive business and inclusive innovation (e.g., involving local businesses, involving women)[81].
- In 2008 a Corporate Social Responsibility officer was assigned to put more emphasis on the environmental and societal impact of TNO's business processes;
- Some interviewees propose that TNO needs to communicate more pro-actively, and needs to develop and express 'opinions': statements about TNO's vision, e.g., on a social issue, and about the role of TNO in solving that issue - underpinned with facts, thereby remaining independent; without choosing sides in a political debate.

81 https://www.tno.nl/en/about-tno/tno-and-its-social-role/innovation-for-development/

4.4.5. Key dimension ‘Science Education’ at TNO

Science Education rationale and goals at TNO

Under the heading of Science Education, TNO attributes several activity fields to the transfer of scientific and science-related knowledge to various target audiences. On the whole, these target audiences can be split into the research community itself, and to young people / students. Other forms of engagement for young people or students refer to the acquisition of new talents. Beyond that, practices explicitly aiming at empowering citizens to participate in the research process cannot be identified. Stakeholders are targeted by means of the TNO websites (including Facebook, Twitter and LinkedIn) and through the digital publication, TNO TIME. Although not specifically aimed at society at large, these could be attributed to belonging to this RRI-dimension.

Science Education practices at TNO

At TNO efforts for young people in most cases have an ‘ad hoc’ character. For young people in primary schools and teenagers, TNO employers are often asked to talk about their profession, to clarify all kinds of issues or to take part in a panel. TNO also has experiences with networks like ‘Eerst de Klas’ and ‘JetNet’ which organizes courses and workshops for young people.

The interviews that were held did reveal the open day as a good practice example. More often good practices from other organizations were mentioned such as the Rathenau Institute that studies the organization and development of science systems, publishes about social impact of new technologies, and organizes debates on issues and dilemmas in science and technology.

Interviewees often mention practices in universities (e.g. because they (have) work(ed) there). Universities, have a programme to help students in secondary education with their assignments (‘profielwerkstukken’), also they help with career choices of students and organize open days etc.. ‘Of course there is a self-interest here, to acquire new students’, states one of the research managers.

The ‘Get to Know TNO’ activity is also an example related to Science Education. It is aimed at acquainting students from STEM-studies to ‘get to know’ TNO, by hosting an event at a TNO location and introducing them to research projects and results.

Institutionalisation of Science Education at TNO

TNO has a significant number of professors at universities and lectors at applied universities; these professors and lectors are seconded for one day a week to a particular university for a specified topic. They teach, do research and help to bridge the gap between fundamental and applied research. They supervise students and PhD students and help to transfer knowledge from practice to (applied) universities and vice versa. In this way TNO transfers its knowledge and practices and learns from fundamental research. The easy transfer and exchange of knowledge is primarily facilitated by similar research orientations and the culture of the organization.

Besides the engagement with universities, one of the most pronounced activities in terms of institutionalising Science Education is that TNO puts structural effort in the development of young professionals by offering a trainee-program for young people with a broad background and mind. This program offers 30 young professionals the opportunity to learn and contribute at three different departments of TNO over a period of two years. At the same time, they establish new connections within the TNO community. This is one of the ways TNO deals with the need to keep its young employees employed for a longer period of time, an issues that is of concern for TNO.

5 Other European RTOs

JERRI has the ambition to contribute to the deep institutionalisation of RRI-related attitudes and practices in RTOs. While the main project activities are focused on embedding RRI in the concrete contexts of Fraunhofer and TNO, JERRI has the objective to generate findings and practical orientation that will be useful for all RTOs of the ERA. To this end, this Work Package 1 also incorporates a brief account of the state-of-the-art of RRI-related practices in other European RTOs. By extending the analytical scope, the perspective is broadened beyond Fraunhofer and TNO. This contributes to a more robust understanding of the current state-of-play in European RTOs, and sheds light on both peculiarities and similarities across different RTOs operating in different contexts. In doing so, commonly observed factors influencing institutional transformation towards RRI can be identified in a comparative way (cf. section 6.1). Where appropriate, the findings from this brief analysis of a number of selected European RTOs will also inform the other WPs of JERRI.

5.1 State of the art on RRI-related practices in other European RTOs

5.1.1. Responsible research and responsible innovation in general

The interviews conducted with representatives of nine different European RTOs show that the organizations relate to issues of responsibility in research and innovation at least implicitly; only in very few instances such a reference is made explicitly. In most cases, disciplinary norms and standards, codes of conduct, corporate social responsibility (CSR) schemes and/or mission statements are in place which can be interpreted as representations of responsibility to some extent. Only in one of the selected RTOs, RRI has become part of the official agenda. Prevailing understandings of *de facto* RRI (cf. section 1), as reflected by the statements of the interviewees about their organizations, include the norms of research integrity and delivering high quality research. This understanding can be also observed at Fraunhofer and TNO. Responsibility, understood as the RTO's obligation to respect certain ethical boundaries, seems to be firmly established, yet mostly without clear definitions of these boundaries and concrete measures to ensure compliance. In some cases, responsibility merely refers to the individual responsibility of preventing harm or the RTOs' mission to facilitate innovation and improve economic competitiveness (indicated, for example, by successful market uptake or the development of sound business cases).

Turning to the interviewees' understanding of responsibility in research and innovation, nearly all have already been confronted with the RRI concept as promoted by the European Commission (EC). In these cases, the various calls in the Horizon 2020 framework programme clearly contributed to the dissemination of RRI to various research communities. Asked about their own understandings of responsibility in research and innovation, the respondents emphasise the need for more reflective approaches, which, in turn, requires a change in the mindsets and cultures in research and innovation. The interviews reveal a shared understanding of RRI as an approach which can contribute to the objective of ensuring that research and innovation will provide benefits to society and addresses societal needs.

With regard to RRI as promoted by the EC, most interviewees indicate that they have a rough understanding of the EC's definition. Some point out that they view the EC's

position merely as one facet in the broader, dynamic and heterogeneous discourse on responsibility in research and innovation. Here, the legacy of older concepts and approaches such as ELSA/ELSI was mentioned. The appraisal of the five key dimensions of RRI delivered a mixed picture. A number of respondents explicitly welcome the key dimensions as a useful approach to make the abstract RRI concept more tangible, particularly if RRI was to be implemented in concrete research settings. For others, the five keys are arbitrary, too narrow and/or do not reflect what they would define as the essence of RRI. In this regard, the key dimension Public Engagement was mentioned most often as the most important aspect of RRI; one respondent emphasised 'science education' as the core of RRI.

5.1.2. Translation of RRI into practice

At this point, none of the RTOs covered in this brief study has embarked on a systematic appraisal or even organization-wide strategy development with the aim of incorporating RRI. Only one RTO has explicitly included RRI-related activities in its work programme. And in another case, the interviewees were optimistic that funds for an internal RRI training programme for researchers would soon be made available by the organization's headquarters. While RRI as an integrated concept encompassing the whole organization could not (yet) be observed (as is the case at Fraunhofer and TNO as well), the interviews show that many practices and elements related to individual RRI dimensions are well established, often since quite a long time.

Of the key RRI dimensions singled out by the EC, the interviews show that Gender Equality and Open Access are broadly established within the RTOs, often as integral elements in organization-wide strategies and guidelines. As Fraunhofer and TNO, some of the RTOs have incorporated gender issues in broader diversity schemes. In comparative terms, ethics (e.g., ethic councils, standardised ethic reviews) seems to have a lower degree of institutionalisation. Particularly individual departments and research units in bio-medical fields tend to have explicit measures in place addressing ethical issues. With regard to Public Engagement, all RTOs have some experience, often concentrated in individual departments. However, long-standing routines and established practices are scarce and do not span the whole organization. What is more, Public Engagement is predominantly understood as stakeholder involvement or,

in technology development contexts, as user involvement[82]. Interactions with lay people and citizens are rare, and if initiated, often tend to be part of science communication and education activities.

5.1.3. Factors influencing institutional transformation towards RRI

In view of the experiences made with RRI-related activities in the RTOs covered, the interviewees were asked to reflect upon factors influencing the institutionalisation of RRI[83]. These responses can be grouped into three interrelated categories: leadership, framework conditions, and establishing practices.

1) Leadership

The interviews emphasise that the leadership within an RTO plays a decisive role when it comes to facilitating or impeding the uptake of RRI. Nearly all respondents expect that clear backing for RRI from the hierarchy and/or dedicated individuals ('institutional entrepreneurs') or groups is an important factor for the successful institutionalisation of RRI practices. The support should include the internal communication (e.g., highlighting certain RRI activities as good and important examples for the whole organization) as well as appropriate incorporation of RRI in mission statements, strategy documents and guidelines.

2) Framework conditions

A number of conditions were mentioned which seem to support the uptake of RRI in RTOs. These include the role of European research funding (H2020), which has contributed to increased awareness by many research actors. While the research funders can play an important role in initiating and inducing change, some interviewees also pointed to the inherent risks of such external steering attempts. Based on previous experience, respondents alerted to possible unintended responses on the side of the recipients (e.g., superficial uptake of requirements, 'tick-boxing' without meaningful transformation of practices). With regard to internal governance, the adoption of RRI-

[82] These findings are supported by the interviewee from DG RTD, stating that CSO involvement in European research projects is still relatively low.

[83] These findings are very similar to those reported by the RES-AGorA project for example see Randles et al. (2016a) and abstracted into responsible research and innovation governance principles in Kuhlmann et al.(2016)

related aspects in an RTO's key performance indicators was mentioned as a potentially promising mechanism to support institutionalisation of RRI. Similarly, financial incentives and disincentives might play a role as well. Others called for concrete norms, guidelines or even regulation, making certain RRI-activities mandatory. Research evaluations and institutional audits could also include RRI elements.

In addition, the interviewees mentioned factors that are rather difficult to influence in the short term. For instance, RTOs (or departments within RTOs) with long-standing experiences with sustainability research, ethical considerations or Corporate Social Responsibility (CSR) seem to be more receptive to the objectives and practices of RRI. This kind of 'literacy' might be conducive for the institutionalisation of RRI. Similarly, an RTO's experience in dealing with technology assessment and certain techno-scientific debates (e.g., nanotechnology) will most likely also contribute to an increased openness for RRI.

3) Establishing practices

Enabling experimentation with RRI within RTOs was frequently mentioned as an important step towards the broader institutionalisation of RRI. Experiments and pilot projects could serve several functions in this regard: First, the pilot activities could contribute to organizational learning and the development of necessary expertise. Second, the design of the activities could be better aligned with and tailored to the specific institutional conditions and cultures of the RTO. And third, such pilot projects can help to reduce scepticism both on the side of leadership and research staff.

6 Comparison of RRI-related rationales and practices

This section synthesises the multifaceted state of the art on existing RRI practices at Fraunhofer, TNO and other European RTOs in two ways: First, commonalities between the organizations are identified in order to engage in the next piloting and institutionalisation steps. Second, exemplary potentials for mutual learning are identified: Rather than benchmarking the organizational RRI-related states of the art against each other, common good practices going beyond 'business as usual' that are potentially suited to be adopted by other RTOs are highlighted.

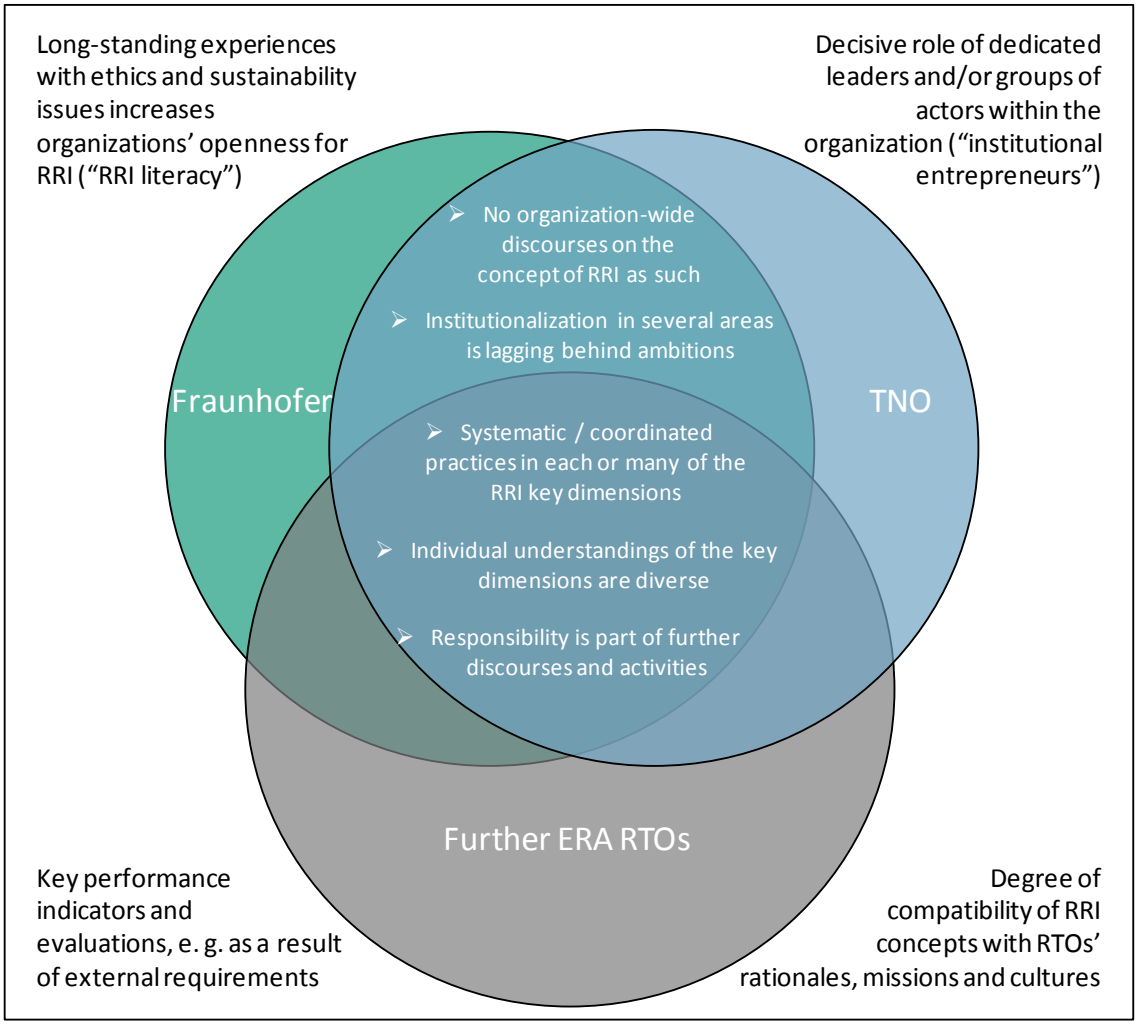
6.1 A common ground to start from

At the level of most key dimensions, organizational histories of Fraunhofer and TNO show significant and – over the last decade – increased efforts to promote responsible research and responsible innovation at various levels. The flipside of this longtime engagement seems to be that organizational structures (and related sense-making) were established before the official concept of RRI emerged. Consequently, no organization-wide discourse on the concept of RRI as such can be observed at Fraunhofer or TNO. This speaks for further engaging in a conceptually 'open' approach: The preliminary working definition of responsible research and responsible innovation as the process of aligning the orientation and effects of R&I to societal needs and values allows to capture the diversity of RRI-related practices at Fraunhofer TNO and other RTOs. Thereby it becomes obvious that, beyond the five key dimensions, responsibility has also been part of other framings, discourses and coordinated activities, such as sustainability, Corporate Social Responsibility, scientific integrity, or the establishment of organizational codes of conduct. The view that various forms of de-facto RRI could be observed before the concept of RRI emerged is also shared by the interviewee from DG RTD.

The individual understandings of what is or should be understood of a specific key dimension, and the discourses in which it is located, are sometimes diverse within and across organizations: For example, diversity at Fraunhofer is primarily a superior goal of gender-related activities, whereas at TNO, it is (also) considered as the main goal of its Science Education activities. It seems important to acknowledge the individual and organization-specific understandings in order to define and accentuate organizational dimension-related RRI goals as actually shared organizational realities[84].

[84] The definition of organizational goals for each RRI dimension will be part of Work Packages 2 and 3.

Figure 5: Commonalities of Fraunhofer and TNO (general commonalities in white, factors facilitating transformations towards RRI in black)



Independent from that, systematic and coordinated practices can be observed in each (Fraunhofer and TNO) or many (other RTOs) key dimensions, although substantial differences in their scope and depth exist. When it comes to the question of how well they are institutionalised within the organizations as a whole (i. e. how well centrally coordinated initiatives are taken up locally, and how well locally organized activities are spread within / taken up by the organization), organizations are still lagging behind the ambitions articulated by their members.

Some factors seem to facilitate institutional transformations towards RRI in all of the analysed RTOs (cf. figure 5). Besides organizational rationales, missions and cultures,

long-standing experiences with ethics and sustainability increase the receptiveness for RRI-related practices. Single groups or leaders are often decisive to promote RRI-related topics, and indicators such as Key Performance Indicators (KPIs), or indicators applied in monitoring or evaluations can help embedding them in the organization.

6.2 Potentials for mutual learning

As set out in the logic of the JERRI project, mutual learning based on good practices will take place at several levels (cf. Deliverable D10.1 Final Dissemination Plan), including the co-development of goals and action plans at Fraunhofer and TNO (WPs 2 to 5). Besides remaining challenges and barriers in the institutionalisation of RRI-related activities, the state of the art analysis uncovered several initiatives, organizational functions or routines that are judged as positive examples. The analysis also showed that these examples vary among RTOs. Presumably because of the diverse organizational settings, it was hence difficult to identify *common* good practices for the institutionalisation of RRI. Moreover, it can be assumed that the definition of what a 'good practice' is essentially depends to the specific values and structural setting of the adopting organization. It seems thus reasonable at this stage to present several RRI-related 'highlights' that are potentially suited for mutual learning, but whose suitability for an adoption by other RTOs remains to be shown. In section 3 and 4, the following 'highlights' could be identified:

- *Ethics*: Establishment of an Integrity Officer leading and overseeing an integrity programme
- *Gender*: Set-up of an integrated HR management and reporting system; formulation of a diversity action plan, facilitating networks e.g. to connect women in the organization; provision of a female leadership programme
- *Open Access*: Provision of an Open Access repository; provision of comprehensive services to support publication processes
- *Societal Engagement*: Place to commonly develop future visions and projects that are open for the public; presentations that can be understood by representatives of the civic society, e.g. arguments maps
- *Science Education*: HR marketing instruments to spark the interest of young people in science

7 Conclusion

As Deliverable 1.1 ‘Synthesis of existing RRI practices’ of the JERRI project, this report aims at capturing the empirical realities of RRI-related practices at Fraunhofer, TNO and other European RTOs. Insights were gained via desk research, a series of qualitative interviews within the focal RTOs, and workshop discussions at the JERRI State of the art meeting.

The report represents an inventory of organizational rationales, goals and practices which can be attributed to a wider concept of responsible research and responsible innovation, specified in an open working definition as a process of aligning the orientation and effects of R&I to societal needs and values. Following the logic of the JERRI project, a particular focus is set on the key dimensions of Responsible Research and Innovation as defined by the European Commission. In addition, different qualities of institutionalisation are set out for each of the key dimensions at both Fraunhofer and TNO.

A comparison shows the commonalities between Fraunhofer, TNO and other RTOs, as well as exemplary good practices. Overall, the report provides the further Work Packages with relevant basic information and a common understanding of existing RRI-related practices to engage into the next piloting and institutionalisation steps (WPs 2 to 7).

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ABBREVIATIONS

AIRI	Associazione italiana per la ricerca industrial / Italian Association for Industrial Research
AIT	Austrian Institute of Technology
BfC	Beauftragte für Chancengleichheit (Equal Rights Officer at the Fraunhofer-Gesellschaft)
CeRRI	Center for Responsible Research and Innovation
CO2	Carbon dioxide
CSO	Civil Society Organization
CSR	Corporate Social Responsibility
DFG	Deutsche Forschungsgemeinschaft
DG RTD	Directorate General (of the European Commission) for Research and Innovation
EARTO	European Association of Research and Technology Organisations
EC	European Commission
ELSA	Ethical, Legal and Social Aspects
ELSI	Ethical, Legal and Social Implications
ERA	European Research Area
EU	European Union
Fraunhofer IAO	Fraunhofer-Institut für Arbeitswirtschaft und Organisation / Fraunhofer Institute for Industrial Engineering
Fraunhofer IRB	Das Fraunhofer-Informationszentrum Raum und Bau / Fraunhofer Information Center for Planning and Building
Fraunhofer ISI	Fraunhofer-Institut für System- und Innovationsforschung / Fraunhofer Institute for Systems and Innovation Research

Fraunhofer UMSICHT	Fraunhofer-Institut für Umwelt-, Sicherheits- und Energietechnik / Fraunhofer Institute for Environmental, Safety, and Energy Technology
Fraunhofer SIT	Fraunhofer-Institut für Sichere Informationstechnologie / Fraunhofer Institute for Secure Information Technology
HR	Human Resource
IJS	Institut Jožef Stefan / Jožef Stefan Institute
ISSI	Integrating Society in Science and Innovation
JERRI	Acronym for the project Joining Efforts for Responsible Research and Innovation
KPI	Key Performance Indicator
NGO	Non-governmental organization
PhD	Doctor of Philosophy
R&I	Research and Innovation
RRI	Responsible Research and Innovation
RTO	Research and Technology Organization
SINTEF	Stiftelsen for industriell og teknisk forskning / The Foundation for Scientific and Industrial Research
STEM	Science, Technology , Engineering and Mathematics; often used to refer to studies in this field of which RTO's rely on for new talent
TNO	The Dutch abbreviation of Toegepast Natuurwetenschappelijk Onderzoek, in English; Applies Scientific Research
VITO	Vlaamse Instelling voor Technologisch Onderzoek / Flemish institute for technological research
VTT	Teknologian tutkimuskeskus VTT Oy / VTT Technical Research Centre of Finland Ltd
W@T	Women at TNO; working group on women in the TNO organization

ANNEX I: INTERVIEW GUIDELINE

JERRI – Joining Efforts for Responsible Research and Innovation

State of the art on existing practices and attitudes in the field of Responsible Research and Innovation

Interview Guideline

Background information

You are invited for an interview regarding your organizations' current practices on responsible research and responsible innovation. The interview is part of the EU project JERRI - Joining Efforts for Responsible Research and Innovations (RRI), and will help the project to understand the current state-of-art on RRI. The goal of the project is to foster Responsible Research and Innovation (RRI) transition in Europe by developing and testing good RRI practices. Further information on the project can be found in the project leaflet.

In this first stage of the project we are organizing interviews within Fraunhofer, TNO and several other applied research organizations (RTOs) in Europe in order to enable bottom-up insights on the actual state of play of organizational orientations and practices which can be attributed to Responsible Research and Innovation. Your input is very valuable in order to understand how different practices are perceived and apprehended by stakeholders inside your organization.

The interviews will be carried out either face-to-face or by phone. Each interview will take one hour at the maximum. Your interview will be used for analysis and publication of relevant results in a public report. Data protection will be ensured according to our data protection statement.

Proposed interview structure and questions

Please note that some questions or parts of questions will not be applied, depending on your specific responsibilities and tasks.

Section 1 "The interviewee and its organisational context"

1) What are the responsibilities and tasks of your current post and how long have you been doing this role?
2) How do you think your career background has influenced your ideas of what it means to 'act responsibly'?

Section 2 "De-facto responsible research and innovation"

3) What does 'responsible research' mean to you? How does this idea translate into practice in your current role?
4) What does the idea of 'responsible innovation' mean to you? How does this idea translate into practice in your current role?
5) Have you heard of Responsible Research and Innovation (RRI)?
6) What does the concept mean to you? How does it stand out or differ from other understandings of 'responsibility' in research and innovation contexts that you described above?
7) Comparing your pre-existing understandings and practices of responsible research and responsible innovation with newer ideas of RRI (explanations will be given by the interviewer): Which, if any of these rationales drive the practices of responsibility within your [unit / department / institute / organisation as a whole]?

Section 3 "RRI practices"

8) What does the concept of [Ethics / Gender / Open Access / Societal Engagement / Science Education] mean to you?
9) How do [Ethics / Gender / Open Access / Societal Engagement / Science Education] issues shape research planning and research practices at your [unit / department / institute / organisation as a whole]? What are the plans for the next months and years?
10) How do [Ethics / Gender / Open Access / Societal Engagement / Science Education] issues shape further processes at your [unit / department / institute / organisation as a whole]? What are the plans for the next months and years?

11) Which further units, departments, institutes or other levels of the organisation do you perceive as particularly active in the field of [Ethics / Gender / Open Access / Societal Engagement / Science Education]? Why?

Section 4 "Issues for the institutionalisation of RRI"

12) Where is your [unit / department / institute / organisation as a whole], in your opinion, especially successful in institutionalising attitudes and practices corresponding to its own understanding / rationales of responsibility?

13) Where is your [unit / department / institute / organisation as a whole], in your opinion, especially successful in institutionalising attitudes and activities with explicit reference to the field of [Ethics / Gender / Open Access / Societal Engagement / Science Education]? Where not?

14) What are, in your opinion, the reasons for this success?

15) What are the reasons for remaining challenges to a successful institutionalisation?

16) Which further transformation(s) within your organisation would you like to see? What would be necessary to achieve this transformation? (Please think of resources, necessary changes in organisational settings, etc.)

ANNEX II: COMPARATIVE ANALYSIS OF RRI POLICIES OF RTO'S (preliminary work of TNO)

Introduction

To clarify the current situation about RRI commitment through Europe, different sources were categorized and analysed, like Ethic Report, Code of conduct, Corporate Social Responsibility Report from RTO's. The core mission of Research and Technology Organizations is to harness science and technology in the service of innovation, to improve quality of life and build economic competitiveness[85]. The membership list is a selection of 97 companies (http://www.earto.eu/about-earto/list-of-members.html). Thanks to these sources we have tried to assess the involvement of each organization, however there is very few or even no awareness at all of evaluation in Responsible Research and Innovation, the concept is still under development.

This analysis was conducted from computer searches and for a period of eight weeks, from 18/07/2016 until 13/09/2016.

Methodology

The research focus of this work involves six steps:

- Define each dimension in order to have a view of what it frames
- Build a framework in which list these dimension according to each company
- Go to each website companies to search to find a document referring to CSR policies. For that, I searched through various ways:
  - Rubric 'About us'
  - Rubric 'Publications' / 'Report'/ 'Press'
  - Rubric 'Search field' and enter (language depends on the companies' nationality, most frequently used: English, Dutch and French):
    - Corporate Social Responsibility (CSR)/ Maatschappelijk Verantwoord Ondernemen (MVO) / Responsabilité Sociétal des Entreprises (RSE)
    - Code of conduct / Gedragscode / Code de conduit
    - Ethical Code / Ethische Code / Code éthique
    - Report / Rapport / Rapport
    - Sustainable development / Duurzame Ontwikkeling / Développement durable
- Read the document found in full and list all information that can refer to the RRI dimensions

85 http://www.earto.eu/about-rtos.html

- Analyse and identify similarities and contradictions on RRI dimensions for all companies involved
- Summarize findings in a report (synopsis)

Define each dimension (Ethics, Gender Equality, Social Engagement, Open Access and Science Education) by its definition is only the beginning of the appropriation of RRI. Reducing RRI to only five key aspects we could deviate from the desired target. It was important to understand what variables are behind each dimension.

Synopsis

There are 97 RTO's as stipulated in the introduction. However, only six codes have been found across these research organizations. These codes are in English and public access. One of these codes is in French, it has been reviewed because it is my mother tongue (Anne Joignant – Intern at TNO). Three others companies have their own code referring to CSR policies, but they have been published on their national language – such as Associazone Italiana per la Bierca Industriale (in Italian[86]), Energy Research Center of Netherlands (in Dutch[87]) and RISE (in Swedish[88]), and so has not been examined. One last organization has been added to this research, this is CSIRO, an Australian company. Certain organizations communicate their CSR involvement with articles or publications but it is not always relevant. This kind of publication is the link between corporate values and social responsibility. This is only a preview of the CSR approach and principles of the entity. Compared to code / report, the company does not deal with ethics as a real commitment but rather as a way of designing. We can say that CSR is still in development. For many businesses, this is just a path to communicate. You can find two examples, with iMec (http://www2.imec.be/be_en/about-imec/corporate-responsibility.html) and Sintef (http://www.sintef.no/en/ethics/our-ethical-principles/). So we chose to do not include this information in our analysis.

This first analysis shows that there is a serious gap in terms of communication around CSR commitment. Only 8% of companies publish free access reports on their social responsibility policies. And less than 20% devotes an article about it. According to the Rome Declaration – SIS-RRI (Science, Innovation and Society – achieving Responsible Research and Innovation) -, the European Commission strongly encourages companies to take into account the RRI dimensions in the way they manage and work. This gives rise to recommendations, such as integrating RRI in the design and implementation of research and innovation programmes; developing and implementing strategies and guidelines for the acknowledgment and promotion of RRI. From this, research companies should enter this prospect according to Horizon 2020.

86 http://www.airi.it/wp-content/uploads/2015/12/Report-Airi-Ricerca-Innovazione-Responsabile.pdf

87 https://www.ecn.nl/docs/library/report/2015/o15045.pdf

88 http://www.ri.se/sites/default/files/files/docs/hallbarhetsredovisning_2014_1.pdf

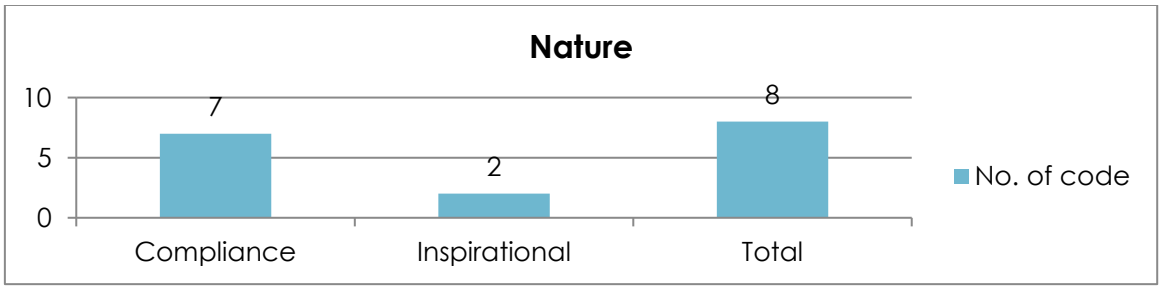
Our work is based on the eight found codes. Each company has been analyzed according to its own structure: establishment, employees, turnover, vision, and mission. The RRI dimensions have been central in the search for information. Several components which can be found at the end of this document guided the research of this analysis. Each dimension is divided into different variables.

Results

Name of the policy guidelines found for each company:

Company	Name of its CSR policies
Centro Sviluppo Materiali S.P.A. (Member of RINA Group)	Ethical code
Deltares	Corporate social responsibility
DHI	Corporate social responsibility report
IFPEN	Sustainable development report
National Research Council Canada	Code of conduct
SP	Sustainability report
TNO	Code of conduct
CSIRO	Policies and guidelines

Nature



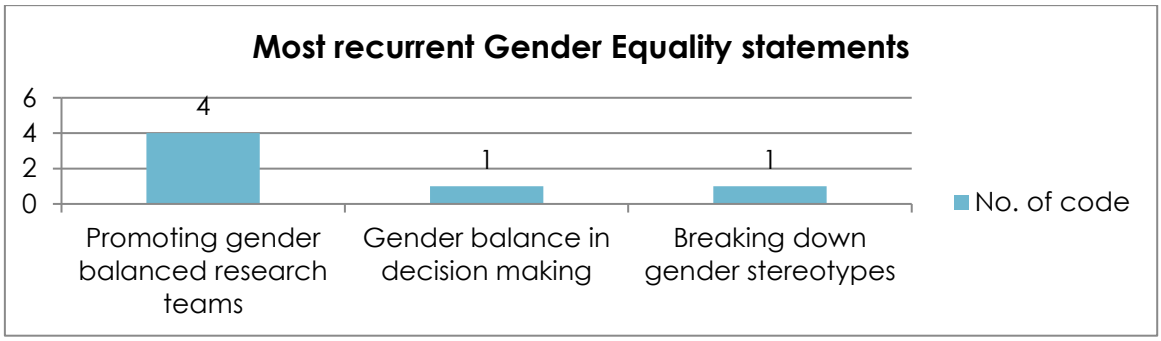
Number of codes with the RRI dimensions

RRI Dimensions	Codes
Ethics	8/8
Gender Equality	4/8
Pubic Engagement	7/8
Open access	3/8
Science Education	5/8

Ethics

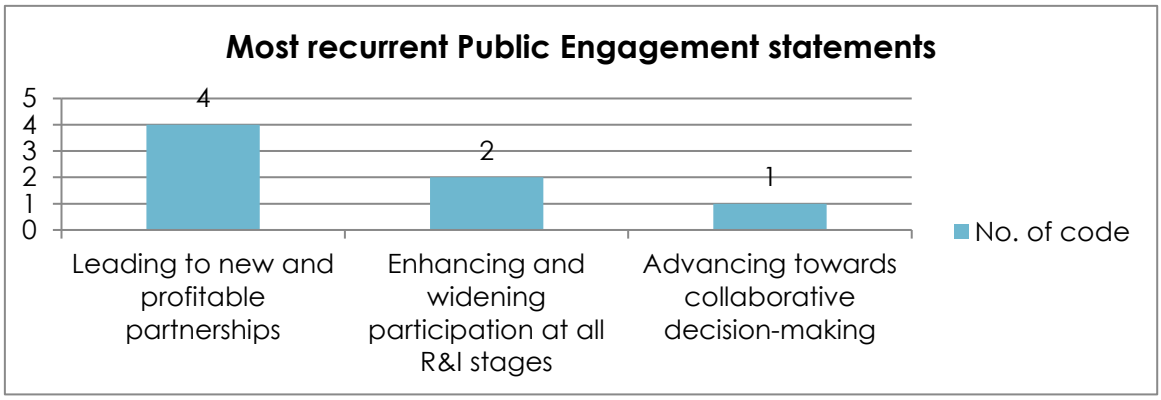
All of these codes deal with the basic principles of ethics in the research.

Gender Equality



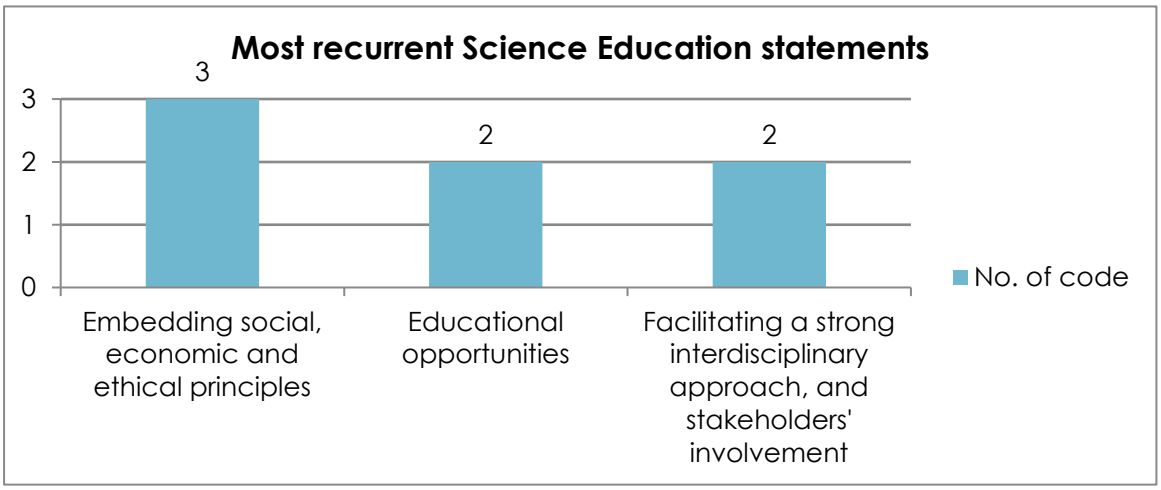
Research institutions have to set up institutional changes in terms of human resources management in favor of gender equality. The aim is to set up innovative strategies, define objectives and assess the progress by means of indicators for gender equality.

Public Engagement

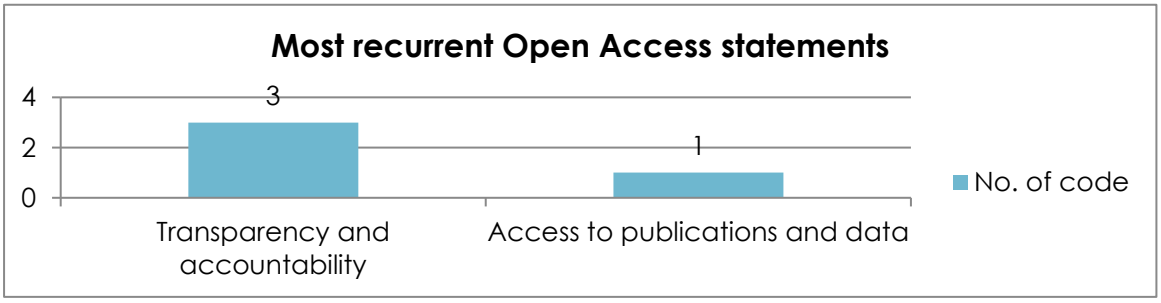


Public engagement means the widest possible diversity of actors that would not normally interact with each other, on matters of science and technology. This dimension injects different perspectives and creativity in the design of research and results.

Open Access



This is the less recurrent dimension which is presented on the guidelines and policies of these Codes. The Horizon 2020 includes the duty to ensure the Open Access to publications which have been funded by (or in part by) this latter, under penalty. Open access does not mean duty to publish, but all beneficiaries have to ensure an online Open Access for all scientist publications on the project results and for all users. This is the objective of Open Access in RRI.



Science Education

The aim of this dimension is to make science education and scientific careers attractive for young people and to integrate society in innovative and scientist processes. For that, research institutions could promote sustainable interaction between schools, industry and the organizations of the civil society. They must encourage the engagement of citizens in the science in order to take into account the citizen interests and their values.

Components guiding the preliminary analysis

Ethics[89]	Quest of truth	Research activity is a quest for new knowledge, with critical and systematic verification and peer review. Honesty, openness, systematicness and documentation are fundamental preconditions for achieving this goal.
	Academic freedom	Research institutions shall assist in ensuring the researchers' freedom in their choice of topic and methodology, implementation of research and publication of results.
	Quality	Research should be of high academic quality. The researcher and institution are required to possess the necessary competence, design relevant research questions and undertake suitable choices of methodology.
	Voluntary informed consent	Consent is the main rule in research on individuals or on information and material that can be linked to individuals. This consent should be informed, explicit, voluntary and documentable.
	Confidentiality	The researcher must prevent any use and communication of information that might inflict damage on individuals who are the subjects of research.
	Impartiality	Impartiality means avoidance of confusing roles and relationships in a way that may give rise to reasonable doubt concerning conflicts of interest.
	Integrity	The researcher is responsible for the trustworthiness of his or her own research. Serious violations of good academic practice are incommensurable with such trustworthiness.
	Good reference practice	Researchers must adhere to good reference practices, which fulfil requirements for verifiability and form the basis for further research.
	Collegiality	Researchers must show each other respect. They must agree on and comply with good practices for cooperation in general.

89 https://www.etikkom.no/en/ethical-guidelines-for-research/general-guidelines-for-research-ethics/

	Institutional responsibility	The institution is responsible for ensuring compliance with good academic practice and for establishing mechanisms that can address cases of suspected violations of ethical research norms.
	Availability of results	Openness regarding research findings is essential for ensuring verifiability, for returning some benefit to the research participants and society in general.
	Social responsibility	Researchers have an independent responsibility to ensure that their research will be of benefit to research participants, relevant groups or society in general, and for preventing it from causing harm. Research decisions must take into account any knowledge that the development of a research area may entail ethically unacceptable consequences for individuals, animals, society or environment.
	Global responsibility	Research institutions and researchers have a responsibility to communicate relevant knowledge to regions that are otherwise excluded for reasons of economic disadvantage. Research should help counteract global injustice and preserve biological diversity.
	Laws and regulations	In the field of research; there are national laws and regulations as well as applicable international conventions and agreements, and researchers and research institutions must abide by these.
Gender Equality[90]	Promoting gender balanced research teams	
	Breaking down gender stereotype	
	Raising awareness towards for gender-sensitive investment and funding	
	Ensuring gender-friendly workplace cultures	
	Considering the gender dimension in research and innovation	
	Gender balance in decision making	
Public Engagement[91]	Enhancing and widening participation at all R&I stages	
	Leading to new and profitable partnerships	

90 http://www.rri-tools.eu/gender-equality

91 http://www.rri-tools.eu/public-engagement

	Guaranteeing a transdisciplinary approach
	Advancing towards collaborative decision-making and shared responsibility
	Promoting Citizen Science and Open Innovation
Open Access[92]	Free access, no more limits
	Access to peer-reviewed literature
	Access to publications, access to data
	Shaking up the current publication system and opening new horizons
	Transparency and accountability
Science Education[93]	Promoting innovative problem-solving and critical thinking
	Embedding social, economic and ethical principles
	Promoting engagement and an entrepreneurial mind-set
	Empowering citizens to participate in science policy making
	Sharing responsibility while solving social challenges
	Facilitating a strong interdisciplinary approach and stakeholders' involvement
	School partnership

92 http://www.rri-tools.eu/open-access

93 http://www.rri-tools.eu/science-education