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1. Executive summary

The following report examines the concept of Responsible Research and Innovation (RRI) in Germany, especially focusing on two research organisations: Helmholtz Association (HGF) and the Karlsruhe Institute of Technology (KIT). These two represent unique structures in the Germany system regarding their organisational structures and funding. Therefore, they can provide valuable insights into current discussions on responsibility and sustainability in the German research landscape, which of course is relevant for an approach such as RRI. The report therefore describes the overall German context for RRI, centring on the legal and normative frameworks as well as aspects of responsibility and the RRI keys (Ethics, Engagement, Gender and Diversity, Open Access, Science Education) and dimensions. Through a national workshop, document analysis and interviews we see that in the national German context the issue of responsibility is key for research today as well as for its funding. This is often connected to ethical standards for research or the responsibility towards society to address challenges. From this comes also an increase in demands for inclusion and engagement of a wider public in science and research in the last years. Indicators for this can be found in main strategy papers of the Ministry for Education and Research, as described below. Even though responsibility is a key issue in Germany, RRI as a term is virtually unknown. Only in the context of EU-funded projects do we find awareness of the concept. Instead contextualisation of responsibility mostly takes place through sustainability. Still, the RRI keys are more or less well represented and, as described in detail throughout the report, we find many activities and initiatives to different degrees. Perhaps the best represented are the keys Ethics, Engagement, Gender and Open Access, not only in Germany in general, but also in the organisations HGF and KIT. When looking closer at the organisations we find different awareness and action levels of the keys. Certain ones are required by laws and guidelines (e.g. Gender or Ethics) other do not belong to the main goals and activities of the organisations (e.g. Science Education). Also, others such as engagement prove difficult to shape in practice since clear aims and methods are lacking or the limits or the organisation to actually include such input become apparent. Still, throughout the research conducted for this report it was clear the notion of responsibility and, for the German context perhaps more important, sustainability, were highly relevant for representatives and interest regarding implementation was high.

Correspondingly, the AIRR dimensions in science policy discussions as well as in the organisations themselves remain fairly blurry, yet show relevance in practice. Especially Reflexivity and Anticipation can be traced in different initiatives and framings of research. For instance, HGF has a cross-cutting research programme dedicated to “Technology, Innovation and Society”, focusing on environmental, economic, political, ethical and social aspects of new technologies to support decisions in politics, the economy and society. Still, in this context we also encountered issues regarding the linkages between this research and other areas such as energy or new technologies. Overall, we see different activities which can be connected to both the keys and the dimensions in Germany, ranging from codes of ethics, TA programmes, engagement formats or advisory bodies. Again, sustainability can be regarded as the most important concept which addresses these issues with accompanying activities and initiatives in the Germany research landscape.

Based on these findings we conclude the report with policy recommendations for national and European policy makers as well as for research organisations. These include for instance including Reflexivity and Anticipation further in sustainability strategies, connecting RRI to similar concepts in research programmes or raising awareness and developing staff reward structures to account for these aspects. Finally, we present a good practice, which can be of interest to a wider level as it is concerned with creating a living urban lab to enhance exchange between various actors in local communities.
2. Introduction: about the report

This report deals with the implementation of Responsible Research and Innovation (RRI) in German research organisations. As described in the overall project Description of Work, RRI is seen from two different perspectives. The first is as an umbrella concept that describes the implementation of five key topics of research: Ethics, Gender, Open Access, Public Engagement and Science Education. This is the standard perspective to be found in the European Commission RRI calls, like the one that our project is attached to, and it is also the default perspective of this report. The second perspective is that of the process of RRI development, based on the dimensions of anticipation and reflexivity, openness and transparency, and responsiveness and adaptation. These dimensions describe the procedural prerequisites for the incorporation of RRI and are therefore complementary to the keys above.

We have undertaken the analysis of both Keys and Dimensions in organisations that focus on research, whether undertaking research themselves, or creating research policies and funding research activities. In order to be able to understand the context in which RRI implementation is taking place in, we have analysed the general German Science & Technology (S&T) sector in terms of both the RRI Keys and Dimensions. Both the contextual analysis and the specific organisational analyses provide the means for the reader to acknowledge the extent of which RRI is understood and embedded in the German S&T as well as its potential development in the country.

The first part of the analysis in the report, that of the national context, is based on documentary analysis, interviews and the results of the national workshop. The documents are major strategy/policy papers in the areas included in the RRI concept or those providing a value-rich view of S&T where the RRI Dimensions are evident. The interviews and the national workshop provide first-hand, face to face exchanges with experts representing active research and management of research in the country. They are important in giving additional standpoints than those in formalised documents. Such perspectives are key in understanding the real challenges that RRI is faced with and the real potential for its development in the country.

Following these, are the two organisational analyses. The first is of the Helmholtz Association, the most significant research policy organisation in the country. The second is of the Karlsruhe Institute of Technology, one of the major universities in Germany representing active research in a variety of fields. The analyses of both organisations followed the same methodology: documentary analysis, interviews and focus groups. This time, as opposed to the national analysis, the focus was on organisational change. Our approach was to uncover the dynamics within the organisation that have resulted in the current adoption of RRI, or parts of it, and those that play a role in future changes that are required for the full adoption of the concept, if at all.

Both organisations have been welcoming of the scrutiny that our project has necessitated and have been remarkably open in the discussions that we have had with them. They provided us with full access to the organisations’ documentation and we had little trouble organising interviews and focus groups (except for scheduling issues). The analyses run as smoothly as one could wish in such a project and therefore, the results are of particular importance to us. The resulting Outlook for each organisation that we developed based on our exploration of its change dynamics, have been received with interest and are discussed at the right level of internal decision making. Whether accepting of RRI in terms of Keys or Dimensions, or even opting for similar concepts with more resonance in the country, our national case study has made inroads in the organisations and has started a process of future exchange.
3. Methodology

3.1 Analytic approach¹

Institutional theory is widely used to analyse public administration. Scott (1987) distinguishes between studying institutions as ‘rational’, ‘natural’ and ‘open’ systems. This has been interpreted in an ethical context by Boyle et al. (2001), who claims that many of the ethical challenges of organisations can be understood only by taking these different dimensions into account. According to Boyle et al., the rational systems approach understands the organisation as having ‘(1) a visible set of hierarchical authority relations in which (2) work activities are governed by formal rules and clearly defined criteria for evaluation, relations that (3) are designed to pursue some set of goals’ (Boyle et al. 2001, p. 31). From an RRI perspective, the rational system includes formal mandates, hierarchies, ethical guidelines and codes of conduct, monitoring and assessment systems, etc. Moreover, thinking in terms of rational systems allows scrutiny of organisational issues such as workload, the availability of resources and so forth.

In contrast, when the organisation is analysed as a natural system, the focus is on the informal sides of the organisation, acknowledging that individuals may have a significant influence on attitudes and conduct in an organisation and that cultures and sub-cultures may flourish more or less decoupled from formal structures, often undermining, replacing or transforming them (ibid., p. 33). Taking this informal dimension into account means – in an ethical and RRI context – to ‘identify the degree to which actual norms, rules, and practices differ from official or formal ones, and then to enquire into how the informal counterparts influence production outcomes, interpersonal relations, and goal attainment’ (ibid., p. 33). Although there is a need for both formal and informal systems in an organisation, a gap between them that is too wide might engender hypocrisy, cynicism and disillusionment. In addition to these rational and natural systems approaches to the organisation, the open systems approach deals with the relationships between the organisation and its environment, on which it is ‘dependent for resources, personnel, and legitimacy’ (ibid., p. 35).

Many mechanisms are at work in the intersection of these three systems, and organisational institutionalism describes the dynamics between the rational, natural and open systems in ways that shed light on some of the problems and opportunities in designing effective RRI programs. Scott (1995) further develops his analysis of organisations and motivation for action by outlining three types of motivation for individual action: regulative (related to rewards), normative (related to the belief that action is morally obligatory) and cultural-cognitive (related to beliefs about what relevant others would do).

In this project, we adopt this analytic framework for our organisational RRI reviews and Outlooks. RRI-Practice takes a perspective from organisational institutionalism described above, seeing implementation of RRI as a process of organisational change. In order to be successful in the actual implementation of RRI, one must first understand how those organisations work. This includes the insight that organisations themselves will frame RRI in different ways.

As with every other national analysis, the current one is using this framework adopted from Scott (1987) and described in the following table.

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¹ The analytic approach is taken from the Description of Work of the project as it is, since it represents a common development by the project consortium that applies to every national case study.
Table 1: Framework for studying the organisations

<table>
<thead>
<tr>
<th>Aspects of organisations</th>
<th>Rational system</th>
<th>Natural system</th>
<th>Open system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspects of organisations</td>
<td>Mandates, legislative frameworks, formal hierarchies</td>
<td>Culture, informal routines, informal reward systems, focus on management</td>
<td>Policy learning, pressures from key stakeholders (owners, the public, etc.)</td>
</tr>
<tr>
<td>Potential drivers for RRI</td>
<td>Active ownership (e.g. the state), legislation that includes social responsibility as a core element of the mandate, formal evaluation criteria adapted to RRI goals</td>
<td>RRI dimensions become mainstreamed, managers start seeing RRI dimensions as an obvious part of their responsibilities, no social acceptance for neglect of the RRI dimensions</td>
<td>Pressure from the media, success stories from organisations considered to set ‘gold standards’ in the field</td>
</tr>
<tr>
<td>Potential barriers to RRI</td>
<td>No formalised pressures to conform to RRI dimensions</td>
<td>Informal incentive systems reward economic output/excellence/etc., effectively marginalising the RRI dimensions</td>
<td>Important stakeholders reward, for instance, excellence and economic performance to a greater extent than RRI related matters</td>
</tr>
<tr>
<td>Methods</td>
<td>Analysis of formal documents</td>
<td>Interviews with employees at different levels in the organisations, focus groups</td>
<td>Media analysis, interviews with top management</td>
</tr>
</tbody>
</table>

3.2 National mapping

3.2.1 Document analysis
The starting point of our analysis is the document analysis. In the first step, the focus was on key players and an initial analysis of the fundamental position papers and documents took place. The central basis for this was the Federal Report Research and Innovation of the German Ministry of Research and Education (BMBF) as an insight into the research landscape and corresponding presentation of the German research and innovation system. In addition, further documents from research organizations of overarching institutions were used. In total, about 75 documents were analysed. A complete list of the reviewed documents is attached in the Annex. An understanding of the framework conditions for research and innovation in Germany was achieved through an analysis of the legal situation. The focus was on national legislation and the laws of the state of Baden-Württemberg. In addition, position papers and government support strategies were used to analyse the dynamic processes. A decisive insight into the goals of research policy and its change over time has been provided by publications of the Joint Science Conference (GWK). Within this framework, the Pact for Research and Innovation (PFI) was adopted in 2005. Since 2007 GWK publishes annual monitoring reports. These contain an overview of the overall situation in the German research landscape as well as reports from the individual research organizations. The focus here is not on the scientific criteria such as excellence, but on further research policy goals. Complementing the political perspective has been achieved through the inclusion of cross-organizational initiatives of the research organizations. These included publications of already established associations such as the Alliance of Science Organizations in Germany as well as ad-hoc initiatives. Further insight was provided by intermediaries such as the DFG.

3.2.2 Interviews
Thanks to the good response and the high level of expert representation in the workshop that proved to be very insightful, only one gap was identified and needed additional input through interviewing. To close this gap, an interview was conducted with a representative of the Association of German Engineers. The document analysis was revisited after the completion of the workshop and the interview for the final evaluation of the national context and the corresponding results.
3.2.3 National workshop
On February 17, 2017, a first workshop was held. Invited were representatives of various organizations in the research landscape who were of particular interest to our analysis. Existing contacts in the science system proved to be very helpful, so that the response rate was very high and all invited participants accepted the invitation. As a result, a very diverse group of seven representatives of various research organizations, civil society and a central advisory body emerged. Central representatives of KIT as a research conducting organization and the Helmholtz Association as a research funding organization were also present. Also representatives from two Fraunhofer Institutes, a civil society organisation dealing with the inclusion of citizens in S&T agenda setting as well as the German Council of Sciences and Humanities participated. The agenda of the workshop consisted of short impulse lectures of the individual persons and a subsequent open discussion. Thus, this workshop provided an insight into the existing structures and discourses within the research landscape as well as the initial location of the research organizations to be analysed later.

3.3 The organisational studies

3.3.1 Document studies
The starting point for the document analysis of individual organizations was first and foremost the websites of the organizations, whereby in the case of KIT we had direct access to the intranet. For the analysis of the Helmholtz Association, a selection of 46 documents, which were rated as relevant by the organization, was made available on request. This opened up a view of the strategic development and the internal focus in the organisations. A special feature was the time horizon of the analysis. KIT as a research organization was created in 2009 as a result of a merger between a university and non-university research institutions that is unique in Germany. This brought together two different policy levels and structural forms of the organization and at the same time opened up a space for change. Accordingly, the underlying conditions were analyzed as much as possible and a special focus was placed on the development of the organisation since 2009. Extremely helpful here was the keyword-based analysis of 600 news published since 2010 on the main page and the annual reports of KIT. In the case of the Helmholtz Association, the time horizon was extended. This relates to a change in 2005 with the introduction of the Pact for Research and Innovation (PFI), which included the introduction of an annual public monitoring report. In 2007, the first report was published and served as the starting point for the analysis. Since the PFI is an agenda for policy, it concerns all major German research organizations and it is reformulated every five years, thus, opening up an insight into the whole S&T system.

3.3.2 Interviews for Reviews
On the basis of the analysis of the organizational structures, central positions and persons were identified and requested for interviews in order to further deepen the understanding of the individual RRI keys and dimensions. The first interviews were conducted with upper level management, after which other relevant people were asked by the interviewees to participate, thus, expanding the group of people interviewed. The overall response rate was very good, in total only two of the planned interviews did not materialize. In summary, a total of 18 interviews were conducted at KIT and the Helmholtz Association. Representatives included individuals directly responsible for individual keys, such as the management of the open access area at the KIT library or the public relations work of the Helmholtz Association, as well as persons from higher management levels to area managers. This allowed an insight into both the strategic level of planning and the operational implementation. See organisational graphs of the two organisations with identification of the location of our interviews in the organisational analysis sections.
3.3.3 Focus group and Outlook process

The results of the interviews and document analysis were evaluated and converted into a draft Outlook for each organisation. Further focus groups were undertaken to discuss these Outlooks, with the guests being provided with drafts in advance to allow them to enter the discussion. A total of seven representatives of the organisations participated in the further two focus groups. In addition to the immediate feedback on the design of the Outlook, there was an opportunity to further discuss the implementation options of RRI. The results of the document analysis, interviews, workshops and focus groups were finally submitted to the organisations as the final Outlook versions.

4. The context for RRI: the national science policy system

4.1 General country information

With about 82 million inhabitants Germany is the country with the largest population in Europe. It covers an area of around 360,000 km² and has a population density of about 230 people per km². It borders nine countries and is located in central-western Europe. Germany has a social welfare system including universal health care and laws on environmental protection as well as education free of tuition (Hahn, Scherz 2018). After World War II, a period of fast reconstruction and development followed in (West)-Germany. An extended time of low inflation and industrial growth resulted in an advanced social market economy. Nowadays, Germany is the world’s fourth largest economy by nominal GDP (an estimated $3.7 trillion) and ranks fifth according to purchasing power parity ($4.2 trillion). Despite the social welfare system with redistribution measures, overall wealth is distributed somewhat unequally, which results in a Gini coefficient (scaled from 0 to 100) of 29.5 in 2016 which ranks 13th in the EU (Gini coefficient in the EU 2016 was 30.8).

The German Constitution (“Grundgesetz”) was established in 1949 by the occupying Western Allies with amendments made in 1990 in light of the reunification of Germany. The Grundgesetz orders the political structure of Germany. The country is a federal parliamentary republic in which the legislative power is assigned to the parliament (Bundestag) as well as the representative body of the regional states (Bundesrat). In the German system, power is divided between these federal and state levels as well as between the legislative, executive and judiciary. For the political structure in Germany the European Union is also very relevant. This is especially the case regarding legislation, which shows in the form of laws passed by EU institutions that must be adopted by member states. EU regulations are passed and should be implemented without additional national measures while EU directives require national implementation actions. The Federal Republic of Germany is a founding member of the European Union and has been part of the Eurozone since 1999. It is also a member of the United Nations, NATO, G8, G20 and the OECD.

Article 20 of the Constitution states that Germany is a democratic and social state, in which all state authority is derived from the people. This sovereignty of citizens means that any form of state power must be legitimised by them (e.g. through elections). This is extended to the right of any German citizen to resist anyone trying to abolish the constitutional order. This outlines the importance of resistance, which is an inheritance of Germany’s past dictatorship under the Nazi regime. The Constitution also

states the roles of different government institutions and strongly emphasises the distribution of power and decision making. The Bundestag is elected by German citizens and executes the legislative process, provides parliamentary scrutiny and decides the federal budget. The system also gives substantial power to the 16 German states, that through the Bundesrat, participate in the legislation process. The Federal President is the official head of state, yet he or she has a mainly representative role, keeping a general distance to party politics. All federal laws must be signed by the President. The head of the government is the Federal Chancellor, who is elected by the members of the Bundestag for four-years. The German Cabinet is the main executive body and consists of the chancellor and cabinet ministers. The Bundestag itself is also elected for four years, a party must have at least 5% of votes or at least three directly elected seats in order to be qualified for the parliament. Currently, the 19th German Bundestag (from October 2017 on) has 709 members.

The German economy is the largest in Europe. In 2017, the GDP increased by 0.6% compared to the year before. Research and innovation play a central role in this. Germany is one of the innovation leaders in the Innovation Scoreboard 2015 of the European Commission, and five of Europe's top ten R & D-strong companies come from Germany. The contribution of medium and high-tech goods exports to the trade balance, at 9.2%, is as high in no other EU country as in Germany. 54% of German industrial goods exports are research-intensive products. The research and innovation system plays a correspondingly important role (Graph 1).

Total gross domestic research and development expenditure (GERD) amounted to € 79.73 billion in 2013. This corresponds to a share of 2.88% (2014) of GDP, almost reaching the EU target of 3%. Germany ranks fourth in terms of R & D percentage in GDP compared to other European countries. 1.9% of GDP and thus two thirds of the GERD are carried out in the economic sector. With a self-financing ratio of 91%, the latter is predominantly self-financing. The government funding share of R & D expenditure in the economy is below average at 3.4%, compared with an average of 6.6% for the OECD. Existing state support focuses disproportionately on small and medium-sized enterprises and on pre-competitive, application-oriented research. This strong and independent role of the economy is a characteristic feature of the German R & I system.

The remaining third of the expenditure, amounting to € 24.2 billion (2013), is public research. The research landscape is characterized above all by a dichotomy between university and non-university research. University research accounts for around 17.9% (€ 14.3 billion, 2013) of the GERD. The research is carried out at more than 400 universities and is therefore fragmented. The universities have far-reaching autonomy and are "highly diversified thematically, disciplinarily and methodically" (BMBF 2016, 64). The research is highly specialized. Another central task of the universities is the education of young scientists.

Non-university research is structured around four major research organizations that share different goals and are organized in different ways. The largest organization with a budget of € 4.5 billion (2017) and more than 38,000 employees is the Helmholtz Association of German Research Centers (HGF). This is an association of 18 research centers with the aim of "pursuing the long-term research goals of the state and society and preserving and improving human livelihoods" (BMBF 2016, 70). By contrast, the Fraunhofer-Gesellschaft consists of nearly 70 institutes and is the largest research organization for applied research in Europe. While the HGF is mainly basic-financed, the Fraunhofer draws € 1.77 billion of the € 2 billion budget from contract research. The third central organization is the Max Planck

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5 All figures for research expenditure are based on BMBF (2016).
Society (MPG). It conducts mainly natural, social and humanistic basic research. The last organization, the Leibniz Association, is a more open association with varying thematic research.

In addition to these four institutions, non-university research is also conducted at academies of science and departmental research. However, their share in the GERD is only marginal. Intermediaries represent a link between the conduction and funding of research. The central institution here is the German Research Foundation (DFG). This is a self-governing organization of science with the task of selecting and promoting the best research projects. For this it has a budget of € 3 billion available. Another important intermediary, for the economy, is the Stifterverband für die deutsche Wissenschaft. This is an association of numerous industry foundations (Mercator, Volkswagen, Bosch, etc.) and supports projects and institutions from various fields of science. The industry supports 10% of R & D in non-university research and 14% in higher education. The important role of the industry is also clear here, because this share is above average in international comparisons.

In Germany, there is a country-specific, division of labour structure. Based on historical experience, there is a strict separation between the federal level and the individual federal states. The sovereignty in the field of culture and education lies with the individual federal states, the federal government here has only general, framework-setting competences. Nonetheless, it has developed an important role, especially through the promotion of large-scale research (nuclear energy) for which the individual states lack the means to develop. As an example, the Federal Government has raised € 15.8 billion for research and development in 2016. 60% of these are assigned to the Federal Ministry of Education and Research (BMBF), the next largest budget is the Federal Ministry of Economics and Energy (21%) and the Federal Ministry of Defense is the third largest with 5%. The strong focus on a single ministry is another special feature of the German system. The independent funding by the Federal Government primarily addresses time-limited funding and technical programs as well as direct project funding, above all, application-oriented research.

The 16 federal states conduct country-specific research, technology and innovation policy support measures. The total expenditure is ca € 10.14 billion and accounts for 41% of total government R & D expenditure. This fragmentation is accompanied by strong regional differences. The R & D intensity (measured by the share of R & D expenditure in the respective GDP) ranges from 3.87% in Baden-Württemberg to 0.42% in Saxony-Anhalt. And while there are 171 full-time R & D jobs in Baden-Württemberg for every 10,000 employed persons, there are only 39 in Saxony-Anhalt. Overall, there is a west-east and north-south divide in the country.

In cases of supra-regional importance, the Federal Government and the Federal States cooperate in promoting institutions and projects of scientific research. However, they must reach an agreement for this. The central forum for negotiations is the Joint Science Conference (GWK), which brings together the federal and state governments. They are supported by the Science Council, which evaluates and advises. In addition, there are a number of other advisory bodies such as the High-Tech Forum and the Innovation Dialogue. Such “cases of supra-regional importance” include the funding of the four non-university research institutions mentioned above as well as the DFG, whereby the ratio differs. 90% of the HGF is financed by the federal government and 10% by the federal states, while the MPG is funded in each case by half.

In addition to this direct institutional support, there is an agreement between three “Pacts” to meet the 3% expenditure target. The Higher Education Pact should concentrate on improving university teaching, while the other two Pacts should focus on research. The second Pact of Excellence, was initiated in 2005 with the purpose to promote cutting-edge research at “excellence universities” as a result of a competition. The pact has already been extended twice, currently running the third call for
applications to which universities can apply. The third is the Pact for Research and Innovation (PFI). This grants the non-university research institutions and the DFG an annual average increase of 10%. In return, they commit themselves to the pursuit of research policy goals and a regular evaluation. Again, the federal government bears the bulk of the costs.

These pacts and similar support programs are a central tool for governance in the science system. This is also due to the fact that in Germany the demand for autonomy and freedom of research, especially at universities, is strongly upheld. Overall, the German research and innovation system is strongly characterized by division of labour, negotiation and cooperation.

In the broader embedding, the EU continues to play a central role. As a result of the Treaty of Lisbon, the federal government formulated a Europe 2020 strategy in which, among other things, the achievement of the 3% target was laid down. Germany also receives 4.11% of the GERD from abroad (BMBF 2016, 59).
Graph 1: German research and innovation system (BMBF)
4.2 Legal and other binding normative frameworks

The structure of the direct legal framework for research in Germany is very complex. The Constitution, in which freedom of research is stated, is superordinate and universal: "Art and science, research and teaching are free. Freedom of teaching does not absolve from loyalty to the constitution" (Article 5, para. 3), which corresponds to a very strong discourse of autonomy in Germany. This is evident in the educational system whereby the universities insist on their freedom of action and autonomy. Overall, the public science system is characterized by strong federalism. The cultural and scientific sovereignty lies with the individual federal states, whereby the federal government can only set a very general framework and carry out specific promotion in agreement with the federal states. That is why there are 16 different state university laws in the country. The approximately 400 universities behind it are in addition self-governing and each has its own statutes.

As a result, different regulations can be found at different levels. This becomes particularly clear in the civil clauses prohibiting research for military purposes. Such regulations can be found in five university laws and 64 universities. For nuclear research centres set up in the 1950s, such clauses were mandatory. Also, the situation with Open Access is very different. The state of Baden-Württemberg plays a pioneering role here. In 2014, the state university law laid down a duty to publish a second copy in open access. The University of Konstanz has also incorporated this obligation into its statutes. Professors of the University of Konstanz have filed a lawsuit against this rule, the case is currently at the Federal Constitutional Court. At some other universities, there are only general concessions on open access.

A similar example in the regulatory area relates to the gender key. Article 3 of the Constitution states: „Men and women shall have equal rights. The state shall promote the actual implementation of equal rights for women and men and take steps to eliminate disadvantages that now exist.” In 1985, by revising the Higher Education Framework Act, higher education institutions were required to work towards the elimination of the disadvantages for female scientists. In the following years, equality and equal opportunities were enacted in all relevant laws and enshrined in the university framework laws and university statutes. Since 2005, all federal states have passed state equality laws. Among others, gender equality officers are legally required. Thus, the gender key is legally codified at all levels.

In addition to these direct laws for public research, there are a number of other laws that frame research in general. The area of life sciences is particularly heavily regulated. For example, in clinical trials of medical devices and medicines, advice from an ethics committee has been mandatory since 1990. Also, the Stem Cell Act requires an ethics committee to oversee importing stem cells and limits its use to "high-level scientific goals". At the same time, the Embryo Protection Act of 1990 prohibits fertilization for purposes other than pregnancy, thus, prohibiting for example, cloning experiments. This is one of the most restrictive regulations in the world.

Animal experiments must also be approved by an Ethics Commission. It is forbidden to inflict pain, suffering or harm to animals for no reasonable reason. Animal experiments are generally prohibited for the development of weapons, ammunition, tobacco, detergents and cosmetics. Tests on vertebrates or cephalopods may only be carried out if the expected pain, suffering or damage to the animals is ethically justifiable with regard to the purpose of the test.

Furthermore, the Data Protection Act regulates the handling of personal data. In the case of publications, an amendment to copyright law in 2014 granted an indispensable secondary publication right. The condition is that at least half of the research activity was funded by public funds (third-party
funding) and there is a 12-month retention period. This regulation is perceived by the Open Access community as a step in the right direction, but still very restrictive.

In addition to the direct legally binding rules in the form of laws, funding conditions play a prominent role. Since the federal government has no legislative competence in science, funding programs form a central element. For example, the federal government is promoting research at universities through the excellence initiative described above. In addition to scientific excellence, equal opportunity forms an evaluation criterion. Since 2005 the research and innovation pact promotes non-university research. In return for an annual budget increase of 3%, the organizations commit to pursuing research policy goals. This includes the promotion of equal opportunities, communication with society and, since 2016, the promotion of open access. Equal opportunities and open access as evaluation criteria are increasingly finding their way into other funding programs.

In summary, the area of life sciences and equal opportunities is most heavily regulated. The legal framework for open access is currently being negotiated. The exchange with society, be it through Public Education or Societal Engagement, is more likely to be found in voluntary initiatives than in legal frameworks.

4.3 Political and cultural values and discussions related to STI

The protection of individual liberty and dignity is a main aspect of the German Constitution. The first article of the Grundgesetz states that: “Human dignity shall be inviolable. To respect and protect it shall be the duty of all state authority”. Topics of human and civil rights make up many articles of the German Constitution and cover aspects such as the right to freely develop one’s personality and the right to life and physical integrity or the freedom of speech and the press. Furthermore, Article 5 guarantees freedom of the arts and sciences, research and teaching. In this sense, Germany’s democracy is not just a formal one (guaranteed by the Constitution), but also represents a system of values in which the free basic democratic structure is an inviolable norm. This can be understood in a historical context and was influenced for instance by the Weimar Republic (1918-1933), in which even the basic rights of the Constitution could be abolished with two thirds majority, which also gave way to the National Socialist Party taking power in 1933 (Hahn, Scherz 2018).

These values correspond to European ones, such as citizens’ rights, equality, justice, freedom, solidarity, which are the main principles of the Charter of Fundamental Rights and the European Union Treaty of Lisbon (Schroeder, Rerimassie 2015, 53ff.). Here the embeddedness of Germany within the European Union becomes clear, also in a formal sense, as the principles of the EU treaty also regulate the national level. This can also be applied to German S&T policies and strategies.

Regarding S&T priorities and underlying values the main strategic document for S&T in Germany, the High-Tech-Strategy (HTS), is key as it presents the broad vision of research, science, technology and innovation for the next years. The HTS is the main document to lead public research and innovation, also mentioning the importance of research on the social implications of S&T. The current HTS from 2014 gives the thematic frame in which public funding and stimulation of innovation take place in Germany. It therefore provides a good representation of the strategic priorities in Germany and their connection to political and cultural values. The main challenges and topics the current HTS addresses are: digital economy and society, sustainable economy and energy, the innovative workspace, healthy living, intelligent mobility and civil security (BMBF 2014, 5). These are regarded as holding high innovation potential as well as dealing with (global) challenges and future well-being. In this way, these

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6 The Ministry provides an English version of the strategy from 2014 here: https://www.hightech-strategie.de/de/The-new-High-Tech-Strategy-390.php. The High-Tech-Strategy as a tool has been implemented for around 10 years.
foci tie the need for research and innovation to the future prosperity and quality of life in Germany. Here, the close connection of the development and public funding of S&T and the societal goals of enhancing well-being, prosperity and growth show clearly.

Next to the thematic priorities, a further key part of the HTS is the emphasis on processes. Here the underlying values of a democratic, ideally open society can be found. Next to the procedural aspects of providing a creative ground for the flourishing of innovation, the HTS highlights the need for widened ideas of innovation: “We are emphasising an expanded concept of innovation that includes not only technological innovation but also social innovation – and that includes society as a central player” (BMBF 2014, 4). The more conventional focus on enabling better transfer between science, research and industry is expanded: “We are promoting innovations and future technologies not for their own sake but for their ability to provide clearly recognizable social benefits. Within our innovation culture, we are integrating processes for identifying and assessing the societal opportunities and risks that are tied to the introduction of new technologies” (BMBF 2014, 10).

Next to core elements of the HTS such as networking and transfer or providing an innovation-friendly framework, issues of transparency, communication and engagement are also addressed (BMBF 2014, 13). The inclusion of citizens is seen as a way towards “better” innovations that are widely accepted within society. This rests on an understanding of participation for the support of innovation and as a way for the “Federal Government [...] to promote development of a participatory, innovation-friendly culture, with the help of new initiatives and formats. For example, the HTS describes plans to enable citizens to help shape innovation policy and it plans to improve its information provision regarding new technologies” (BMBF 2014, 45). The move towards more inclusion, although often vague in the question of what useful formats are and how they can be incorporated in the political system, can be seen as a way to increase the legitimacy and acceptance of policies and S&T itself. Yet, when looking at the HTS document, it is often unclear what role participation should play: this ranges from a way to gain acceptance to being an integral part of transdisciplinary research (e.g. real-time laboratories).

The HTS shows the underlying motivations for driving research and S&T in Germany. Well-being, prosperity and Germany’s dominant position in the light of global competition are referred to throughout the document. These can be related to main values that lead many of the S&T debates in Germany. These include the fundamental rights of individuals and their dignity, as stated in the first paragraph of the German Constitution as well as freedom, citizens’ rights, justice, equality, which are fundamental European values (Schroeder, Rerimassie 2015, S3ff.).

Sustainability is also considered a priority task. The HTS describes the way we produce and consume should be more resource-efficient, environmentally friendly, socially acceptable and thus, more sustainable. Over the past decades the German socio-political landscape has been highly influenced by sustainability, which has also shaped S&T7. This is often connected to the idea of responsibility (e.g. for future generations). For example, the energy transition or the highly contested discussions on nuclear waste disposal are often debated in the context of sustainability. This can be seen as a specific characteristic of Germany, as the value of sustainability has become important in regards to the wider understanding of responsibility (in S&T) as well as created concrete measures, instruments and tools.

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7 An example is a Helmholtz coordinated project from 2003, which developed an integrative sustainability concept focused on providing rules and reference points, flexible enough but also robust, for actual use in practice (e.g. in areas such as mobility, living and building, food and agriculture. (for publications see: https://www.itas.kit.edu/english/gze.php)

A more current project is one on sustainability management for non-university research centres (LeNa) from 2016, which developed a framework for Helmholtz, Fraunhofer and the Leibniz Association. (see: https://www.itas.kit.edu/english/2016_055.php)
(e.g. for industry standards). Also, it has brought to life a variety of local or regional initiatives that try to re-shape how development or progress are understood.

Overall, political decision-making in the German context is often characterised by a balancing of values. This can revolve around, for instance, the protection of individual rights and the welfare of the general public. Different “poles” are especially obvious when it comes to ethical issues, e.g. when introducing a new technology. Also, the balancing of these different values can also be seen as a value in itself. This is an essential part of the value system in Germany and frames many of the debates on S&T. This can be seen in one of the main areas in the HTS. Civil security has become central because societal and technological developments such as the wide-spread use of the Internet or increased global networking, have raised issues for the public and policy. The guarding of privacy and individual freedom becomes a key issue for policies. In Germany, we can see the link between the S&T priority of civil security and the research or development needed for this and the basic values of rights and freedom for citizens. As the HTS states: “The Federal Government’s aims in this area include helping to safeguard individual freedom. Solutions in this area also help enhance citizens’ security and quality of life – and they help to strengthen the civil security sector” (BMBF 2014, 28).

Other S&T priorities are, for instance, concerned with developing robot systems and including them in the daily lives of people in need of care. Of course, this area brings up highly sensitive issues such as privacy or dignity, also in connection to individual rights. A recent project on humanoid robots funded by the Ministry of Education and Research examined the area of health and care, especially regarding the aspect whether robots were more accepted if they resembled humans or not. If the robots were described as a technical tool they were more likely to be accepted than if they were assigned more human attributes like the ability to act independently. Resulting from this, even in the area of care, where qualities such as warmth and helpfulness are important, robots shouldn’t be humanised too much. This example uncovers how values of individual freedom or dignity, which are ascribed to humans can also determine the design of technical systems such as robots, which in turn is highly relevant for S&T priorities.

5. Aspects of responsibility in national science policy

5.1 The conceptualisations of responsibility in national science policy

Our interviews and workshop discussions show a widespread awareness and agreement in the view that researchers and research organisations have certain responsibilities regarding society. It is an interesting aspect that the overall content of the responsibility revolved around the need of research and science to communicate and interact with society, with the goal of bringing the aims of science and those of society closer together. Although a relevant point for RRI, either as the key of public engagement or the dimension of inclusivity, it was nevertheless connected by participants to mission statements of their individual organisations. These highlight the importance of feedback from society and contextualize their research as reflecting societal needs. On the other hand, there is a clear criticism of the standard current research practice, that frames the discussions mainly around problems and focuses on negative challenges instead on a positive concept of responsibility.

From the analysis of the documents and the discussions, one can deduce the development of, at least two different understandings of responsibility. First, responsibility is perceived as being responsible

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8 One example of this is the ITAS project “Quartier Zukunft”, which is a local urban initiative to make a city quarter more sustainable in a wider sense. This includes transdisciplinary activities regarding consumption patterns, or economic and social aspects. [http://www.quartierzukunft.de/en/](http://www.quartierzukunft.de/en/)

9 Description on the project in German: [https://www.bmbf.de/de/humanoide-roboter-sympathisch-oder-unheimlich-4918.html](https://www.bmbf.de/de/humanoide-roboter-sympathisch-oder-unheimlich-4918.html)
towards society and also as a critique of research without limits or boundaries. This implies that the responsibility of research is about pursuing the aims of society and ensuring this by a constant exchange with societal actors. Second, responsibility is about how research is conducted in order to ensure a certain standard and progress. This understanding is seen in contrast (or to a certain degree opposed) to the demands for more responsibility towards society, a point that is usually highlighted by the research funding organizations.

When it comes to science and society in Germany, the demand (particularly from civil society) for engagement in S&T decision making has increased over the last years, “obliging” organisations to engage with societal actors in some way. There is a clear trend therefore, to developing activities that include some type of interaction with the public. Such activities are organised internally at each institution but they also become part of the external presentation of the institute, particularly to research funders that see such activities as part of their evaluation process. It should be noted though that there is so far no standardised methodology to promote public engagement, or to assess its impact at institutional level.

Similarly, the gender issue is well discussed and promoted in German S&T as part of its perspective on responsibility. The country has developed many established programmes in promoting gender equality and allow for more female research position. It should be added that the issue of gender equality is also regulated through national legislation that sets quotas for male-female ration in management positions.

Finally, the concept of responsibility in the country is interlinked with its federal system of S&T policy. It is clear that importance is given to cooperation between federal, state and institutional levels, since they all have a certain autonomy in structuring their activities. Our analysis shows that there is a demand by researchers to be provided with more open spaces for discussion and exchanges between the different policy levels and societal actors. A top down approach is not appropriate in this case, since there is a need to pursue a “cultural” change within research peer groups.

5.2 The notion of ‘RRI’ in national science policy discussions

The term RRI as such is virtually unknown in official S&T documents in Germany. The term is known only from EU project and can be found only in case of a German partner participating in such projects. In our discussions, we routinely had to describe the concept of RRI and its various interpretations to participants. Once explained as an amalgamation of individual keys, RRI is well understood as a common approach in S&T developments. Nevertheless, the actual term is not regarded as having much intrinsic or additional value to existing ones. For instance, its relation to many already widely discussed and established practices (e.g. ethics, public engagement, gender equality, etc.) make it redundant as an innovative concept or approach.

As such, RRI is already being implemented in the national S&T without having been labelled in this way. This is particularly true regarding the themes of public engagement, ethics and gender. For instance, the German government has already initiated a number of laws ensuring gender mainstreaming and setting concrete goals on gender equality. This in turn creates an obligation for most RRI-relevant organisations to develop initiatives or establish programmes on gender, ensuring that this is approached in a systematic basis.

Another criticism of using the term RRI to cover the issues represented by the keys is that in Germany the concept of sustainability is presented in very similar manner (i.e. responsible research and innovation). This is a much more established concept with concrete content in terms of application
possibilities. It is also a globally recognised concept whereby, there is already an instant positive view and a history of discussions about its mainstreaming at the highest global policy level.

When it comes to the theoretical implementation of RRI in the national S&T system, the national workshop discussions offer some interesting insights. According to these discussions, RRI can be helpful in the current conflict between the increasing application of quantitative standards in research evaluation processes, on the one hand, and the mainly qualitatively assessed inclusion of various stakeholders in the research process, on the other. The research system does not take these inclusive aspects into the evaluation process, resulting in difficulties to correctly assess the impact of research and researchers. Evaluation criteria should be reassessed, opening up spaces for discussions in which topics and challenges can be reframed. The actual establishment of RRI has to be done on the level of peer groups with a focus on the communication between different actors within the science system.

5.3 Ethics in the national science system

The ethics debate in Germany is strongly influenced by medicine and the life sciences. Encouraged by the experience of the Second World War and the subsequent Nuremberg Doctors’ Trial, a dispute began in politics, society and professions. Increasing “technicization” led to the emergence of bioethical issues in the 1980s and led to the extension of the debate to other areas. The result of these debates was the accompanying formulation of research ethics codes and, from 1973, the increasing establishment of ethics committees as the most important institutionalized control procedures. Since the 1990s, consultation by an ethics committee has been mandatory by law in all medical research projects with people before they begin. These serve as internal scientific bodies of self-control and administration and are still a central element to this day.

The basic structure of ethics committees has thus been adopted for the debate of major concerns at the national level. The central national institute is the German Ethics Council, established in 2001 and legally codified in 2007 by an Ethics Council Act. This Council is composed of 26 members “specializing in scientific, medical, theological, ethical, social, economic and legal concerns result in connection with research and development”. As a result, the Council formulates statements, recommendations and reports on various topics that serve as a basis for political decision-making. In addition to its advisory function, its task is also to promote a social debate. Following this, there is an increasing involvement of the public in the process.

In terms of content, the focus continues to be on the life sciences, with a shift from directly human-related ethical issues such as the beginning and end of life to socio-economic and socio-cultural issues, such as intersexuality or cost-benefit assessments. In addition to other classic topics such as animal experiments and military research, similar approaches are also being extended to other research topics: in 2011, a national ethics committee for safe energy supply was set up, which called for a nuclear phase-out, while in 2018, a national ethics committee for autonomous driving followed. This trend also reached other scientific disciplines and led to the establishment of corresponding committees and codes, among others in the engineering and social sciences. In view of this development, some scientists speak of an increasing "ethicization" of research (Bogner 2013).

In addition to the establishment of advisory and controlling bodies, since the 1980s scientific institutes have increasingly been developing (interdisciplinary) research on social aspects of technology and technology ethics has become established as an independent discipline. Since 1997, the BMBF has been supporting ELSA research as part of the German Federal Government’s Health Research Program.

Despite the current debate on the ethical aspects of progress, the main challenge remains its integration into the practice. Above all, in view of ethics committees as a central instrument there is
the danger of a pure “checking box” approach, instead of actually discussing the consequences. In such a case, it would be mere enforcement without essence. A separate position takes up the question of internal research ethics and scientific integrity. Shaken by a particularly serious case of scientific misconduct, the German Research Foundation (DFG) issued scientific recommendations in 1998 to ensure good scientific practice. These, form the central reference point in this matter. Ombudspersons and commissions, which serve as points of contact in problem cases, are used as a central instrument for ensuring the good practice.

5.4 Societal engagement strategies in research

In terms of societal engagement, a shift from the initial debates and societal demands for increasing participation since the 1970s, resulted in the opening up of science and politics in the 1980s and 1990s until the emergence of participation as a central pillar of post-2010 research and innovation policy.

At the latest since the 1970s, the increasingly critical public, which expressed doubts about some technical developments, as well as about the self-controlling abilities and legitimacy of S&T, laid the foundation for further developments. In the 1980s, new social movements, that sprang mainly from the sustainability and environmental realm, emerged. Accordingly, debates on nuclear technology and genetic engineering were particularly strong.

As a reaction from the side of politics, the promotion of dialogue between science, politics and society was formulated for the first time in the early 1980s as the task of a parliamentary (Enquete) Commission on Genetic Engineering in the Bundestag. In the 1980s and 1990s, the consultation of civil society groups became a standard instrument of the Enquete Commissions.

A special role was played in the topic of participation with the growing involvement with nanotechnology. Here, the BMBF launched a comprehensive information and dialogue initiative in 2006. One core element is a "NanoDialogue" as a central, national dialogue platform. This consists of numerous stakeholder and citizen dialogues. Also, a joint project for the early involvement of the public with 40% industrial participation was started with "NanoCare". For the first time, communication was explicitly recorded as an aim of a joint project. While "public information" was the key word in the beginning, in the current nanotechnology action plan formulated in 2015, it changed to "communicating transparently and conversationally" and "participatory governance". Another particularly discursive field of technology was the energy technology and nuclear waste repository search.

However, the activities of the participation were not only an add-on to individual topics, but gained more relevance from 2010 as an overarching cross-cutting issue. In 2011, the BMBF initiated a broad citizens' dialogue on future technologies as a foundation for a continuous exchange with society. In 2014, the exchange with civil society was anchored as an evaluation criterion in the funding guidelines. In 2016, the BMBF formulated a policy paper on participation and declared the exchange a central goal, both as participation in research and as participation in research policy.

In 2016, the BMBF formulated a policy paper on participation and declared the exchange a central goal, both as a participation in research and as a participation in research policy.

In addition to these activities to increase participation, there was also an increasing anchoring in the strategic programs. The high-tech strategy, the central research and innovation program of the Federal Government, is particularly vivid. While in the first formulation 2006, the emphasis was put on technology fields, with a reformulation in 2010 social requirement fields moved into the foreground.
Already here "Dialogue on Innovations" set a new accent. With a revision in 2014, "Transparency and Participation" was declared as one of the five pillars of the strategy. In 2015, for the first time representatives of civil society groups were appointed to the central advisory board "High-Tech Forum". Thus, between 1980 and 2015, citizens' dialogues and similar participatory formats were increasingly established as components of research and innovation policy.

On the side of science, a similar development took place. While a "participatory turn" began here in social science technology research and above all in technology assessment as early as the 1980s, science increasingly began to open up to the public, especially in the 1990s (Grunwald 2010, 91). This process was accompanied by debates about the role of science and, above all, concerns about freedom of research. In 1999 the "Science in Dialogue" (WiD) was founded. It is an initiative of the German research organisations modeled on the concept of "Public Understanding of Science" with the aim "to promote discussions and exchange about research in Germany". This initiative is sponsored by the BMBF and continues to be a central actor and source of impetus in matters of science-society communication on the part of science. While the focus of the PUSH memorandum, which was signed in 1999, was primarily on the communication of the results, two new position papers in 2009 and 2012 are realigning "from information to participation."

The latest development in the area of public engagement follows the concept of Citizen Science. From 2014 to 2016, the WiD with funding from the BMBF led a comprehensive project to promote Citizen Science. After 13 dialogue forums with more than 900 participants including 6% citizens and 30% representatives of civil society, a "Green Paper - Citizen Science Strategy 2020 for Germany" was formulated and a "central platform for Citizen Science in Germany" was set up. This has been taken up by the scientific organisations and the BMBF with the first implementation steps.

One can argue that a central driver of this development towards more participation, was the increased social demand for participation since the 1970s. At the same time, despite numerous citizen forums and dialogue series, the question of the actual impact of participation on decision-making remains open. Particularly critical is the question of public involvement in the actual agenda setting. Even the policy paper on participation in the high-tech strategy was formulated without much public involvement. The research organisations also tend to coordinate their research programmes directly with policy makers as elected representatives, without involving other representatives of civil society. There is thus the risk that participation will remain ineffective.

5.5 Gender equality and diversity strategies in the science system

Under the heading of promoting women in the 1980s, gender increasingly became part of German science policy. A first legal obligation of the universities to reduce the disadvantages for women was adopted in 1985. At the same time, equality officers were established at all universities. Since 1989, an annual survey has been conducted on the role of women in the science system by the Joint Science Conference. At the same time, several model projects for the practical promotion of women in science were initiated.

At the end of the 1990s however, the topic received particular relevance, at the same time as anchoring gender mainstreaming in European law. An important impetus was that Germany at that time had one of the lowest proportions of women in research in Europe. As a result, in 1998, the progress in fulfilling the gender equality mandate was made an evaluation criterion for research and teaching. Thus, the promotion of equal opportunities became the funding condition for major funding streams such as the Excellence Initiative 2005 and the Pact for Research and Innovation 2006. At the same time, politics also promoted women directly. The central feature here is the Women Professors Program, which was launched in 2007.
The central driver of the gender key is thus, policy, with a top-down approach, which is also perceived by science as such. Nonetheless, from 2000, the research organisations reacted to the impulse, committed themselves to increasing the proportion of women and formulated appropriate initiatives. Particularly outstanding are the research-oriented standards on gender equality, formulated by the DFG in 2008 and renewed in 2017, which all research organisations have become acquainted with. The guiding principle of this standard is the so-called cascade model. It sets out targets for the proportion of women at each career level, based on the proportion of women at the next lower level. At the same time, the research organisations joined together in 2006 for an "Offensive Equal Opportunity". However, the main focus of research organisations remained the practical implementation of the objectives and less political development of the agenda.

In terms of content, there was a linguistic change from “promoting women” to “equal opportunities.” Nevertheless, the focus remained on the role of women in science, especially in professorships. In addition to the quantified share of women, more structural barriers and a better reconciliation of family and work were addressed. There is also a trend towards further diversity. In 2006, the General Act on Equal Treatment was adopted: „The purpose of this Act is to prevent or to stop discrimination on the grounds of race or ethnic origin, gender, religion or belief, disability, age or sexual orientation” (General Act of Equal Treatment). In 2017, the BMBF signed a Diversity Charter.

In addition to the intrinsic value of equality, the potential benefits of tapping women as a human resource serve as justification for such activities. Equality of opportunity is understood as the “decisive criterion for the success of the science location Germany”. Despite numerous initiatives and specifications, however, there are some difficulties in achieving the goals. Although the proportion of women in professorships doubled from 10.5% in 2000 to 22.7% in 2015, this figure remains below target and is also rather low in European terms. At this point, the “leaky pipeline” phenomenon poses a major challenge, especially since the proportion of women in primary enrolment is almost 50%. Another obstacle to achieving this goal is the lack of sanctions in the event of non-compliance with equality plans by organisations.

5.6 Open access and open science strategies in the national science system

Open Access is very present and up-to-date in the German context. The main starting point and drivers for this were initiatives and movements in science and scientific libraries. The movements manifested themselves in 2003 in the signing of the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities, in which all major German science and research organisations were signatories. As a result, numerous science organisations adopted open access policies that expressly called for and encouraged support for Open Access. However, these were always on a voluntary basis. These policy positions were followed by numerous (inter-organisational) initiatives and measures. These included activities for the practical further development of Open Access through the development and linking of repositories or the promotion of publication funds at universities by the DFG, but also measures to popularize, for example through the organisation of annual Open Access Days and information portals. Across the organisation, a coalition of research organisations, the Alliance of Science Organisations in Germany, initiated a Priority Initiative "Digital Information" in 2008. It sees open access as a central element of a general change to "improve information provision in research and teaching". Internationally outstanding is the "Open Access 2020 Initiative", launched in 2016 and led by the Max Planck Digital Library. The main driving force behind the movement was the "serials crisis" that emerged in the 1990s as a result of higher prices for magazine subscriptions. The potential economic benefits of adopting Open Access remain an important argument to this day.

https://www.gwk-bonn.de/themen/weitere-arbeitsgebiete/chancengerechtigkeit/
Furthermore, the fundamental benefits of open access to science and an intrinsic value of open access are being addressed to reinforce the requirement that publicly funded research should be publicly available.

In addition to the activities within the scientific community, the policy was addressed with this concern. An important concern is, in addition to appropriate support, the creation of legal framework conditions through a reform of copyright. This demand was also supported by numerous research institutions and universities, which in 2004 joined forces to form the Coalition for Action "Copyright for Education and Research". The central demand was the introduction of an indispensable secondary publication law. This requirement was received in 2007 for the first time in politics and in 2014 a corresponding amendment was made on a trial basis for five years. Although the ideas of the research organisations have not been fully implemented, it is at least understood as a step in the right direction.

At the same time, this change shows a general change at the level of politics. While Open Access has not been discussed before, many political activities have been taking place since 2014. For example, a German Council for Scientific Information Infrastructures was set up in 2014, bringing together representatives of politics, science and public to promote the topic of information infrastructures. A Digital Agenda 2014-2017 and an Open Access Strategy were also adopted in 2016. As a result of the initiatives, Open Access has been anchored in the BMBF funding guidelines and incorporated as a binding goal in funding initiatives (PFI III). Further goals are the establishment of a national competence and networking office with contact persons in all organisations initiated as well as the development of a national Open Access Monitor.

Political leading narrative is the idea of using the information and the open access and resource and driver for improving the ability to innovate. In addition to the bottom-up demand from science organisations, another driver was anchoring the issue at the European Union level in the form of the Digital Agenda (2010) and the designation of Open Access as a priority for the European Research Area.

A central obstacle to the establishment of Open Access is the economic interests of publishers. Also in this regard, the alliance became active and called a DEAL-project on the agenda. The aim of the project is to conclude nationwide licensing agreements and to allow access according to the “publish and read” principle. The negotiations with Elsevier are particularly intense at the moment. Around 200 institutions refused to renew Elsevier's contract in 2017 in order to jointly build up pressure.

Summary shows the science community as the main driver of the movement. At the same time, the concern, which is motivated by potential gains in innovation, is increasingly becoming a political agenda and, through its broad integration, directly leads to activities of the organisations. Nevertheless, political and legal concessions are not far-reaching enough from the perspective of science, and negotiations with publishers are difficult. Furthermore, the transfer from the agenda of the organisations and corresponding management levels to those actually researching and publishing is difficult. According to a survey by the European Commission, the share of open access publications in SCOPUS, despite numerous activities, is below average in European comparison, according to a survey by the European Commission. One reason for this is the previous voluntary nature. Changes in the direction of stronger liability are only now emerging as a result of political guidelines.

While open access to research has always been a priority, access to research data has been considered as a (potential) add-on since its inception. With the increasing interest of politics in open access as an engine of innovation, the research data has also been increasingly addressed as a resource. Politicians made recommendations for the management of research data and called for the establishment of a National Research Data Infrastructure, based on the European Open Science Cloud.
5.7 Science education as integrated in research

Basically, Science Education, especially under the slogan of technological literacy, has a high priority in Germany. A central reason is an often-repeated shortage of skilled workers. Scientific and technical education is understood as a key element in strengthening Germany as an innovation location. Correspondingly committed are the economy, politics and science. By contrast, society appears more of a passive actor to which the numerous initiatives are devoted.

In this area, the recording of practical activities is difficult. The main reason for this is a country-specific challenge. In the federal system of Germany, education is a matter for the State, so that there is a highly fragmented field with different school types and educational framework plans in each Federal State. Thus, there is no uniform education system or overarching standards, since in the States there are very different initiatives and actual conditions. Since 2004, the federal level has increasingly supported individual projects and initiatives in agreement with the federal states, for example, in the improvement of higher education or in the "development of further education programs for new target groups." A current focus is the "Education Offensive for Digital Knowledge Society" that started in 2016 as part of the Digital Agenda. In this context, the BMBF supports "numerous projects, initiatives and competitions to strengthen digital and STEM-oriented competences".

The core competence in education lies with the federal states. Here, in 2009, the Conference of Ministers of Education formulated with the "Recommendations for the Strengthening of Mathematical, Scientific and Technical Education" an overarching impulse. Here, too, the value of STEM education for the "technologically efficient and innovative economy" is emphasized, but its role is also designated as a precondition for active social participation. Based on this, the states have agreed on a catalog of measures to improve education. A follow-up survey in 2011 of "Activities of states to strengthen mathematical-scientific and technical education" showed a large number of different initiatives in all education sectors and federal states.

In addition to the general extension of all educational levels, the recommendations also identified the improvement of training as well as cooperation / extracurricular learning places, as a field of action. The latter forms a bridge to economic and scientific initiatives as well as policy activities outside the immediate educational system. The offers are very diverse, a special focus is the promotion of young talent. Thus, the Association of German Engineers supports schools in the development of STEM lessons from a fund. Other scientific and technical associations such as "acatech" and the national STEM forum are also actively involved in the topic of technical education. Universities increasingly offer children's universities and school laboratories. For example, in Germany there are over 400 School Laboratories, which are networked together. A special focus of the early STEM education is a decision on the gender key. Since 2001, the BMBF has actively supported the Girls Day and other initiatives to introduce girls to STEM professions.

Outside the promotion of students, there is a wide overlap to the beginnings of the Public Engagement Keys. Here the WID represents a central actor, which in 1999 adopted the concept of the Public Understanding of Science. Since 2000, with the support of the BMBF and the DFG, it has been conducting annual science years, each of which presents a different scientific topic to the public. The federal nanotechnology action plan is also accompanied by an information campaign and a "nano truck". The "InnoTruck" repeats the approach to innovation in general. In addition, other science communication organisations have emerged, such as the National Institute for Science Communication.

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2012 and many new formats. These include Long Nights of Science, Science Film Festivals, Public Lectures, etc.

There are thus numerous initiatives for scientific education, from integration into the school system, through external support, to offers for the interested public. The key driver for these activities is the direct benefit, whether through advantages for Germany as an innovation location or for the organisations through the education of the next generation. In addition, the openness to innovation and technology through technical maturity and thus growing acceptance, forms a second central justification. Reflections on human resources and public relations form two key elements. Accordingly, slow expansion and a lack of (financial) support are always identified as key barriers. In addition, the highly fragmented education system and the lack of standards also lead to criticism.

5.8 Incorporation of AIRR dimensions into science policy discussions

There are several developments in the last two or three decades that indicate a growing awareness of the need for anticipation of societal effects of R&D and reflexivity of science and research with regard to their societal roles and responsibilities. Calls for reflexivity and anticipation are part of the social discourse on R&D starting from the debates about nuclear energy in the 1970s and later on genetic engineering. This indicates a growing public scepticism with regard to self-steering abilities of the R&D system that also led to demands for more public involvement.

Anticipation in terms of environmental and health risk assessment for advanced technologies is widely established in research institutions and also part of governance processes. The latter is indicated by setting up institutions such as a federal institute for risk research (Bundesinstitut für Risikoforschung), a series of federal enquiry commissions on advanced technologies by the German parliament, by the establishment of many advisory bodies for problems such as climate change, energy transition and the national ethics council (mainly for questions of modern bio-ethics). Apart from that the German research landscape is characterised by a vivid STS community with related activities at many universities and the German TA community (NTA Netzwerk) can be said to be among the most active and well developed in Europe. In this context, also the Office of TA at the German Parliament which is working now for more than 25 years, has to be mentioned.

Germany has a long tradition of critical environmental research starting in the 1970s in the aftermath of the anti-authoritarian student movement, which was coupled with criticism against industrialism and consumerism. In this context, also independent ecologically oriented research institutes have been founded which pushed activities in established research organisations and have meanwhile become part of the mainstream. It was in the context of the sustainability debate that reflexive and anticipatory research as well as the inclusion of lay people and interest groups, has been fostered. This debate on sustainable development has institutionalised e.g. by establishing the National Sustainability Council.

In the current framework for funding and developing of federal public research structures (the “High Tech Strategy”) “societal challenges and potential for innovation” are the main steering criteria. Society is regarded to be a “main player” in innovation, citizens participation is addressed as being a precondition for the acceptance of innovations as well as “assessing societal opportunities and risks” as being an integrated part of R&D. It is however difficult to assess how far these commitments are translated into research practice. Sustainability is a priority task of the “Strategy”, and sustainable development in Germany is the conceptual frame by which many of RRI aspects are addressed: responsibility with regard to resource-efficiency, social acceptability and environmental friendly R&D. Recently the debate on energy transition can be regarded to be a focus of anticipatory, transparent and self-reflexive research and research policy making. A commission has been set up at the parliament
to restart (more or less from scratch) the search for a national nuclear waste disposal site and to make suggestions to organise this search in as much as transparent way as possible.

There is a widespread perceived need in R&D communities for doing better with regard to communicating science and research to the public and getting into a dialogue with society about research needs, objectives and achievements (in policy making, professional organisations and academies, universities and public research institutes). This observation has also been supported by discussions at our national workshop. The many activities and commitments in this respect, however, do so far not lead to broad and visible reorganisation of decision making structures or processes towards engaging society. Activities are often restricted to science education and public understanding of science approaches (see e.g. “Wissenschaft im Dialog” as a programme supported by public research institutions as well as the federal ministry for research). These and many other activities, however, show a growing importance of activities which include aspects of public participation. Exchange with the civil society is an evaluation criterion in the funding guideline of the Federal Research Ministry. And the ministry in the context of its policies on nano-technology has set up and supported a series of public dialogue initiatives. Thus, public engagement, inclusiveness and responsiveness towards civil society are gaining growing attention in R&D practice and governance but remain an add-on to mainstream or “core” activities in decision making and research practice. RRI dimensions (reflexivity, inclusiveness, responsiveness and anticipation) are e.g. not included in the repertoire of criteria relevant for evaluation of programmes, projects, and institutions.

The recent concerted action of many leading NGOs in Germany to initiate a “turn in research policy” (“Forschungswende”) by strengthening the involvement of public interest groups in decision making, namely at the federal ministry of research and education, exemplifies the so far existing restrictions for transparent and inclusive structure in R&D policy. The initiative raised complains about the fact of a missing representation of civil society and NGOs in R&D decision making on the federal level, compared to much more open structures and options for engagement of NGOs in the practice of the federal ministry for the environment.

Main drivers for the up-take of RRI aspects clearly are expressed public demands for participation, public awareness and concerns regarding environmental issues, which led to a legitimatory crisis of R&D in the 1970s and 1980s (genetic engineering, nuclear research). Quite vivid public debates on genetic engineering resulted in legal regulations (embryo protection act, Genome act) that are rather restrictive compared to other European countries. The many activities in the German R&D landscape in the field of TA, risk assessment, risk management and public engagement as well as a certain scope of institutional innovations (advisory boards, public authorities) and the integration of strategic concepts (sustainable development) can be seen as a reaction to a growing public attention with regard to R&D. Existing barriers such as a dominant culture of excellence, global competitiveness as a central goal of R&D policy making as well as an expert-centred culture of decision making, so far prevent a deeper integration of RRI aspects, beyond discourses; in research and research policy making practice.

As regards openness towards society, the German R&D system reveals contradictory or ambiguous features. There are various activities and self-commitments by the government, research organisations and institution to “open access” for which first effects on research and publication practice are visible, there is a widespread commitment to serving societal needs and getting into dialogue with society. There is as well increased funding for and activities in setting up single processes of consulting society in questions of ethics and risk assessment for advanced technologies. There are also first attempts to open up research itself by involving citizens (citizen science). However, transparency and openness towards society in terms of participation in research processes as well as strategic debates and decision
making is restricted to individual initiatives, and single standing events, but is not an integrated part of strategic planning and steering of the R&D system. The latter still remains to be restricted to a closed circle of experts from science, politics and economy.

5.9 The integrated or fragmented nature of different responsibility related aspects

RRI as an integrated concept is not widely known, neither discussed nor applied, in the German R&D landscape. Nevertheless, certain RRI aspects or dimensions are addressed not only individually but in an integrated manner. Anticipation and reflexivity and related programmes and activities are usually closely coupled with some notion of involving civil society, initiating public debates and making decisions transparent and understandable to the public. It is often a discursive understanding of public deliberation on questions and problems related to R&D that is behind initiatives and discussions on opening up science for society. This also emerges in mission statements or programmatic statements on the level of governance of R&D. A strong integrative concept in this respect for the German case is the concept of “sustainable development”. In discussions and debates as well as programmes set up around this concept several dimensions of RRI normally are touched upon in an integrated manner: anticipation of long term impacts of R&D, responsiveness to societal needs, inclusion of different values and interests, establishing public dialogue. In a recent turn of the debate on sustainability that is ongoing (although in a restricted research and research policy making community), this is channelled into what is called “transformation research”: exploring ways and strategies to transforming socio-economic practices by means of trans-disciplinary research including, society and citizens in problem oriented research and development of problem solving strategies.

6. Organisational reviews and outlooks: Karlsruhe Institute of Technology

6.1 Mapping of the organisation

The Karlsruhe Institute of Technology (KIT) describes itself as “The Research University in the Helmholtz Association” and was founded in 2009 as a merger of the Technical University of Karlsruhe and the Karlsruhe Research Centre. Both original organisations had long standing traditions: The University existed for 181 years and the research centre was founded in 1956. This combination of university and non-university research is unique in Germany since these areas usually are institutionally separated. As such, KIT is one of the biggest research and education institutions worldwide. The general mission of KIT is to “create and impart knowledge for society and the environment”. Overall, this includes three areas: research, teaching, and innovation. As a national research centre, KIT aims to contribute to “solving grand challenges which face society, science, and industry by performing top-rated research.”

KIT is one of 18 Helmholtz centres throughout Germany. The Helmholtz Association has overarching research programmes that span across the different centres and go beyond the individual activities of each centre (POF – programme oriented funding). An evaluation and adaptation of these programmes takes place every five years. Still, KIT remains a legally independent organisation governed by public law.

KIT has a total annual budget of 851 Million Euros (2016). 35% of the total budget is allocated through POF; 40% is external (mainly public) funding. Most third-party funding comes from the Federal Government, the State Government, the German Research Foundation (DFG) and the EU. KIT is currently the most successful German university regarding funding from Horizon 2020.
KIT has a total of 9239 employees, of which 3373 are women and 5773 are scientific staff. The university has 25,892 students, three quarters of whom study science, technology, engineering and mathematics (STEM) subjects and engineering.

Guidelines manage and shape the general work of KIT. On a general level, the highest guideline is the German Constitution, which guarantees the freedom of research. More specific details are part of federal and state laws as well as the common statutes of KIT. In addition, the requirements of major funding organisations play a role, especially those of the Federal Ministry of Education and Research, the Ministry of Science, Research and the Arts of Baden-Württemberg and the German Research Foundation. In this framework, the organization is largely self-governing, the general structure is recorded in Graph 2.

The management of the KIT consists of a presidium which, in addition to the president, consists of five vice-presidents with different responsibilities, a senate elected by the staff and a supervisory board with external representatives. The administration consists of 30 service units, which provide support in different areas across the organization. In addition to Human Resources, Compliance and Financial Management, three units are particularly important to research and assigned to the Vice President Research. First of all, this is the library, which ensures access to literature as well as supports the publication process. Second, it is the KIT House of Young Scientists, which supports junior scientists and doctoral students. The third service unit is the Research Office, which supports the project application and implementation process. Particular emphasis is placed on EU, BMBF and DFG projects.

The actual research ranges from basic research to applications in a broad range of disciplines and addresses the overall areas of energy, mobility, and information. It is organized in five research divisions: 1) Biology, Chemistry, and Process Engineering 2) Informatics, Economics and Society 3) Mechanical and Electrical Engineering 4) Natural and Built Environment 5) Physics and Mathematics (Graph 3). These areas are subdivided into individual Helmholtz programs, which originate from the four Helmholtz programs Energy, Earth and Environment, and Key Technologies and Matter. The KIT research areas are also assigned to faculties responsible for university teaching. There are seven KIT Centers to facilitate cross-disciplinary exchanges between the university and large-scale research areas as well as among the individual programs. These cover general topics such as “elementary particle and astroparticle physics”, “mobility systems” as well as “humans and technology”.


Graph 2: Organisational structure of KIT I, marked green with areas where interviewees were from (KIT)
Graph 3: Organisational structure of KIT II, marked green with areas where interviewees were from (KIT)
6.2 Aspects of responsibility in organisational policy and practice

6.2.1 The conceptualisations of responsibility in the organisation

The statements of KIT respondents show a change regarding the conceptualisation of responsibility within KIT. In the past, responsibility was often understood as an add-on that had to be done by each researcher individually. Now, ethical questions are increasingly being addressed in scientific studies, for example in the field of technology assessment (TA). Important in this regard is the wider context. Societal issues and negative impacts of S&T have become increasingly debated in Germany and have resulted in a growing awareness of science communication and deliberation among the public and civil society.

KIT documents as well as interviews show that responsibility is understood as assuming responsibility in research for society and the environment; responsible action is seen in the sense of ethical action. As one respondent said: “Researchers want to reach an impact.” However, as also described in interviews, in the context of basic research focus is often on gaining knowledge, not necessarily on possible wider societal implications. Furthermore, respondents see responsibility as feeling accountable for the success of KIT as a whole. And more application-oriented research areas focus on utilizing research output for economic use.

The notion of RRI itself is not used at KIT and the term was not well known among respondents. But similar approaches are described in the “KIT 2025 Strategy” paper: e.g. The Equal Opportunity Plan serves as a guideline for personnel policy and the fair treatment of students; Participation is part of the committees and bodies of KIT and serves as a permanent guideline for management action; Inside and outside, KIT strives for transparency, reliability and trust. As such, even though the concept of RRI is not used, many aspects are taken up and have long been part of the discussion about responsibility at KIT. Transparency, integrity, equal gender opportunities or open access are all issues discussed at KIT and are included in programmes or strategies. Therefore, respondents see RRI only in the context of EU proposals and projects. In this context, RRI is understood as a research policy concept with a strong symbolic effect. Although many respondents criticised the arbitrariness of the concept, a possibility to fill the concept with substance was described.

Also mentioned by the respondents, in the context of responsibility and RRI, was the discourse on sustainability. This can be related to wider societal debates on sustainability in Germany, also regarding policy strategies. Therefore, sustainability plays a key role, also for research conducting organisations such as KIT, which have to position themselves within this socio-political setting. This can also be seen in regard to wider issues that are relevant in Germany. Next to sustainability, the German Energy Transition or societal challenges such as digitalisation also contribute to the awareness of responsibility within research.

6.2.2 Ethics in the organisation

KIT has established three relevant policies on different topics, but with similar structures: ethics, compliance and research integrity.

KIT’s conduct regarding ethical principles is anchored in the organisational guidelines. An ethics committee and two ombudspersons ensure the implementation and maintenance of these principles. Usually they take care of specific ethical issues relevant in research involving human subjects or research with animals. Also, the history of KIT as a nuclear research centre has been taken up by this committee since this is a highly debated issue in Germany.
The other two policies are concerned with compliance and research integrity. There is an established Code of Conduct regulating aspects of animal testing, corruption and data protection, and a staff department that ensures compliance with these rules. The same goes for research integrity, there are established rules that are based on those of the German Research Foundation (DFG) and ombudspersons become active in case of uncertainty. It can be summarised that KIT does everything necessary to comply with (ethical) obligations, and in particular to do so by avoiding rule violations.

“Normal business at a technical university. Since you cannot smear with glory. I would say that’s the standard, but not more” (KIT interviewee)

Beyond this clear area, a change in research practice can also be observed. Ethical aspects are becoming more and more important as a research topic itself. They are included in the evaluation of technological innovations, environmental risks and analyses of sustainability. For this aspect, there is a well-established unit at KIT for research into the ethical and social consequences of technologies: The Institute for Technology Assessment and Systems Analyses (ITAS). Initially it was rather isolated from the rest of the research process of other institutes within KIT, but especially with wide societal issues regarding nuclear research, it experienced increasing integration. Currently it is often requested as a cooperation partner in order to introduce the problem-oriented perspective into research projects. This goes along with a general change of the mind-set (also apparent in the interviews and focus group discussions) towards social aspects on every level. There is an emerging realisation, that excellent science alone is not enough for the success of a technology. Still, this is an ongoing process and currently ITAS takes part only in a small number of projects.

Another central institution at KIT, important for ethics, is the Centre for Cultural and General Studies (ZAK). One of the missions of the ZAK is pushing forward interdisciplinary education “as an instigation to be socially responsible”. For this purpose, they offer different courses and supplementary studies on social aspects of technology. However, they mainly address students and the courses are voluntary. The in-house training for staff does not include ethical aspects and offers mainly courses of soft-skills and personal/professional development.

Overall at KIT, RRI does not play any significant role as a term regarding ethics. However, the Ethical Guidelines, Code of Conduct and research on ethical aspects target some other RRI-issues/keys as well. For example, the Ethical Guidelines also consider gender equality and diversity. In addition, they call for a dialogue with society. However, the aspects remain stand-alone and are not subsumed under ethics.

Main barriers

The hurdles for a deeper establishment of ethical principles in research, especially promoting a consciously critical reflection on one’s own research, are high, since these are not rewarded in the current science system, e.g. in evaluations. Next to a structural, this shows a cultural barrier regarding the integration of ethics into research. Researchers too often perceive ethical issues as an additional hurdle in their work. The understanding that responsible research must always consider a level of ethical reflection is not clear. There is no effort to systematically promote this and, for example, to include it in faculty curricula.

Main drivers

With increasing debates in society, ethical aspects are becoming relevant in research topics in areas such as technological innovations, environmental risks and analyses of sustainability. The codification
of ethical aspects and the implementation of responsible units are mainly driven by external (legal) demands and do not go far beyond that.

Changes in practice depend on various factors. One of the main internal drivers in KIT are the institutes ITAS and ZAK, also because they are unique among centres within Helmholtz. They have been pushing forward the topic of ethical responsibility inside the organisation itself for many years and offer ways to address issues in practice. Another main driver are wider societal debates, e.g. controversial debates on nuclear power resulted in a shift away from research in this area. For KIT, as a former nuclear power research centre, this is important since it can be seen as the beginning of a realisation that scientific excellence alone is not enough for success. Societal and political change increasingly requires attention to social aspects. This shows in the political expectations regarding research and its funding. Through RRI, the term responsibility and ethical reflection becomes more relevant, even if this has come through the “outside” (i.e. at EU level).

Good practices

Good practices of different kinds in KIT can be seen in ZAK and ITAS. The ZAK’s Studium Generale (voluntary basic courses for all new students) also explicitly conveys ethical orientation knowledge for students through courses. And ITAS is a well-established and widely recognised institute that provides expertise on ethical and social aspects. Part of dealing with ethical issues in research processes is discussing them with the public. For a number of years, ITAS has been conducting regular public events on various topics (such as autonomous driving, energy transition and resource management, food safety), where people can discuss questions about the institute's topics.

Current indicators

Indicators for positive practice regarding the ethics key are hard to come by because the established structures only become active in the case of misconduct: the only indicator is the number of negative cases like scientific misconduct or corruption. Also, this information is yet not open to the public.

Points of improvement

Several points to improve ethics in the organisation have been identified. For instance, an awareness of societal concerns that does not view ethics as a detached but as an integral part of research needs to be developed. It would also be helpful to highlight the added value of ethics for research, which goes beyond the mere fulfilment of external or formal requirements. For that, there is a need for positive experiences and awareness of these.

Furthermore, a broader integration of research on ethical implications could be a point of improvement. This could be realised through an in-house institute such as ITAS. But it cannot be left to individual initiatives; ethics in research isn’t only a research subject, but also has to be enacted on all levels of the organisation. Allocating a fixed percentage explicitly to ethical aspects of project budgets could facilitate an implementation. In addition, ethics trainings for KIT researchers could be implemented as mandatory.

Since the implementation of ethics in the various KIT organisational units is perceived to be very heterogeneous (individual “points of crystallisation”), the organisation should create a structured process that systematises questions brought by society to KIT research. In addition to the goal of answering questions of society, the internal discussion of ethics would help to question the own methods for integrating ethics into research, to find gaps and to strive for improvements.
Controversies about research with the public are generally welcome. However, it was criticised by respondents that there is a lack of good institutionalised corresponding communication units and corresponding processes; e.g. it would be helpful to name a person or group who is explicitly responsible for the communication between society and science and vice versa at KIT.

Resulting Matrix

<table>
<thead>
<tr>
<th></th>
<th>Structural issues</th>
<th>Cultural issues</th>
<th>Interchange related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspects of organisations</td>
<td>Ethic committee, ombudspersons, code of conduct</td>
<td>Responsibility from history as a nuclear research centre</td>
<td>Increasing interest from public and society to act transparent; pressures from key stakeholders especially in the field of research with animals and nuclear power</td>
</tr>
<tr>
<td>Potential drivers for ethics</td>
<td>Basic ethical compliance driven by external (legal) demands</td>
<td>Technological innovations are more and more socio-technically relevant; increased perception of environmental risks</td>
<td>Increasing debates in society; RRI is a driver from outside to strengthen reflections on responsibility and ethics</td>
</tr>
<tr>
<td>Potential barriers to ethics</td>
<td>No reward-system in scientific evaluations</td>
<td>Being excellent in a research topic often disregards the integration of ethics in projects.</td>
<td>Students, professors are not intrinsically motivated</td>
</tr>
<tr>
<td>Most important potential organisational actions</td>
<td>Establishment of a reward system for ethical research within KIT</td>
<td>Explicit reference to candidates’ attitudes to gender balance in job interviews of leaders</td>
<td>Teaching and training possibilities for all KIT members (students, professors, executives, researchers, project staff)</td>
</tr>
<tr>
<td>Indicators for success</td>
<td>Establishment of a staff unit for linking ethics and research; establishment of an accompanying curriculum</td>
<td>Increase of reported awareness for ethics</td>
<td>Number of (new) students because of the integration of ethics in the curriculum</td>
</tr>
<tr>
<td>Potential indicator for improved performance of the dimension in the research activities/programme</td>
<td>Increasing number of research projects that explicitly place ethical issues at the centre of their research. The key figure is a parameter in the distribution of program-oriented funding (POF).</td>
<td>Increasing number of research projects with an explicit part on ethical aspects of the developed technologies.</td>
<td></td>
</tr>
</tbody>
</table>

6.2.3 Societal engagement strategies in organisation

A strategic reflection and overall strategy of societal engagement cannot yet be seen in KIT. Correspondingly, there is no common understanding of societal engagement. At the level of the overall organisation, only classic public relations work takes place. Public events such as open house days are geared to an external audience, but not to the actual feedback of a wider public.

The overall scientific and organisational culture at KIT understands societal engagement as an act of communication in which the public is informed about research activities. But the specific understanding of engagement differs depending on the individual initiative and the actors behind it.

Respondents already active in the area of societal engagement pointed out the need to increase activities at KIT. This supports the observation that overall, the awareness of this issue is developing slowly even if some people perceive an actual opening.

Main barriers
A main barrier for societal engagement at KIT is the lack of money allocation from basic funds. ZAK e.g. acquires approx. 50% of its budget from third-party funds. Furthermore, as mentioned above, most engagement exercises take place in specific institutes and are therefore limited to these. Moreover, at KIT as a whole, the common scientific and organisational understanding of engagement as communication is a barrier regarding actual societal integration in research processes.

Above all, the overall structure in which KIT is situated (within HGF) means that broad research priorities are set within this larger organisational setting. HGF negotiates research priorities together with policy representatives and centres such as KIT. Therefore, engagement with the public or stakeholders regarding agenda setting cannot be initiated by KIT itself in the current structure.

Main drivers

A main driver for public engagement are external funders, such as the Ministry of Education in the state of Baden-Württemberg, who seem to have an increasing interest in societal engagement. The common notion is that citizens should not only be involved in the evaluation of technologies, but through their involvement, they should also shape the research agenda. If political demands and expectations increase, this will have an effect on KIT. Yet within the overall setting of HGF, many factors play a role for further implementation. In addition, one respondent described that KIT institutes that conduct socially oriented research (including participatory methods), enjoy high recognition in society. Therefore, a positive outward impression can be a driver.

Good practices

There are single activities that explicitly promote public engagement. Most of these initiatives are motivated and initiated bottom-up: ZAK for example conducts “Public Science” with the aim to make science more inclusive (detailed in 6.2.3 c.). ITAS has a public event that appeals to citizens and presents opportunities and risks of new technologies, but the focus is mainly on communication. The KIT “Department of Science Communication” at the Institute of German Studies researches science communication and carries out its own practical projects.

An initiative that has emerged bottom-up and is increasingly supported from above is the Urban Transition Lab created at ITAS. In the next years, it will be extended to the “Transformation Centre for Sustainable Futures and Cultural Change” (KAT). This centre is a meeting place for citizens and scientists and fosters transformative research.

It is also possible to identify good practice in research projects, in particular in technology assessment, which increasingly integrate participatory methods and where the assessments of citizens and stakeholders becomes the subject of research itself.

Current indicators

Knowledge transfer is an indicator (also in HGF) when it comes to harnessing scientific knowledge for society. Institutes such as ITAS also see themselves as advisory institutions. This means they are also evaluated (also in the POF) according to how studies found their way into political consultation processes.

In addition, well-measurable activities are included in the list of public engagement indicators, this includes among others, the press department of the KIT. The Corporate Communications Department of the Strategic Corporate Development and Communications Service Unit is responsible for KIT’s institutional internal and external communication. Indicators are the reported results of KIT’s cutting-edge research and achievements in academic education and innovation on multiple channels (press
releases, online and social media reports, expert statements, printed and online magazines, video and audio services for the general public).

Points of improvement

As a point of improvement all respondents stressed the need for better cross-organisational coordination and exchange of experience. In addition, a closer connection of engagement activities to the research process itself is required.

Similar to the parameter ethics, competence could be strengthened by teaching methods and practices on public engagement early in the curriculum.

The focus group described a need for public engagement that goes beyond traditional press relations. In order to discover how the public could be more closely involved in research processes, it is recommended that a person in charge of communication between society and science be named. The aim is to develop new consultation formats and to establish communication processes that react specifically to issues of public disclosure.

Finally, good communication processes also depend on overcoming the (still existing) different identities of Campus North (formerly Research Centre) and Campus South (formerly University). The “KIT 2025 Strategy” is seen as an important step in the right direction.

Resulting Matrix

<table>
<thead>
<tr>
<th>Aspects of organisations</th>
<th>Structural issues</th>
<th>Cultural issues</th>
<th>Interchange related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public relations work is established (department and stuff); department strengthened when KIT was founded</td>
<td>No training activities on public engagement for researchers, no internal evaluation system</td>
<td>first signs of learning visible: e.g. Promotion of the Transformation Centre (KAT)</td>
<td></td>
</tr>
<tr>
<td>Driven by external demands, especially through the participation of the population</td>
<td>Training and rewards for scientists including PE in research</td>
<td>Increasing debates how to involve the public in co-creation processes</td>
<td></td>
</tr>
<tr>
<td>Lack of basic funds</td>
<td>Research traditions in KIT as well as in the faculties of the former Technical University are characterised more by natural science and engineering</td>
<td>No need for / understand of societal integration into research processes</td>
<td></td>
</tr>
<tr>
<td>Strengthen knowledge transfer as an indicator</td>
<td>Support in the organisation of PE events through a central office</td>
<td>Use of the already existing initiatives of single institutes to understand benefits and lessons learned</td>
<td></td>
</tr>
<tr>
<td>Proof that topic suggestions from the public have been included in the research agenda</td>
<td>Increase of reported awareness for PE</td>
<td>Increase of NGO representatives in the Supervisory Board</td>
<td></td>
</tr>
<tr>
<td>Number of research projects, teaching programs that deal explicitly with public engagement in innovation processes. Number of KIT researchers engaged in PE activities</td>
<td></td>
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</tbody>
</table>
6.2.4 Gender equality and diversity strategies in the organisation

The gender key is overall well established in the German context, through legislation and numerous initiatives supporting equality between men and women (as described in the national context above). Therefore, an organisation such as KIT has to have a gender strategy in place. In its own words “KIT protects and supports equal opportunities of women and men in all areas of research, education, innovation, and administration. Equal opportunities are understood to be a guiding principle in all areas of work”\(^\text{12}\). This shows the comprehensive understanding of gender within KIT, which is that of providing equal opportunities and through this ensuring equality of men and women.

Gender equality has a high priority at KIT which is reflected in the “Equal Opportunities Statutes for Women and Men at Karlsruhe Institute of Technology” adopted by the KIT Senate in May 2014. Upon approval by the Supervisory Board, these guidelines became relevant for all members of KIT in September 2014. The guidelines define the framework conditions for the implementation of equal opportunities on all organisational levels of KIT. The Equal Opportunities Plan is part of KIT’s Structure and Development Plan and focuses on KIT working towards the elimination of existing disadvantages for women, actively pushing the increase of the proportion of women working in all disciplines, at all levels, where women are underrepresented. Further, improving the compatibility of job and family for both women and men is a goal. In addition, KIT aims to improve access and career chances of women.

It can be said that the principles of equal opportunities are understood as an eminent part of the organisation. They can therefore also be found in all strategic-programmatic papers of KIT. The most important programmatic document is the five-year equal opportunities plan. Here, the status quo is described, goals in the form of women’s shares to be achieved by 2018 are formulated and measures necessary are listed. The plan is subject to an annual evaluation: reporting is given both internally to the President and Senate as well as externally to the State Ministry of Baden-Wuerttemberg for Sciences, Research and Arts and the German Federal Ministry of Education and Research. On the one hand, the legally necessary, elected Equal Opportunity Officer and, on the other, the Diversity Management department are responsible for personnel development. This is about more than equal opportunities for men and women. In Diversity Management, KIT also unites compatibility of work and family, inclusion, inter-cultural and generation management.

Different units have been formed to implement the goals set regarding gender equality and diversity. For instance, Equal Opportunity Representatives take over the legal representation of interests and form a controlling body. For this purpose, they are assigned to the Executive Board and are involved in all important committees. Also, besides others, there is the Department of Diversity Management which takes over the operational area: It develops the equal opportunity plan, coordinates and implements various measures and is responsible for monitoring.

Main barriers

One of the main barriers repeatedly stated in the interviews was that there were still too few female undergraduates in the technical disciplines. Only if the number of female young scientists increased, more women could be expected to take on leadership positions at KIT. This perspective shows two shortcomings. First, the perspective of those responsible should be more focused on why only few young women study science and engineering. Secondly, a causality is assumed that cannot be proven directly.

\(^{12}\) https://www.chg.kit.edu/
Several respondents discussed that the implementation of what the Equal Opportunities Plan demands and also what the Bureau wants (always) depends on people within KIT. This is seen as a barrier since it makes a difference whether the person responsible for gender equality is rather open-minded or not and if appropriate measures are promoted more or less. In the administrative sphere, “conservative” structures are still observed, that is, cliques of men who make decisions outside formalised processes. This can be regarded as a main cultural barrier.

Main drivers

Main drivers are clear and comprehensive legal requirements, e.g. BMBF and DFG formulated quotas. The KIT President is aware of the importance of the external evaluation processes and therefore aims to comply with legal requirements. In particular, as part of the strategy of excellence, the issue of equal opportunities has gained a new status. As one respondent said: “KIT is clearly positioning itself here.”

The “University Suitable for Families Audit / Work and Family Audit”, an external audit that KIT has undergone since 2010, can also be seen as a driver, as it was signed by the presidium. With regular re-audits, it forms an additional set of rules and an effective, external, monitoring. In addition, the KIT merger itself was named a driver for equal opportunities. In the merging process, the KIT strategy gained relevance, which sets the goal that by 2025, 40% of its students should be female. An interviewee therefore stated: “The merger with KIT has once again brought a huge boost.”

The reflection of diversity claims at KIT was decisively influenced by the so-called “refugee crisis”. In 2015, a large number of refugees came to Germany in a short time and presented many municipalities and the federal government with considerable challenges. KIT developed bottom-up a support structure for this situation. In 2015, the first roundtable with the President and representatives of different KIT initiatives took place. This was also supported by an overall strategy of Helmholtz regarding the support of refugees.

Good practices

Good practices regarding gender equality and diversity at KIT can be found in several areas. For example, KIT carries out a children’s university, which aims to inspire girls for the STEM subjects. This is one of the activities that aim to get more women to take over leading positions at KIT which among other aspects depends on getting girls enrolled early in the biography for the STEM subjects.

Another area to witness good practice at KIT is the work and study environment. KIT acquired the label “University Suitable for Families Audit / Work and Family Audit” in 2010. These certificates are awarded through an independent audit to universities and enterprises exercising a family-oriented personnel and student policy and designing the working environment for their employees, scientists and students to support the compatibility of family, work, and university studies. KIT was awarded the three-year certificate in 2017 for the third time since 2010.

Also, the attitude towards diversity should be mentioned. Respondents see the diverse cultural backgrounds of the students as an opportunity for KIT. Foreigners who are already studying at KIT often take the role of “study ambassadors”. Especially regarding refugees, they can mediate between administration and refugees and can thus contribute to the integration of refugees and better mutual understanding. One interviewee summarised the mind-set: “Everyone involved has the same wish: they want to make the integration at KIT somehow possible.”

Current indicators
The goal of equal opportunities is important in order to be competitive nationally and internationally. Therefore, measurable indicators in this area are of particular importance. KIT has formulated clear target rates to achieve. The calculation basis is the “Research-oriented Standards on Gender equality” of the DFG, which corresponds to the following criteria: consistency, transparency, competitiveness and forward-looking orientation, and competence.

KIT executes a gender and diversity concept, which at its core aims to coordinate and bring together different initiatives: it serves as a central platform for those units at KIT that deal with the diversity of employees and students, support cross-functional exchange and initiate joint projects.

Points of improvement

In the area of gender, KIT has clear strategies and initiatives and as such, it is very active in this area. Therefore, no explicit points of improvement have been suggested for gender.

Overall, diversity is underrepresented within KIT. This is due to the general context in Germany, where the issue is not seen as relevant as gender so far. A point of improvement could be to approach diversity issues in a similar way as gender issues.

The focus group’s discussions pointed out that, in a well-established field such as gender, there is always a risk that no further efforts will be taken to evolve, and to become even better.

Resulting Matrix

<table>
<thead>
<tr>
<th>Aspects of organisations</th>
<th>Structural issues</th>
<th>Cultural issues</th>
<th>Interchange related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal Opportunities Statutes for Women and Men = framework for equal opportunities; five-year equal opportunity plan; Equal Opportunity Officer; Diversity Management department</td>
<td>Equal opportunities of men and women are politically regulated for many years. Result: very high acceptance in (publicly funded) institutions to implement the legally regulated equal rights</td>
<td>Pressure from laws (gender); cultural diversity is seen as a guarantee of scientific excellence</td>
<td></td>
</tr>
<tr>
<td>Legal requirements (quotas), external evaluation processes, audits</td>
<td>Merging process of KIT with the KIT strategy: 2025, 40% female students Refugee crises led to bottom-up support structures (e.g. employees engaged in structures, supported by KIT)</td>
<td>Gender equality = part of the excellence strategy, this means: equality is introduced as a driver of scientific excellence (indicator)</td>
<td></td>
</tr>
<tr>
<td>Potential barriers to Gender &amp; Diversity</td>
<td>Potential barriers are not a structural issue</td>
<td>Not enough young female scientists Equality must also be “lived”, how well this succeeds is person-dependent</td>
<td>too little awareness in society to inspire girls for technical disciplines</td>
</tr>
<tr>
<td>Strengthen the cooperation with schools in the STEM subjects</td>
<td>Roundtables within KIT to exchange ideas about good practices; reward systems and transparent communication about successful and unsuccessful study ambassadors</td>
<td>Improve work-life balance</td>
<td></td>
</tr>
<tr>
<td>Setting up top-leadership for diversity / diversity action plan</td>
<td>Establishment of structures that specifically promote the benefits of cultural diversity and make it fruitful for the institution; Training for awareness raising</td>
<td>Recognition in society for special gender equality policy</td>
<td></td>
</tr>
</tbody>
</table>
6.2.5 Open access and open science strategies in the organisation

Open access (OA) and open science (OS) are seen as similar strategies in HGF and are also overall relevant for KIT. The Berlin Statement on Open Access (2003) as well as guidelines formulated by HGF also determine OA strategies of KIT. In 2010, KIT also passed an OA basic position paper and signed the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities. At KIT, there are two distinct areas for OA: open access publications and the management of research data (RDM). Open Access is increasingly important for research funding and has become a requirement for many, e.g. the EU requires OA publications for grant funding as does HGF as well for funds from the Impulse and Network Fund (IVF), which is the internal HGF budget.

The KIT Library mainly drives the OA strategy for KIT. It comes up with ideas and is the contact point for the Presidium on questions regarding OA. The KIT Library has its own department, which deals with the management of research data since 2011. There is also a so-called service team (RDM@KIT) which is put together out of staff members from the Centre for Computing, the library, ZAK, FOR, and ZAR. The service team sees itself as a partner of science and research. They support with services for a sustainable research data management, from the application of scientific projects to the publication and archiving. Their services are KITopen, bwDataArchives, re3data and Research Data Management Organizer.

On the top-level KIT has a presidential statement providing a research data policy. In October 2016, the “Guidelines for Responsible and Sustainable Research Data Management” were adopted due to initiatives from library management. As a respondent stated: “if we did not make the first step, we need a research data policy, then we probably would not have any.”

Main barriers

Interviewees mentioned different barriers ranging from the politics of scientific publishers to the (missing) intrinsic motivations of the scientists. In particular, good open access journals, which also have a good ranking, are not yet numerous. In addition, the publishers stick to the so-called subscription model, this means reading online articles requires users to pay. Also, the APCs (Article Processing Charges) that publishers demand for open access publishing have increased in recent years. Respondents also mentioned the lack of reward structures for open access publications and research data management that hinder the promotion of the topic.

Main drivers

A main driver can be seen in the Open Access Policy of the Helmholtz Association (April 2016), which urges scientists to publish OA. KIT has further specified this guideline for its own centre and has set up a publication fund. In addition, a driver can be to provide a “good service” to make open access publishing as easy as possible, as an interview partner stated.

In terms of research data, funders have been demanding for some years now that data should be better preserved and, if possible, publicly available during and after a project. The DFG, for example, suggests that raw data should be kept for about ten years. This can be regarded as a driver as it fosters a different way of dealing with data and thus also a new scientific culture.
Good practices

An example for good practice at KIT is its own OA publishing house existing since 2004. KIT invests in the publication of around 200 open access books per year. Also, there is a large document server (one of the first in Germany): KITopen contains about 220,000 documents from KIT research results and nearly 30% of them are open access. In addition, a fund has been set up in cooperation with the DFG from which the resulting Article Processing Charges (APC) are paid.

Current indicators

Indicators for good or bad practices are also derived from HGF. The Open Access Policy of the HGF describes planned monitoring: HGF would like to quantify its efforts in order to make them verifiable. It establishes the objective that by December, 31, 2020 at least 60 % of the publications from the previous year falling under this policy, will be available in open access. Measured quantity for this objective is the number of entries with full text in the repositories of the Helmholtz Centres or in other appropriate repositories in relation to the overall number of entries in the repositories/publication databases of the Helmholtz Centres for the year of publication. The target rate is increasing by another 10 % for every subsequent year of publication until the target value of 100 % from the year 2025 on. This is also relevant for KIT being a HFG research centre.

Points of improvement

Though the endeavour to publish as much open access as possible is laid down in program-oriented funding (POF), reward structures (in the allocation of funds) should be provided in order to achieve a high number. Also, more recognised open access journals are needed as well as more recognition of open access publications. The most extensive option would be to use only open access publications for evaluations. Yet, this is a large-scale change that goes beyond KIT’s reach.

A reform of the existing KIT publication regulations is necessary in order to comply with the HGF guidelines. It is a process that KIT must negotiate internally, since the actors (library, authors, institute director) have different interests. An indicator would be a binding time frame in which the agreement should be reached. Furthermore, scientists must be trained both in the content relevance and in formal matters of OA.

Resulting Matrix

<table>
<thead>
<tr>
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<th>Structural issues</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OA basis position paper</td>
<td>Increasing importance, e.g. through OA grants funding</td>
<td>RDM@KIT = service team as partner for scientists</td>
</tr>
<tr>
<td></td>
<td>OA strategy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential drivers for OA</td>
<td>Open Access Policy of HGF</td>
<td>“good services” and support; interest of preserved data and availability of data during and after a project</td>
<td>The way of dealing with research data influences the scientific culture</td>
</tr>
<tr>
<td>Potential barriers to OA</td>
<td>Different politics of scientific publishers; low number of good open access journals; APCs increased</td>
<td>Different publication traditions depending on the discipline; missing intrinsic motivation of the researchers to publish OA</td>
<td>Lack of reward structures</td>
</tr>
<tr>
<td>Most important potential organisational actions</td>
<td>KIT OA publishing house; large document server KITopen</td>
<td>The library focuses on OA and accelerates the discourse on the topic</td>
<td>OA policy depends on the intensive cooperation of research and administration</td>
</tr>
<tr>
<td>Indicators for success</td>
<td>Fulfil the HGF indicators / monitoring; by December 2020 60% OA available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>OA is broadly accepted, no question whether a OA publication is “better” in the sense of reputation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>IT infrastructures and support for researchers, number of trainings</td>
<td></td>
<td></td>
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</tbody>
</table>

Potential indicator for improved performance of the dimension in the research activities/programme

Internal specifications for open access. Specify key figures - also independent of default from HGF and external donors.

6.2.6 Science education as integrated in research

For science education, there is no overall common understanding across KIT, but several largely isolated spheres of activity with varying levels of institutionalisation exist. The Strategic Corporate Development and Communications Business Unit (SEK) supports KIT’s executive board in all strategic, structural and communications activities of overarching character. Hence, they act as a central point of contact for media and public. They are responsible for tasks such as appointment procedures, corporate communication, quality management, strategy projects, and services for the KIT bodies. The corporate communication is a typical one-way communication that essentially communicates the success of the organisation to the outside world. This is done through a website, magazines, podcasts, videos and various events ranging from exhibitions over the open day to the science festival.

ZAK, Centre for Cultural and General Studies, has the explicit goal of communication with society. There are many formats here, like the Colloquium Fundamentale, a lecture and discussion series directed towards the public, which also takes up critical aspects. In addition, ZAK offers an academy for adult education and various smaller formats, including models with an involvement of politics (KIT in the town hall, Karlsruhe talks, Science Film Days). The guiding principle of the ZAK is “public science”.

The area of “school labs” is a bit more fragmented. These are mainly about recruitment therefore the Equal Opportunities Officer is heavily involved here and MINT institutes are active in this field as well. In addition, some non-institutionalised offers emerged in the KIT. ITAS organises for example, theme evenings for interested citizens (technik.kontrovers) or the university group “Night of Science”. In general, units that are already close to society are more likely to create new educational formats and interfaces to society. The integration of classical STEM research and thus coupling with other activities at KIT is more difficult.

Main barriers

The main obstacle for science education is the lack of a cross-KIT, integrative strategic concept and communication structures. Because many activities arise bottom-up, they are highly detached from each other. They know little about each other and there is hardly any exchange of experiences. Respondents critically formulated that existing experiences are not recognised although they exist. Cooperation and synergies only take place within a limited framework on an individual basis due to the lack of established communication channels between individual initiatives. Respondents pointed out that this lack of communication also leads to competition between the individual units offering science education for funding and recognition.

Another barrier can be identified in the lack of active support for individual bottom-up initiatives. Although there is scope for activities in addition to core tasks of individual units, resources must be acquired independently, usually externally. In addition, a long-term stabilisation of such activities hardly takes place, so that they exist only as long as the self-motivation and external funding exists.

Main drivers
A main driver for science education is the commitment of individuals, e.g. the ZAK was founded mainly because of the initiative of its director. Also, positive public feedback on the activities is helpful for their continuation. Positive feedback from the public helps to internally justify these KIT formats and to point out their importance. In addition, another key driver is third-party funding for communication activities.

Good practices

There are several bottom-up initiatives, e.g. multimedia exhibitions (showcase ocean), a science festival, Science Film Days, established lecture series for the public (Colloquium Fundamentale, technik.kontrovers) and opportunities for encounters between the public, politics and science (Karlsruhe Dialogues).

Good practice can be seen in form of school children laboratories at KIT that take place annually with about 5000 children. This format is aimed to educate children on “the world of science”, with courses and experiments.

Current indicators

A media resonance analysis is the central measuring instrument for public relations. It is used as an indicator for the aim of the highest possible presence of the organisation in the public.

ZAK evaluates its own events in-house with the aim of improving formats, but this is not tied to an overarching goal.

Points of improvement

In the establishment of educational formats, a lack of resources was noted both in the initial stages of initiation and in continuity. The provision of budget for experimental format development in the form of seed money and the further promotion of particularly successful formats would strongly support current bottom-up activities.

While format development is mainly due to units that are already close to society, incentive systems have to be developed for the other areas of research that go beyond their own motivation. Central to this is the explicit recognition and not just acceptance of communication with society.

As a major point of improvement all respondents expressed the wish for a central coordinating body, which would allow an exchange of both good and bad experience.

Resulting Matrix

<table>
<thead>
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<th>Cultural issues</th>
<th>Interchange related</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strategic Corporate Development and Communications Business Unit as central contact for media and public One department with the explicit goal to communicate with society (ZAK).</td>
<td>SE is still regarded as a one-way communication</td>
<td>The fact that the society can also be included differently is not widely known within the organisation</td>
</tr>
<tr>
<td>Potential drivers for SE</td>
<td>Third-party funding for communication activities</td>
<td>Support for the commitment of individuals; positive feedback from society</td>
<td>Better communication between those offering SE as well as between institutes and Presidium</td>
</tr>
<tr>
<td>Potential barriers to SE</td>
<td>No cross-KIT strategic concept for SE</td>
<td>No overall understanding of SE; bottom-up initiatives are not supported enough.</td>
<td>SE activities are not good connected and communicating.</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------------</td>
<td>-----------------------------------------------------------------------</td>
<td>--------------------------------------------------------</td>
</tr>
<tr>
<td>Most important potential organisational actions</td>
<td>Use existing initiatives to create a common understanding; avoid paralyzing competition between individual event formats</td>
<td>Cooperation with schools (e.g. labs)</td>
<td></td>
</tr>
<tr>
<td>Indicators for success</td>
<td>Number of visitors in school labs, exhibitions public lectures etc.</td>
<td>Evaluation formats that are tailored to the offer</td>
<td>Media resonance analysis</td>
</tr>
<tr>
<td>Potential indicator for improved performance of the dimension in the research activities/programme</td>
<td>Number of research projects and teaching programs that explicitly focus on education</td>
<td>Written policies on science education in KIT</td>
<td></td>
</tr>
</tbody>
</table>

6.2.7 Incorporation of AIRR dimensions into policies
Anticipation and reflexivity

Reflexivity and anticipation seen as social responsibility and social effects of R&D play a role in the KIT mission documents, as the duty to contribute with R&D to solving social challenges and problems. Beyond this, anticipation and reflexivity is part of KIT’s portfolio in terms of specialised research entities for Technology Assessment (TA) and interdisciplinary research and teaching (ITAS; ZAK).

Anticipation and reflexivity can be found in the guidelines and research practices of KIT in the sense that these provide a framework of ethical demands towards research as well as the societal frame in which research responds to challenges. In the document on “Guiding ethical principles of the KIT” (2016) it is stated that members and entities of KIT in their research activities “reflect the influence of their work on societal, technical, economic and ecological systems and the thereof emerging effects”. As far as “inner” scientific integrity is concerned ethical principles are set into practice and are controlled via an ethic committee and 2 ombudsmen. Institutional structures with regard to wider societal aspects are not developed in a comparable manner on the general organisational level of KIT.

Through the general agenda setting of HGF, KIT is situated within a wider context, which fosters a certain level of anticipation and reflexivity. Also, because KIT works together with other centres within various POF programs, there is exchange between different actors. This entails a certain degree of reflexivity as part of working together with different centres, which however is mainly related to aspects of scientific performance. Central criteria guiding the development of the overall organisation is “scientific excellence” (as mentioned in interviews). Reflexivity in terms of self-monitoring and self-evaluation comes into play with regard to this criterion (and is also applied in bi-annual evaluations within the framework of the HGF-POF programmes). Others, like anticipation of risks or unintended societal impacts of research, are relevant, but are secondary to scientific excellence or taken account of mainly as far as these are related to further development of the scientific profile of the organisation.

Whereas on the overall organisational level of KIT reflexivity, beyond aspects of scientific development of the organisation, is almost not visible besides statements in mission documents (see ethical guidelines above), reflexivity with regard to social accountability of research, and anticipation of possible societal effects of R&D, is very well established on the level of single research units via ITAS. Anticipation and reflexivity (in terms of TA, STS research, policy analysis, environmental impact assessment, science ethics) are the focus of ITAS’s activities as an interdisciplinary research entity. ITAS is a leading organisation in the discourse on Science and Society and TA in the German speaking
countries and beyond, and because of this, KIT can be regarded as the organisation with the strongest TA profile among the bigger German public research organisation (within and beyond HGF).

In general, an increasing interest in science in society and reflexivity with regard to societal impacts of R&D can be observed and was also expressed in interviews. Sustainable development is a term which gained increasing importance in programmes and research activities of KIT. Ambition for integrating of research activities in TA or STS with other (natural science and engineering) departments is indicated by interdisciplinary and inter-institutional formats like “Humans and Technology” (“Mensch und Technik”). Notwithstanding the best interdisciplinary intentions motivating these formats, the integration is however not as deep as one might assume since institutions and persons active in these formats are mainly from the social sciences and humanities and not from the engineering and natural science departments which form the core of the organisation (in terms of budget as well as tradition of KIT). The university-wide “Karlsruhe School of Sustainability” (KSS) can be regarded as a promising approach to providing more integration of anticipation and reflexivity within a broad scope of KIT research departments. KSS runs several programmes in the field of higher education for sustainable development, e.g. an introduction to the sustainability-oriented research at KIT for first-year students or a transdisciplinary elective module for all students (“Sustainability and Transformation”). To realise this broad spectrum of courses and modules, KSS cooperates with a number of institutions and centres within KIT which are either engaged in interdisciplinary teaching or in sustainability sciences, like ITAS.

Barriers

The weight of activities in this dimension, especially regarding the growing range of activities of ITAS, is significant compared to other major research institutions in Germany. However, activities in TA, risk assessment, science ethics and the like, appear to be running somewhat separate from the “main” fields of R&D. Structures for more integration of both have been established with limited success. The main barrier for deeper commitment to anticipation and reflexivity is rooted in cultural aspects. Anticipation and reflection on the societal embeddedness of R&D appear to be still regarded by many as being the job of the social sciences and humanities. In addition, there is a strong orientation towards “scientific excellence” fostered by political steering authorities (Research Ministry) which also guides strategic thinking of HGF as an umbrella institution for KIT. Although activities in the field of sustainable development and TA are also supported by these levels, they appear to not really be dealt with as being an integral aspect of scientific excellence.

Main drivers

There is a perceived social expectation for R&D to be more active in reflecting on societal accountability. This is constantly articulated by influential parts of civil society and politics in Germany and driven by events like the Fukushima nuclear power accident in Japan. This is taken up also in funding programmes that are relevant for HGF/KIT and that support respective activities in these institutions. On the operative level (of research projects) the initiative of research staff is decisive to translate this into relevant and sustainable research projects or formats of inner-organisational discourse.

Good practices

Good practices can be found in the activities of institutes such as ZAK or ITAS. Here, elements of anticipation and reflexivity are part of research activities and communication activities. ITAS as an institute specifically devoted to TA, can be regarded as the institutional place within KIT for reflexivity and anticipation to be dealt with.
Current indicators

The direction of the research is evaluated within the framework of the POF and the excellence initiative of the federal Research Ministry. The POF-programme, which ITAS is participating in, encompasses the systematic research of the many and varied interconnections between technology, innovation and society (TIS). ITAS makes up about 90% of the programme, which at the same time underlines the relevance of ITAS and the restricted range of integration across institutions within KIT and HGF.

Points of improvement

For KIT, a forum would be helpful that allows exchange on science in society questions and its practical implications for the performance of KIT and its social accountability. Incentives are needed to involve researchers beyond those who are anyway addressing these questions as the central focus of research in the social sciences and humanities. It is necessary to bring existing interdisciplinary expertise and reflexive research closer to the classical STEM disciplines. One possible way to do this is to reserve parts of project budgets explicitly for this.

Openness and transparency

Open Access, as far as inner scientific openness is concerned, can be regarded as being very well established and also monitored within KIT and the open access HGF strategy. As described above, the KIT Library is the driver of ideas and the contact point for the CEO level of KIT. The implementation, however, only comprises exchange within the scientific community whereas open access in a wider understanding of access to research by society is less visible. Although Citizen Science, i.e. the involvement of laypersons in research, has become a subject within the portfolio of ITAS via several projects to explore practices in the field and potentials of Citizen Science to further open up research towards society.

Although in strategic documents (like the KIT strategy 2025) the “exchange of KIT science regarding the expectations, hopes and fears of society” is mentioned as being a fundamental task of the organisation (Dachstrategie KIT 2025), openness and transparency towards society on the level of KIT management is mainly understood in terms of KIT’s public relations strategy. However, in this respect a broad spectrum of activities can be observed: from more standard PR activities, such as publication of magazines, production of Radio programmes (Campus radio) and open-house days, to more interactive formats organised on a regular basis such as open lectures, or open meetings in the city of Karlsruhe on controversial scientific issues. Whereas the KIT department for science communication mainly follows a standard informational, one-directional communication strategy, interactive formats are provided by the “KIT Centre for applied cultural studies” and “studium generale” (ZAK). The latter activities involve aspects of science education (of the general public) as well as more discursive approaches

Activities related to inclusiveness in the sense of public engagement and involvement of society are (as is the case for reflexivity and anticipation) mainly covered by ITAS. Here inclusiveness is a central research subject within the STS projects run by the institute and public engagement formats are often part of standard TA projects. Beyond this, ITAS has also developed formats such as technik.kontrovers, i.e. open discussion events on controversial S&T issues designed for the general public, as well as living lab activities such as the “Quartier Zukunft” involving citizens and NGOs from the city of Karlsruhe for a sustainable development of living areas. In this respect, also the so called “school of sustainability” as an outreach to the general public is of significant relevance. These activities are supported by the management of KIT as part of KIT’s portfolio. They, however remain as niche kind of activities that only
are only slightly integrated with the central engineering and natural science departments of the organisation.

Responsiveness of the organisation towards expectations of society can be observed in taking up issues of the public discourse in research activities. This is best visible in activities like the “Energy Transformation” programme that is meant to support the German “Energiewende” towards a renewables-based energy system. Generally, sustainability is a concept that is widely taken up by KIT in the context of energy, transport and environmental research (and is also embedded on the operational level by taking sustainability criteria into account in planning of KITs infrastructure).

KIT as a publicly funded research organisation has undergone significant changes in the last decade due to shifting societal expectations and political priorities in the field of energy and environmental research. KIT went from a research centre dedicated to nuclear power to one focusing on alternatives in the energy systems, mainly as a response to socio-political changes. Formats to increase the organisational awareness of public concerns or expectations are mainly realised on the project level with restricted or no visible impact on KIT’s overall strategy.

Main barriers

Regarding the limits of openness and transparency the development of the Overarching KIT 2025 Strategy is relevant. For this, efforts were made to involve KIT employees, yet this was only partially successful. Reasons that were named by respondents were: the process was too complex within an organisation like KIT, lack of motivation on the part of employees, and missing reward structures.

As with anticipation and reflexivity, there appears to be cultural barriers for a more integrative approach to public engagement or interaction with the public and societal groups. There are significant approaches and initiatives which, however, are mainly driven by single institutions which have research on science and society issues as a part of their portfolio. Openness towards society (beyond one-directional communication) is not an integrated part of day-to-day practice in STEM departments. Activities in this respect are not regarded as being “part of the job” and are also not rewarded or regarded to be conducive to the scientific career of single researchers. This was expressed in interviews by statements like: “there is not enough time in day-to-day work to care for transparency and openness towards the public”.

Main drivers

The main driver for a more interactive and open interchange with society as well as for being responsive to changing societal demands is the wider socio-political institutional setting. Societal discourse as translated into political programmes leads (via policy making authorities) to respective demands and expectations that are taken up by strategic decisions on the HGF level: sustainable development and interchange between research and society have seen growing attention in this respect in the last decades. This has led to a re-orientation within KIT which is mainly visible in the area of energy research and the significant relevance of environmental research.

Also, initiatives regarding public engagement as a subject of social research and as integrated part of research activities have been supported by funding organisations in Germany, however, this is restricted in scope and these activities remain to be part of the portfolio of social sciences and humanities departments. Initiatives in this respect (e.g. Living labs) are often dependent on particular engagement of research staff.
Good practices

KIT’s Open Access activities can be seen as a good practice example in this dimension. Also, communication activities and education initiatives such as school labs or living labs can also be regarded as being examples of good practice of interaction or communication between research and the public, with a restricted relevance however, for and effect on strategic management of the organisation.

Current indicators

Open access indicators, as described above, are the only active indicators in this field.

Points of improvement

While research results are communicated externally as part of public relations work and KIT’s mission statements on its obligation to be transparent towards society and responsive to societal demands, research practice itself remains largely closed and inaccessible to the public, as well as the strategic decisions of the KIT-management. There is obviously a lack of institutionalised channels to respond to societal demands. Respondents in interviews have expressed the need for structures that allow requests from the public to be channelled into the organization and discussed internally.

6.2.8 Other concepts used to characterise responsibility in the organisation

A central concept that emerges in discussions of (social) responsibility is sustainability. On the one hand it appears in the sense of a neutral temporal definition, understood as "long-term". On the other, as a normative determination, especially in the context of the environment. In this sense, it has become increasingly important in recent decades and is in line with overarching social and political change. In the last ten years, this change has also become more apparent in the structures and culture of KIT. Since 2011, sustainability has been omnipresent in the strategy papers. It is anchored in numerous umbrella strategies such as KIT 2025, and a KIT 2030 master plan that was formulated as the central sustainability strategy. The topic of sustainability permeates all areas of activity of KIT. In 2014, the president of KIT said: "Sustainability is (...) not only a central topic in research, teaching and innovation. Sustainable action is also important to us in everyday life on campus "(KIT Annual Report 2014). In the same year, a staff initiative ZUKUNFTSCAMPUS (Future Campus) was established, which acts as the central coordinative body of all sustainability issues at KIT. It is divided into three units: sustainability management, campus development and environmental and energy management. An important element here is the sustainable development of the energy and construction infrastructure as an “energy transition at KIT”. This includes issues of energy supply (solar energy, etc.) and mobility (hydrogen buses, bicycles, etc.) on the campus but also the consumption of resources. For example, as a result of a 2015 paper initiative, which was followed by a Bureau decision in 2016, 100% of the paper used has been recycled paper since 2017. A "green campus office" has been set up for the coordination of further cross-organizational activities. Numerous bottom-up activities converge here, enabling participation for all students and employees. This includes, among other things, a bicycle repair, a campus garden and a beekeeping. Furthermore, the staff function organizes various information events such as annual sustainability days, competitions and carried out a survey on sustainability at KIT. To improve coordination, a "Sustainability Network at KIT" (NeNa) was set up under the leadership of the ZUKUNFTSCAMPUS. Research has seen a shift from the former Nuclear Research Center to more sustainability issues, especially as a result of the nuclear phase-out. The areas of regenerative energy and storage systems as well as mobility are firmly anchored. Sustainability also plays a central role in (social) accompanying research at KIT. At ITAS, as the central institution for the social dimension, "sustainability and environment" is one of four research areas. Within this framework, the concept of "integrative sustainability" emerged in the 2000s, and is still widely used today. Throughout the
organisation, the KIT Center Humans and Technology is dedicated to "Sustainable Development" as a cross-cutting issue and Environment and Technology as a topic. These activities have not only led to further popularization and deeper understanding of the sustainability concept, but also have a practical dimension. The focus is on the "analysis and design of interactions between technological progress and sustainable development" with the aim "to assess and influence technology development, based on the objective of Sustainable Development" (http://www.mensch-und-technik.kit.edu/english/nachhaltige_entwicklung.php). In addition to the research, there are numerous other activities which are mainly due to bottom-up movements. For example, the Living Lab, which is currently being expanded into the Transformation Center for Sustainable Futures and Cultural Change, is dedicated in particular to the transformation to sustainability. They explicitly commit themselves to "sustainable urban development" as the goal of the activities. Furthermore, sustainability plays an important role in teaching. The "Karlsruhe School of Sustainability" emerged from a bottom-up initiative with the goal "to establish education for sustainable development in the KIT in a broad sense of the concept". This includes the involvement and education of the public, a module is explicitly dedicated to a transdisciplinary perspective. An important keyword is "Local Education", means "communication and knowledge transfer between the KIT and the citizenship". In addition, sustainability is a topic of Studium Generale, ZAK offers Supplementary Studies on Sustainable Development. Overall, the narrative of sustainability is thus widespread and serves as a central reference point for questions of social responsibility. This is accompanied by important research fields as well as numerous activities directly related to society.

Main barriers (structural, cultural or related to interchange dynamics)

The biggest barrier in the history of the concept was old habits and ideas. In part, a change in the organization took place only through a generational change in the management levels. Even in the MINT disciplines, the change was slow. When it comes to the question of actual implementation, there is still the problem of "green washing", i.e. the use of sustainability narratives without actual change in practice.

Main drivers (structural, cultural or related to interchange dynamics)

The fundamental social change represents a central open system driver. Since the 1970s, there has been a very strong environmental and anti-nuclear movement in Germany, which has also found its way into the party landscape with the Green Party. Finally, in 2011, as a result of the disaster in Fukushima, a final exit from nuclear energy took place for the time being. Thus, the energy transition was initiated as an important agenda of the government, which has particularly hit the KIT as a nuclear research center. These activities also extended to numerous other technical and social areas.

In interaction with this external driver is an intra-organizational cultural change, which has been promoted by numerous bottom-up initiatives. For example, the theme of sustainability at ITAS has played an important role since its founding 25 years ago, and has been continually developed within the organization. Many of today's well-established structures go back to that.

Structural drivers emerged, especially after 2011, through the formulation of strategy papers and the formulation of goals. Although they go back to the environment and cultural drivers, but promote the development in recent years, through appropriate financing.

Good practices

As a good practice, the numerous self-initiatives within the organization can be aggregated. These have contributed to a change within the organization and formed the basis for the development of a cross-organizational coordination structure. On the one hand, the School of Sustainability, which carries the topic into both the organization and the society, is outstanding. On the other hand, the Living Lab,
which contributes to sustainable urban development. The Living Lab are described as comprehensive
good practice in chapter 9.4.

6.3. Reflection on Review findings, Outlooks developed and ways forward

6.3.1 The integrated or fragmented nature of different responsibility related dimensions

The notion of RRI itself is not used at KIT and the term is not well known. Nevertheless similar
approaches are described and activities concerning the RRI dimensions and keys are implemented in
different form (especially societal engagement, ethics, open access, gender equality). Openness and
transparency are well known aspirations; here, the specifications by HGF are important impulses.

Responsiveness and adaptation of KIT to requirements from politics and society are characterized in
particular by the program-oriented funding of HGF (POF). The regular evaluation of the individual HGF
centers also tries to meet societal expectations. This is expressed differently in the individual programs.
In the current funding period, among other things, there is the program “Technology, Innovation and
Society”, which focuses on research questions that focus on the interface between problem-oriented
research and society.

Concerning the integrated (or fragmented) nature of the dimensions it can be stated that reflexivity
and anticipation play a role in the KIT mission documents especially in the duty to contribute with R&D
to solving societal challenges. In terms of self-monitoring and self-evaluation, reflexivity is often
connected to “scientific excellence” and plays an important role in the organisation. In this sense
reflexivity with regard to social accountability of research is highly connected to the dimensions
openness and transparency.

With the expectation for R&D to be more active in reflecting on societal accountability, openness and
transparency is supported. Here we have to distinguish whether openness and transparency expresses
itself in publishing strategies (inner scientific perspective) or in the sense of access to research by
society. On the level of KIT Management openness and transparency towards society is mainly
understood in terms of public relations strategy.

6.3.2 Common barriers or drivers

Despite the different characteristics of the individual RRI keys in KIT, common barriers and drivers can
be identified: All of them are not rewarded in the current science system. Although there are gradual
differences, in sum the keys are not decisive for the allocation of funds. In this respect, open access is
still the most widely used. There is a trend that in the future the number of open access publications
could play a special role in the POF evaluation catalogue. Another common barrier is that initiatives
can often not be started by KIT itself in the current HGF structure. Finally, the implementation depends
on individuals within KIT (missing intrinsic motivation of scientists).

However, the analysis of the individual RRI keys and dimensions also shows common drivers. External
funders such as the national ministries or the Ministry of Education in the State of Baden-Württemberg
recognize the relevance of gender equality, open access, societal engagement and innovative forms of
science education. Explicit tenders help raise awareness amongst scientists. The same applies to
political demands and frameworks as well as legal requirements, which can be seen as a driver across
all keys.

6.3.3 Final reflections and plan for follow-up

To sum up: The keys are heterogeneous in their institutional anchoring and expression. It would be
helpful if KIT describes minimum requirements for the implementation and standards. A suggestion
for better implementation of ethics e.g. would be courses in all subjects related to responsibility in research. In addition to the institution, scientists should be encouraged to reflect on and communicate their research on social added value. In this sense, the public’s interest in research and science can be considered very positive. To be successful various kinds of support are conceivable: Rewarding system for scientists who are active in communication formats with the public, or targeted processing of the research results by means of science communication. The goal should be that KIT promotes all keys on an equal level and sets up transparent processes, in which the advantages and disadvantages of individual measures are carefully weighed. The institutional embedding of KIT must always be considered.

7. Organisational reviews and outlooks: Helmholtz Association

7.1 Mapping of the organisation

The Helmholtz Association of Research Centres (HGF) is the largest research organisation in Germany and is an association of 18 individual research centres across the country\(^\text{13}\). Research within HGF is conducted in the following six research fields: Energy; Earth and Environment; Aeronautics, Space and Transport; Matter; Health and Key Technologies (see Graph 4). According to the mission of HGF, its research is dedicated “to pursuing the long-term research goals of state and society, and to maintaining and improving the livelihoods of the population”. This already frames the close connection between science, research and society as well as issues of responsibility. Overall, HGF sees its mission as “contributing to unravelling complex systems by means of large-scale facilities and infrastructures” by combining research and technology development with perspectives for innovative applications.

HGF connects 18 scientific-technical and medical-biological research centres and, with an annual budget of 4.24 billion euros (2015), it is Germany’s largest scientific organisation. A good two thirds of this is institutional funding and comes from a public budget. Beyond this, the individual Helmholtz Centres are responsible for attracting more than 30% in the form of contract funding provided by public and private sector sponsors. As of 2014, the Association’s research centres employed 38,036 staff, of which 14,734 are scientists, 7,356 are PhD students and 1,657 are in vocational training.

The individual centres are funded through programmes (programme-oriented funding - POF), which form cross-cutting programmes along the six research fields mentioned above. These programmes are evaluated and adjusted regularly. Funding is provided of up to 90% by the federal government and 10% by state governments. HGF’s central offices in Berlin and Bonn are in charge of coordinating this process. International HGF offices are located in Brussels, Beijing and Moscow.

HGF itself has a fund called “Impulse and Networking Fund” to support central and overall activities across the centres. This is used to set strategic goals and it is coordinated directly by HGF’s president. A basis of these strategic goals is the “Pact for Research and Innovation” (PFI) between federal and state governments, which has existed since 2006 (one of the main Pacts described in the national context). This pact functions as an agreement between non-university research organisations and the research-policy goals, and includes an increased budget of 3% annually. In 2011 and 2016 the PFI was renewed, with adjustments along strategic goals.

HGF cooperates with diverse international partners to conduct competitive, cutting-edge research that produces results of worldwide significance. To this end, HGF creates strategic international alliances, consortia and networking with national and international partners, especially from universities and industry. Each year, several thousand visiting scientists and researchers join HGF centres to work with

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\(^{13}\) For an overview of all centres see: [https://www.helmholtz.de/en/about_us/helmholtz_centres/](https://www.helmholtz.de/en/about_us/helmholtz_centres/)
large-scale scientific facilities; in some cases, HGF equipment is the only one of its kind in the world. In 2014, 7,476 foreign scientists made use of the infrastructures in the HGF centres.
Graph 4: Organisational Structure of HGF, marked green with areas where interviewees were from (HGF, adapted)
7.2 Aspects of responsibility in organisational policy and practice

7.2.1 The conceptualisations of responsibility in the organisation

Responsibility as a specific term is not a key focus in the strategic-programmatic documents of HGF, but the overall mission of HGF can be connected to an understanding of research being “responsible” for solving societal challenges:

“Contributions for solving the large-scale and pressing questions of society, science and the economy through strategic-programmatic directed excellent research”.

In the examined documents, the notion of responsibility can be found regarding the development of research infrastructures and the scientific systems as achieving societal responsibility through research. For instance, since 2016, an initiative for hiring skilled refugees explicitly refers to this being part of societal responsibility. This was a direct and fairly fast response to current political pressures regarding the large influx of refugees to Germany at that time.

Most understandings of responsibility are implicit in the way guidelines and strategies are framed or how people at HGF understand their daily work. Also, responsibility is implicit in HGF’s views on research integrity and good scientific practices, as for instance, HGF does not take part in military research. The link to societal issues and the responsibility of HGF to do research in certain thematic and strategic areas is the result of political negotiations done in the context of the PFI, which sets the overall strategic goals of HGF. In this sense, responsibility plays a more conceptual role for setting the agenda of HGF. Furthermore, it shows the expectations from the political side for HGF to take responsibility in developing new technologies and transferring these into society, which also applied to HGF’s communication activities.

RRI as a term is not used in HGF, neither in the documents nor by the interviewed representatives. Only within the context of EU-projects was the term known by some participants. RRI was seen as a “political term “that may play a role in administration, but not in the everyday work of researchers. Beyond this, the RRI keys as such, were known and represent areas in which HGF is active. Responsibility was also used by the interviewees as a motivation to work at HGF and to do meaningful work. This shows the basic understanding of having the responsibility to conduct research as a societal and cultural duty. Among the interviewees, it was argued that taking over responsibility for societal challenges can also create tensions with the independence of research and also HGF as an organisation. In the socio-political frame in which HGF has to act, this has to be balanced continuously.

Responsibility is a central term for the communication department at the HGF main office, since it is publicly funded and therefore accountable. This was connected to the need to legitimise the work of HGF towards the public. Moreover, there are continuous debates within HGF on responsibility (e.g. for future generations), also in the area of research results and applications and whether researchers should be held responsible for how their research is being used. Overall, most respondents viewed responsibility as an important aspect, also regarding the future of HGF research.

Competing concept

Arguably, the most important social and political concept regarding responsibility in Germany is that of sustainability or sustainable development. This is also very relevant for HGF and shapes its research and main goals. Sustainability became even more relevant in Germany from 2011/12, after the Fukushima accident and the decision on the German energy transition. This intensified the role of sustainability within the German social, political and S&T landscape, a fact that also effected HGF directly. It actually changed its logo to “Helmholtz: sustainable research shapes future” (before that, it
was “Helmholtz: concentrated research shapes future”). The annual report 2012 has the title “Helmholtz – long-term research, sustainable effects”. In the preface to the annual report 2012 the HGF president states:

“our goal is to contribute to a sustainable improvement of future perspectives through research. Therefore, we will ensure that findings in our basic research are translated into innovative applications, new technologies, products or services in a fast way.”

There is a common view that HGF has a mainly environmentally framed understanding of sustainability, mixed with a more general understanding of long-term solutions (e.g. “the medical supply and the quality of life for citizens should be made better in a sustainable way” HGF Annual Report 2012, p. 30). Thus, sustainability, in these different forms, is a concept used to characterise HGF activities and goals that are connected to its research goals, especially in the context of energy (e.g. energy transition).

7.2.2 Ethics in the organisation

Within HGF ethics is addressed mainly in two forms: as an accompanying, reflexive technology assessment (TA) and as research integrity. TA is seen as the overall way ethical aspects are processed in HGF research. For instance, in the second Programme Oriented Funding (POF) period in 2005, the programme “Technology, Innovation and Society” (TIS) was developed. TIS is a cross-cutting programme in the areas “Key Technologies” and “Energy”. The Institute for Technology Assessment and Systems Analysis (ITAS) at the research centre KIT is mainly conducting research on social and ethical aspects within TIS. The goal of TIS is “research of the environmental, economic, political, ethical and social aspects of new technologies to support decisions in politics, the economy and society”. As such, ethics plays a key role in the research done, on the one hand as ethical reflection on scientific and technological developments, and on the other as research done on TA itself and the ethical aspects of S&T. In HGF the TIS programme is referred to in questions regarding the societal dimensions of S&T developments and responsibility. Yet, many of the activities in this programme remain separated from other research areas. Within TIS, policy advice is a main activity and refers to providing ethical reflections for policy making. Important to mention here is the financial situation of TIS, as it can point out to how many resources are assigned to ethical reflection within the structure of HGF. Financially TIS is the smallest program of the entire POF with ca 0.15% of the total budget dedicated to social and ethical assessment (ca 4mill €)

Research integrity is the other main area relevant for ethics in HGF. In 1998 the HGF general meeting of members developed guidelines for ensuring good research practice and the process of dealing with misconduct. The basis for this was the establishment of a commission on “self-control in science and research”. These guidelines are aimed at the HGF centres and address issues of misconduct, appropriate education of young scientists and storage of primary data. Central instrument for this are the ombudspersons in each of the HGF centres. Other than these, the centres themselves are free to promote further activities in this area. There seems to be a general feeling that the research integrity system works sufficiently good in the organisation.

Main barriers

A main barrier in ethics as a reflexive process is cultural and inter-organisational in nature. Next to formal structures, such as ethics committees in the individual research centres, respondents mainly referred to the TIS program as the place where ethical reflection takes place. As such, it is felt as if ethical reflection is “out-sourced” to a specific programme, but it is not integrated throughout all the
research activities. This also shows in the relatively low budget for TIS activities, which entails a fairly small number of researchers working in this area.

Main drivers

Regarding research integrity, the guidelines of the German Research Association (DFG) to ensuring good research practice were the basis for the guidelines done by the HGF in 1998, which can be seen as a main driver in this area. Regarding TA and TIS a main driver is ITAS itself, as it is an institute explicitly dedicated to TA as well as providing policy advice. Some interviewees referred to the political expectations to take on certain issues as a driver, also to think about the ethical implications of research. This is especially relevant in the German context regarding questions such as what are the limits of what science is allowed to do.

Good practices

A good practice is, to a certain degree, the TIS program as it explicitly does ethical research on S&T developments. But it is also detached from other research activities. ITAS was mentioned by respondents as an institution which offers integration between basic research, ethical reflection and societal embeddedness. A good practice of directing research due to ethical issues is that of not developing the next generation of nuclear power plants.

Current indicators

At the moment, there are no explicit indicators for this key within HGF. Yet, one respondent did mention that it would be difficult to implement HGF-wide indicators. For instance, the POF programmes at the moment could not reserve 5% for ethics or TA research, an ideal case prescribed since the early times of the Human Genome project, since the experts for such endeavour are missing at the individual centres. On the other hand, each HGF centre has the capacity to incorporate their own ethics indicators without the need for a HGF-wide approval.

Points of improvement

Ethics trainings and awareness building can be improved, for example by using the Impulse and Networking Fund of HGF to promote this across the different centres. This could help establish organisation-wide activities and provide capacity building for the individual centres.

Number of employees taking part in trainings could be an indicator of success, along with increasing awareness for ethics issues amongst active researchers.

Resulting matrix

<table>
<thead>
<tr>
<th>Aspects of organisations</th>
<th>Structural issues</th>
<th>Cultural issues</th>
<th>Interchange related</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIS programme as in-depth research on ethics</td>
<td>Responsibility a motivator for doing research addressing societal challenges</td>
<td>Increased public and political awareness on ethical issues are “translated” into HGF research programmes also via public funding</td>
<td></td>
</tr>
<tr>
<td>Guidelines on research integrity</td>
<td>Large-scale organisation like HGF needs to provide guidelines and good examples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HGF doesn’t engage in military research</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential drivers for ethics</td>
<td>basic ethical compliance driven by external (legal) demands</td>
<td>Technological innovations influence everyday life more and more, therefore ethical</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increasing debates in society and from political side</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
HGF guidelines can provide orientation across all centres
considerations relevant to more people and in various contexts
Research integrity has become a topic in public/media

Potential barriers to ethics
TIS is a somewhat isolated programme
No capacities (personnel and budget) to provide ethical reflection in all programmes
Out-sourcing of ethical issues as these aren’t seen as part of all research activities
Freedom of research is seen as important, also regarding autonomy

Most important potential organisational actions
Ethics trainings HGF-wide for researchers in all centres
Awareness building and capacity building on all HGF levels
Inclusion of public and political debates on ethical aspects

Indicators for success
none
Increase of reported interest from different levels in HGF centres
Number of researchers explicitly naming ethical reflection as motivation for their research as well as improvement of research conditions

7.2.3 Societal engagement strategies in organisation
Based on the interviews as well as the focus group discussions, the question of engagement seems to be a fairly controversial subject within HGF. There is a tension within the organisation which comes from political (and societal) expectations towards their research and a certain pressure to include a wider public in some way. This is a general aspect in Germany, in which demands for engagement and inclusion come from various sides (e.g. political representatives and citizens or stakeholders). Overall, it is unclear how this can be done in various research areas or how it can be institutionalised. For HGF the main actor when it comes to “engagement” is the political side. The process of setting research goals and agendas (POF and PFI) is done in exchange between the ministry and HGF. Many of the interviewees regard engagement as a politically legitimised process of setting goals and main tasks. Other societal actors are not formally part of this process and a need for changing this process is not really seen.

Since 2013, there is more activity regarding communication, such as, dialogue events. Yet this is limited mostly to communicating HGF research to the interested public. One respondent did stress that they see the public not as a target group but as an interaction group, which through communication events, has the possibility to give feedback. Since 2014, the term “knowledge transfer” has gained influence within HGF. This goes beyond the transfer of research outcomes as innovations into the economy, and now includes transfer of knowledge from HGF into society. Newer concepts such as Citizens Science play a role, yet mainly the focus is still on communication, not engagement as understood in RRI. Overall, these communication activities, due to the structure of HGF overseeing independent centres, are mainly concentrated in the research programmes of the centres themselves.

Main barriers
Demands from the external evaluation of the POF funding programme, which was done by the Wissenschaftsrat (national research council advising federal and state governments on structural development of research institutions and universities), did include the engagement of civil society in...
the agenda setting of HGF. Yet, interviewees mentioned that this remained vague and that it is not clear what is meant by “the public” or “society” in this respect. In this case, a barrier was seen to be that of lobby groups that take over such engagement processes.

The organisational culture of HGF is itself a barrier as it is not sure where engagement can take place within the system. Several respondents referred to the independent centres where these activities can (potentially) take place. This means that there is not a general administrative level of HGF that sees this as their task. The HGF main office sees itself as a coordinator and mediator between the centres and external actors, for example, the media. Furthermore, the political structure is a barrier in the sense that exchange between HGF and the ministry is seen as the main process through which societal needs or expectations make their way into the research agendas. This is the main legitimisation process and therefore an inclusion of a wider public is not seen as necessary.

Main drivers

A main driver in the current system of agenda setting is political pressure. If the political side (e.g. ministry) formulates demands regarding engagement, then this will be taken up by HGF as part of their programmes. As we have seen in the description of the German S&T system above, this is indeed the case in Germany. The government is keen in promoting public participation in, amongst others, S&T discussions.

Good practices

Examples of good practices that were mentioned in the context of engagement were: The Cancer Information Service (DKFZ) website, which was initiated quickly because it was in the interest of the new HGF president. The DKFZ was founded in 1964 and is a network of research centres across Helmholtz with funding for research on cancer. The website itself aims to provide detailed information for patients and interested individuals. Another aspect mentioned was The March for Science in 2017 in Berlin, which HGF actively promoted and participated in. March for Science is a worldwide initiative with many representations in various countries which focus on promoting the importance of science and its societal relevance. Large demonstrations, like in 2017, provide a public representation of this. This isn’t engagement as such, but was described as an important activity regarding communicating to society that issues of responsibility or autonomy of science and research are important to an organization like HGF.

The Online platform for animal testing (https://www.tierversuche-verstehen.de/) was also mentioned because it works well as a communication and transparency project, also engaging in critical debates. This is nevertheless, mainly a communication activity. The website itself aims to provide information from researchers themselves about animal testing in publicly funded projects mainly in areas like research on cancer, diabetes, Aids or Alzheimer’s. Its focus is on responsible testing and transparency.

The office “Wissenschaft im Dialog” (WiD) (Science in Dialogue) is supported by all large research organisations including HGF. Funding comes through the ministry (BMBF). WiD conducted a large BMBF project on Citizens Science (2014-2016). Two main outcomes were, the central platform for citizens science in Germany (www.buergerschaffenwissen.de) and a handbook on Citizen Science.

Social media was seen as an important tool in future communications as it can have higher impact than traditional media outlets.

Current indicators
Indicators play a role in HGF in the area of knowledge transfer. The development of indicators (quantification) is mentioned as a goal but it is still under development. As it is described in a strategy paper, developing numbers for measuring knowledge transfer of HGF has not been possible yet, but it is clear that this should play a role. The concrete activities and their societal and political effects of knowledge transfer and dialogue should be measured better. Three aspects for measuring this are suggested: strategic anchoring of knowledge transfer; obligatory numbers for input and output activities in the area of information and advice, exchange and further education; self-chosen indicators as addition.

Other indicators were seen critically by respondents as it is difficult to weigh these against scientific indicators. If indicators for engagement were to be developed, this would have to be part of POF, making it difficult to balance these against the more established, traditional academic ones.

Points of improvement

Engagement is mainly understood in the context of communication with different target groups. Even though this was described as a “dialogue” by several interviewees, it mainly revolves around informing the public about research of HGF and potential wider societal implications. This is done in a professional way, events and outputs are generated of a high standard. Yet, a clear point of improvement would be to include societal actors in the agenda setting of HGF as suggested by the Wissenschaftsrat as well. A reward system for engagement activities in form of prizes was seen as a possibility. This kind of system would have to be on the level of the centres, since this is where the researchers reside. HGF’s role in this was seen as coordinating these activities.

Resulting matrix

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<thead>
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</thead>
<tbody>
<tr>
<td><strong>Aspects of organisations</strong></td>
<td>Press work in specific unit</td>
<td>Science system itself doesn’t reward PE activities as such, therefore evaluations within POF don’t regard this either</td>
</tr>
<tr>
<td></td>
<td>Knowledge transfer is key topic for HGF</td>
<td>Public discussions on accountability of science have enhanced awareness of organisation regarding interactions with public</td>
</tr>
<tr>
<td></td>
<td>Communication activities fairly well developed</td>
<td></td>
</tr>
<tr>
<td><strong>Potential drivers for PE</strong></td>
<td>External evaluation by Wissenschaftsrat addresses PE within POF</td>
<td>If POF takes up PE criteria this will also influence the cultural setting in the long run regarding the importance of PE</td>
</tr>
<tr>
<td><strong>Potential barriers to PE</strong></td>
<td>Evaluation system and related funding for PE lacking</td>
<td>Within HGF it is unclear on what level (beyond individual researchers) PE can take place in a more substantial way</td>
</tr>
<tr>
<td></td>
<td>Independent centres can or can’t take up PE activities</td>
<td>Different centres have different cultures regarding this</td>
</tr>
<tr>
<td><strong>Most important potential organisational actions</strong></td>
<td>Inclusion of PE activities in the agenda setting processes for POF</td>
<td>Take up public and political demands in a more comprehensive way to develop clear strategy for PE including possibilities but also limits</td>
</tr>
<tr>
<td></td>
<td>Inclusion of indicators for POF evaluations</td>
<td></td>
</tr>
<tr>
<td><strong>Indicators for success</strong></td>
<td>Goal of indicators for knowledge transfer is currently under development</td>
<td>Reward system and acknowledgement of PE activities by HGF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inclusion of different stakeholders as part of an advisory structure for agenda setting</td>
</tr>
</tbody>
</table>
7.2.4 Gender equality and diversity strategies in the organisation

Gender is a well-defined and established concept within HGF. Due to strong political demands, the issue of gender has been well-implemented, at least on the level of awareness, in S&T organisations such as HGF. In this political setting, HGF as an organisation could not be without a general gender strategy.

Gender activities are mainly concerned with men and women. In Germany, the term “Chancengleichheit” (equal changes) usually refers to men and women, but can for example also include people with disabilities. Gender is represented in two main strategic concepts in HGF, namely equal opportunities (focus on percent of women employees) and compatibility of family and work. A further area important for gender in HGF is talent management, which is centrally pushed by the head office and specific funds from HGF.

In 2005 the PFI was initiated with one of the clear political goals being the promotion of women. Building on this, HGF developed a plan with equal opportunities as part of the talent management within HGF. The plan was originally developed by the equal opportunity commissioners in the centres in 1997, but played an actual role from 2004 onwards. Main aspects of the plan are the support of the compatibility of family and work (activities in the centres) as well as personal and professional qualification (activities in a general HGF mentoring program, leadership academies and recruitment initiatives). The Impulse and Network funds of the HGF support these activities in the area of talent management. In 2016 with the PFI III these activities were increased. This resulted in a new strategy developed by the working group of the equal opportunity commissioners. Also, HGF activities were increased explicitly aimed at recruiting women.

In 2017 the Alliance of Research Organizations formulated a statement with demands for increased child care facilities and legal changes in income tax regulations. From the political side, there have been demands towards HGF to increase the number of women as well as to present concrete targets. Basis for these targets are the ones developed by DFG in their cascade model. This model sets the targets for the number of women in each scientific career level by using the number of women in the level directly below. The monitoring of this is done through the PFI monitoring, but no direct sanctions are known.

The unique structure of HGF with individual centres makes it possible to pass these targets and activities directly to the centres. HGF functions as a nodal point for funding and monitoring. HGF has also introduced a general quota regarding reviewers for their programmes, 30% of which should be women. Diversity as a concept is not referred to (exception is the refugee recruitment initiative). In general, HGF was described by interviewees as a very “German” organisation in the sense that there is a lack of foreign expertise within HGF.

Main barriers

Main barriers are seen to be within everyday practices and underlying cultural aspects (unconscious bias) as well as intense pressure from the political side resulting in case-by-case decisions on what is actually possible in reality. Again, the structure of HGF does not allow for setting standards, which are
legally binding for the centres. HGF can pass guidelines, but this requires strong commitment by the centres to follow through.

A barrier regarding diversity, which itself is becoming more relevant in Germany, is seen to be the culture within HGF, in the sense that they do not see themselves as trend-setters in this area. General political discussions in Germany regarding diversity (e.g. on the top management level) are going on but have not yet been fully incorporated in HGF. Missing here is an active actor (champion) that can take this up.

A barrier was also described regarding the refugee recruitment program. It was established in a specific context, with high political pressure, and has therefore taken on a more symbolic role.

A further barrier regarding diversity was the lack of knowledge on the status quo at HGF (structure of staff, measures taken by centres). This is on the level of the centres, where a general HGF-wide information basis is missing. Furthermore, there does not seem to be discussions within HGF regarding the question what desirable goals should be.

Main drivers

In the case of gender the main driver was the political pressure and clear targets connected to financial incentives. Gender has been a main part of the PFI from the beginning, showing the importance of this issue in the German research context. Respondents specifically described that political pressure made HGF “move” and got many gender programmes started. The connection of gender to the HGF strategies on talent management and recruitment enables the taking up of this issue as part of the main interests of HGF.

Good practices

PFI as a strategic document gives a yearly addition in financial means for pursuing the research political goals, and has strong influence. Moreover, the DFG cascade model is widespread and offers a central benchmark for targets. It was described by the respondents as a useful tool.

The HGF mentoring program for women and leadership training academy was seen as especially important.

Reward systems were described as a good practice regarding the recruitment of more women. The HGF recruitment initiative gives funding in this area and has worked very well. Concrete target was 1/3 women.

Current indicators

The percent of employed women according to the cascade model were seen as an especially straightforward and useful indicator.

Points of improvement

HGF is very active in the area of gender. Initiatives as well as monitoring indicators are common within HGF as well as in the individual centres. Therefore, it can be stated that very good practices for this are in place. Therefore, no explicit points of improvement have been suggested in the area of gender.

Diversity aspects are still underrepresented in HGF as well as in Germany in general. This issue could be approached with similar strategies such as gender, including recruitment, mentoring and set goals.

Resulting matrix
<table>
<thead>
<tr>
<th>aspects of organisations</th>
<th>structural issues</th>
<th>cultural issues</th>
<th>interchange related</th>
</tr>
</thead>
<tbody>
<tr>
<td>well established guidelines and quota for gender in HGF, but lacking for diversity</td>
<td>family and work-life balance is key issue and is addressed</td>
<td>increasing awareness in public and politics that diversity is important</td>
<td></td>
</tr>
<tr>
<td>Generally, HGF is seen as a “German” organisation, lacking in diversity</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>potential drivers for gender &amp; diversity</th>
<th>legal requirements (quotas), guidelines for gender</th>
<th>gender issue has large awareness and is integrated part of organisation standards</th>
<th>gender is pushed by political side and publicly important</th>
</tr>
</thead>
<tbody>
<tr>
<td>HGF as an umbrella organisation can pass this on to centres</td>
<td>refugee initiative as an example for quick response to political pressures by the organisation</td>
<td>diversity is becoming (similar to Gender) important in public and political debates</td>
<td></td>
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<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>potential barriers to gender &amp; diversity</th>
<th>HGF cannot establish legally binding guidelines across all centres</th>
<th>everyday practices still sometimes disregard Gender and Diversity (unconscious bias)</th>
<th>established decision making processes may continuously disregard Gender and Diversity issues because they themselves are too homogeneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>lack of knowledge regarding status quo of Diversity within HGF</td>
<td>lack of active actor in HGF to take Diversity up comprehensively</td>
<td></td>
<td></td>
</tr>
<tr>
<td>gender can be seen as tick box activity in evaluation</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>most important potential organisational actions</th>
<th>increase number individuals with diversity background in leading positions through increased talent management activities</th>
<th>continuously communicate unconscious bias issues throughout all levels of HGF</th>
<th>improve work-life balance</th>
</tr>
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<tbody>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>indicators for success</th>
<th>certain percent of women according to the cascade model were seen as a useful way to come to indicators.</th>
<th>establishment of structures that specifically promote the benefits of Diversity</th>
<th>gender and Diversity don’t require specific programmes anymore because they become integral part of research and everyday work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>trainings for awareness raising</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>potential indicator for improved performance of the dimension in the research activities/programme</th>
<th>number of women, on all levels of career development</th>
<th>number of international researchers, in particular: number of scientists who are being recruited from abroad</th>
<th>setting up top-leadership diversity action plan</th>
</tr>
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<tbody>
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</table>

7.2.5 Open access and open science strategies in the organisation

HGF was one of the first supporters of the Berlin Statement on OA in 2003. Resulting from this, HGF formulated a guideline as well as a realization plan to support OA throughout the organisation. This plan included the creation of a general platform in the form of a working group and a coordination office. Activities in OA are mainly done through the individual centres. Implementation at the centres is supported by networking and experiences from good practices on HGF level.

HGF is part of the initiative “Digital Information”. The project is run by the Alliance of German Research Organizations and involved reforming the copy right laws and supports new negotiations with publishers (DEAL-Project).
The OA activities within HGF have been especially fostered by active centres, which aim to change their organisations as well as provide feedback throughout HGF. In this way, the OA activities within HGF have been bottom up. Yet, the year 2013 marked a change in this approach. OA increasingly became a top down demand, from the political side as well as from HGF. In 2016, the federal ministry (BMBF) released an OA strategy and with this OA became a political goal within the PFI. This was also driven by the OA activities of the European Union (FP7 and H2020).

In 2013, HGF introduced a mandatory OA policy for projects funded by their funds through the IVF. In 2016, guidelines were introduced establishing incentives, monitoring and controlling at the centres. Furthermore, a clear goal was named: 60% OA by the end of 2020. After that a yearly plus of 10%, reaching 100% by 2025 As of now, monitoring is being built up and overall the percentage of OA has not explicitly been collected yet.

Within HGF, but also the wider research community, OA has developed more toward the idea of Open Science (OS) which also focuses on research data. In 2014, the HGF working group and the coordination office were renamed from OA to OS. In 2016, the HGF general meeting of members released a position paper on how to deal with research data. The main idea behind this is that research data is a resource which is not being used enough. Here the main question is how to use this data for a better networking.

Overall, OA goes together with a restructuring of research topics. In 2016, the area of information and data science became a strategically important topic for HGF, also due to a new HGF president. HGF sees itself in a pioneering role here. Connected to this is the development of a digital domestic market on EU level and the future European Open Science Cloud. A differentiation between the various forms of OA (gold, green) doesn’t play an explicit role and isn’t differently monitored at the moment.

Main barriers

Respondents mainly described the academic system as a barrier since it does not necessarily support OA or OS. This was seen as very dependent on the specific discipline. For example, in biomedical research, data cannot simply be made public due to legal restraints.

HGF as an organisation within the academic system is on the one hand influenced by it, but on the other also has possibilities to shape it. Especially as a large organisation HGF can take on a strong position here, also regarding what role OA plays in evaluations.

Main drivers

A cultural driver was described by interviewees in the sense that it is inherently ideal for research to be open to everyone. This is a driver coming from academia and individual researchers. Main drivers regarding OA are the centres themselves, especially the libraries. Here the HGF system provides possibilities for individual activities as well as the exchange between them.

A further driver is the OA policies on the European level and the OA commitments in H2020 projects.

A driver described by a respondent was the dramatic rise on prices for journal access. Among the research community, a limit was reached and this lead to the cancelling of subscriptions from 2003 onwards. This also supported the development of an OA movement. A driver is also the Berliner Statement on OA, which was seen as a positioning of key players.

Good practices

The Open Science coordination office is a platform to bring together the various activities and develop common strategies and guidelines. The office’s main tasks include the collection of information and
support of OA and OS implementation in HGF as well as the centres. Each centre has a contact person for OS as well.

Current indicators

Since 2016, a concrete indicator is: 60% of OA until 2020, then +10% each year, with the ultimate goal of 100% by 2025. This indicator is adopted by all HGF centres, including KIT as we have described above.

Points of improvement

Improvement here is seen as a system wide issue. The research community, including large organisations such as HGF, needs to position itself clearly. Pressure can come from HGF regarding the public funding criteria and the need for OA publications. This should be done within the negotiations of the research agendas, in which HGF could take on a pioneer role. HGF has used its position to put pressure on journals, also to improve the subscriptions. Here there is collaboration between the research organisations and universities. This could be intensified by, for example, contributing to a wider public and political debate on this.

Resulting matrix

<table>
<thead>
<tr>
<th>Aspects of organisations</th>
<th>Structural issues</th>
<th>Cultural issues</th>
<th>Interchange related</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HGF Guidelines on OA Participation in various OA and OS activities</td>
<td>Requirements of OA in funding from IVF shows commitment HGF has developed OA towards OS to include research data</td>
<td>Positioning of HGF for OA and OS as a large-scale research organisation in Germany</td>
</tr>
<tr>
<td>Potential drivers for OA</td>
<td>Open Access Policy of HGF</td>
<td>Service provided for HGF-wide OA activities and coordination Academia and researchers themselves push for OA</td>
<td>Lobbying for OA as publication standard for research organisations</td>
</tr>
<tr>
<td>Potential barriers to OA</td>
<td>Legal issues (e.g. biomedical research data) which hinder OA</td>
<td>Different publication cultures in different disciplines influence the motivation and awareness of researchers for OA</td>
<td>Academic system as barrier for wide-spread OA</td>
</tr>
<tr>
<td>Most important potential organisational actions</td>
<td>OS office as a platform unit already useful to bring together HGF-wide activities</td>
<td>OS office should “lobby” within HGF and outside for importance of OA</td>
<td>Make OA as part of the knowledge transfer strategy of HGF therefore stressing the importance of transparency and accessibility of research</td>
</tr>
<tr>
<td>Indicators for success</td>
<td>Since 2016, a concrete indicator is: 60% of OA until 2020, then +10% each year, 100% by 2025</td>
<td>OA is broadly accepted and part of the motivation of researchers to communicate their research</td>
<td>Downloads of OA papers ???</td>
</tr>
<tr>
<td>Potential indicator for improved performance of the dimension in the research activities/programme</td>
<td>Number of OA research journals increases and are the more attractive publication platform OA publications for POF evaluations of the programmes (has to be adapted to specific areas and disciplines)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7.2.6 Science education as integrated in research

In general, science education within HGF has two main addressees: the general public and potential researchers or employees. One aspect of addressing a wider public is the HGF website, which was relaunched in 2013. New formats were introduced that were made for a wider public, HGF in-house publications (e.g. HGF magazine) were re-designed, and several public events introduced (e.g. public dialogue events on specific research). For HGF this marked a step from the classic self-PR to topic and dialogue oriented public communication. Core of the strategy is the realization that citizens are not primarily interested in institutions and their self-representations, but in research results and their implications. Based on this, new communication instruments were developed. Also, a strategic frame of “knowledge transfer” was introduced, making transfer into society a main strategic goal. This strategy is in the development phase at the moment.

The other addressee of potential researchers or employees is part of the talent management strategy. This is focused on employees at the centres and their networking and further training. Of relevance here, is the foundation “House of young scientists” of which HGF is a member. The foundation is active on a national level, especially in the areas of sustainable development and the STEM subjects. Furthermore, a network of school student labs and the establishment of these labs in schools has been an important activity for HGF. Since 2012, there is a HGF-wide open day for the public as well, which invites visitors to learn about the centres and interact with researchers. HGF has a coordinating and supporting role, while the actual activities are done in the centres. Respondents did state that even though there are these activities, there is no coherent programme in science education (besides communication) since this is not a main mission of HGF as a non-university organisation. Basic funding provided through POF does not include teaching activities.

Main barriers

Again, a main barrier is the inner-organisational culture. For HGF science education is not regarded as a main goal, especially regarding teaching activities. Therefore, there is no specific person or department who explicitly takes this up. One has to remember that HGF is an association of relatively independent centres and science education would fall under the remit of each centre’s strategy, as we have also seen in the case of KIT

Main drivers

A main driver regarding the education and training of employees is the support of talent and encouragement for career development. A further driver is the PFI, which declares the promotion and support of researchers/employees as a main goal. Another driver here is the goal of science communication and knowledge transfer.

Good practices

The school labs described above were described by interviewees as a good way to involve students in science and research and to encourage their interest.

Current indicators

There are no explicit indicators for SE within HGF at the moment. This is also unlikely to happen, since science education is not seen as in need for a top-down approach, as is the case with gender for instance.
Points of improvement

Participants were of the view that more could be done regarding science education in HGF. Yet, as the mission of HGF is not explicitly to educate and teach, and there are many other institutions with this specific aim, the question is whether HGF should build up more activities in this area. One point of improvement could be to provide input for other institutions doing science education. This can include input for school books or other expert scientific knowledge needed for developing science education.

Resulting matrix

<table>
<thead>
<tr>
<th>Aspects of organisations</th>
<th>Structural issues</th>
<th>Cultural issues</th>
<th>Interchange related</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Communication activities via website, social media and in-house publications oriented along research itself</td>
<td>Move from self-PR to public communication more tailored to different target groups</td>
<td>SE seen as important also as a way of providing sound facts to society on science and technology</td>
</tr>
<tr>
<td></td>
<td>Knowledge transfer as a strategic goal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Talent management strategy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Potential drivers for SE | | |
|--------------------------| | |
|                          | Trainings for researchers on how to do SE activities | Support the commitment of individuals (e.g. budget and acknowledgement) | Demands from Ministry side can enhance SE activities |

| Potential barriers to SE | | |
|--------------------------| | |
|                          | Many activities in individual centres are difficult to bring together into more comprehensive strategy | SE not a main goal of HGF in general therefore no specific unit for this | Overall mandate of HGF not SE |

| Most important potential organisational actions | | |
|-------------------------------------------------| | |
| Further develop knowledge transfer activities to encourage individual researchers | Raise awareness of potential of SE activities for knowledge transfer | Presentation of SE activities towards funders (Ministry) to show importance |
| Provide input for other organisations | | |

| Indicators for success | | |
|------------------------| | |
| None | Number of activities of individual researchers in SE | Media analysis and questionnaires for use of output in policy decisions |

Potential indicator for improved performance of the dimension in the research activities/programme

| Indicators for knowledge transfer should be developed according to HGF internal structure and main goals. These could include: Number of participants in events, number of readers/downloads of publications, number of social media likes, number of participants in talent management activities |

7.2.7 Incorporation of AIRR dimensions into policies

Anticipation and reflexivity

Anticipation and reflexivity processes are established in HGF on the level of scientific research regarding the societal implications of S&T, especially in the form of TA. The TIS programme, as described above, is specifically devoted to doing research on this. The political negotiations for the agenda setting (POF) as well as the PFI ensure a certain degree of anticipation and reflexivity are included in setting the strategic goals for future HGF research. In this process, which is characterised by many discussions on different levels of HGF and the ministry, different perspectives and demands can potentially be included.
Main barriers

As the TIS programme is almost specifically dedicated to TA research, it remains somewhat separate from other programmes such as Earth and Environment or Aeronautics. Ideally these kinds of activities should be cross-cutting, through which anticipation and reflexivity would be integrated across the various POF programmes and research activities.

Due to the clearly defined actors involved in processes of priority and agenda setting (e.g. ministry, HGF itself), there is not much room or even a wish for a wider reflection by more actors in the organisation. Inter-organizational barriers regarding the awareness of anticipation and reflexivity are apparent since there is little interaction in the TIS programme between HGF centres.

Main drivers

A main driver can come from the political side that can clearly define programmes with more reflexivity and anticipation activities (e.g. TA). The new POF programmes (after 2020) aim at including TA activities on a wider level, which offers the potential to include anticipation and reflexivity. Yet, this is still in the negotiation phase, therefore it remains to be seen how anticipation and reflexivity can and will be integrated HGF-wide.

Good practices

The TIS programme can be seen as a good practice in the sense that it is specifically devoted programme to doing research on societal implications as well as TA methodology itself.

Current indicators

Policy advice provided in the TIS program is evaluated through peers, but mainly in a qualitative way. There are no quantitative indicators of the programme currently.

Points of improvement

An improvement could be to make anticipation and reflexivity a mandatory part of all POF programmes. This would mean to incorporate TIS into every programme of the organisation. The inclusion of different stakeholders in the agenda setting or at least as an additional knowledge source, could be a point of improvement. This was seen as very difficult to realize by the respondents, because of already established processes of agenda setting.

Openness and transparency

Openness and transparency are important factors regarding the communication activities in HGF. Communication and dialogue activities are seen as a way to present HGF research in an open and transparent way. The issue of scientific integrity and good scientific practice is seen important as a way to be accountable and transparent regarding, for example, data collection or what kind of research is conducted.

Main barriers

Beyond the communication activities, a barrier is the scientific culture which emphasizes autonomy and independence of research. This can lead to a somewhat closed off attitude whereby research can only be valued by specialised peers and thus, wide openness can lead to wrong decisions.
Main drivers

A main driver can be seen in the accountability demands on science deriving from the public or politics. HGF is publicly funded and therefore has to be open and transparent regarding how the funds are used and how results of research are communicated to the public.

Good practices

Open access provisions are considered a good practice in this respect, along with the considerable communication activities of the organisation towards the general public.

Current indicators

Open access indicators are the only active indicators in this field (see above for details).

Points of improvement

Openness and transparency is provided to a certain degree in the agenda setting of research priorities. Yet, the negotiations between HGF and the ministry remain mainly between these two actors, even if many different people are involved. More openness towards the inclusion of other stakeholders or the public could help to foster anticipation as well as reflexivity also in the steering bodies of the HGF.

Responsiveness and adaptation

Responsiveness regarding the political situation is enabled to a certain degree. An example here is the Energy Transition in Germany, which invoked a response from HGF to focus on key issues such as energy or to not do research on future nuclear power plants. The most important actor regarding responsiveness and adaptation is therefore the political side (e.g. the ministry). HGF must remain sensitive towards political demands and expectations, while also remaining independent from short-term political developments.

Main barriers

A main barrier is the awareness of how responsiveness and adaptation can be scaled up to the HGF level. Many activities can be included on the centre level, yet it is unclear how this can translate into a general strategy for HGF. The POF would be an obvious means to foster responsiveness by opening up the agenda setting for programmes to other stakeholders, as well as by introducing appropriate criteria for programme evaluation. This however, would probably require coordination with the political level (BMBF) and is difficult to be aligned with the existing “scientific excellence” culture within HGF.

Main drivers

A driver mentioned by respondents was the position of the HGF president, who as an individual can bring up issues and push for measures. In order to push through topics, the president needs to do so continuously in the committees and meetings on HGF level.

Good practices

No particular good practices were mentioned in this respect. It should be noted that participants had difficulties grasping this dimension and therefore also had difficulties acknowledging a particular practice in the organisation that can be described as “good” in this area.

Current indicators

No particular indicators are used in this area. This is not surprising, given the novelty of this approach.
Points of improvement

Respondents did not feel a need to improve in this area since they see HGF as by default responding to the needs of science and society as they are communicated through the extensive negotiations between the ministry and the centres. Of course there is always a scope of improvement in the practices but in this particular case, there were no specific ideas developed; presumably due to the fact that respondents found the discussion on the dimensions too novel.

7.2.8 Other concepts used to characterise responsibility in the organisation: Sustainability

Overall, during the interactions with HGF representatives, it became clear that the keys provided the best way to connect HGF activities to RRI. Since RRI as a term or as a concept is unknown, respondents were mainly able to give input for the individual keys as these represent established research activities in themselves. As mentioned above, responsibility was often connected to sustainability. This is a well-established concept in Germany, including evaluation methods with both quantitative and qualitative aspects. Sustainability is therefore known on a practical level. It is usually understood in the narrower environmental sense, but also as long-term thinking (e.g. long-term research goals, societal sustainable). When it comes to a general strategy on sustainability though, HGF still lags behind though.

The LeNa project\textsuperscript{14}, which developed a sustainability framework explicitly for large research organisations in Germany and in which HGF participated, is a first step to come to an overall strategy. Yet, it remains to be seen how much of LeNa will be realized in HGF in the longer run. As of now there are no formal references to it and no further actions initiated.

Main barriers

Sustainability is an important concept politically, socially and therefore also in the context of research. Yet, it is difficult for HGF to implement a wide strategy, due to the independence of the centres. That would require a top-down approach, similar to the one on gender equality, but that should be a political decision making. In this sense, HGF has difficulties developing a concrete implementation of this concept although it is widely acknowledged and accepted by the research community.

Main drivers

One respondent stated that monitoring activities were a driver as they enabled uncovering the status quo and also informing each other on what is being done. It also encouraged a reflection on what is desired and what not in terms of monitoring activities.

The LeNa project includes a number of recommendations related to responsiveness and inclusion as well as (ethical) reflexivity that – if set into practice – would go far beyond the current practice in the German research system. The project consciously named the sustainability framework a “guideline”, in order to carefully start debate on its implementation. A driver here is that people do not see the guidelines as top down activity, forced upon researchers or organizations. This can facilitate the implementation process with wide inclusion of actors.

\textsuperscript{14} http://www.lena-projekt.de/startseite/
A driver is also the implicit understanding that the organisation does not plan to set too high standards. Implementation in such large organisations is complex and requires culture change. As such, the higher the standards, the lower the implementation potential.

Good practices

The LeNa project as described above can be regarded as a good practice since it was a process that included the largest German research organisations, which came up with sustainability aspects directly suited to their reality.

Some respondents also described the Zukunftscampus in the research centre Jülich. The idea here is to create a sustainable campus with research in the fields of energy and the environment, but also including communication activities with the aim of providing options for society for action in sustainable development.

6.3. Reflection on Review findings, Outlooks developed and ways forward

6.3.1 The integrated or fragmented nature of different responsibility related dimensions

The RRI dimensions play a role in the activities of HGF, yet to different degrees. Openness and transparency are probably the most known and concrete activities that play a role here (e.g. good scientific practice). Also, OA and OS guidelines are important for an open and transparent organisation. Yet, the idea of autonomy and independence of the research remains an important aspect in the debate and it is sometimes difficult to combine it with Openness and Transparency (e.g. difficulty of inclusion of different stakeholders in agenda setting).

Responsiveness and adaptation are important regarding the socio-political aspects of HGF programmes. Demands and expectations from the political side reflect national priorities and therefore find their way into the activities of HGF. Nevertheless, a direct “translation” of societal needs into the political sphere could result in considerable “dilution” in some research areas. This is an aspect that has not been discussed comprehensively in HGF.

6.3.2 Common barriers or drivers

The structure and size of HGF was mentioned by respondents as offering more possibilities regarding the inclusion of the dimensions. Since HGF is the sum of very diverse centres there are different routes for the emergence of new topics and mutual learning. In this way, HGF is understood as more than the sum of its centres, as it has the possibility to re-structure research platforms into new constellations of people and research.

The structure of HGF also means that movements towards the inclusion of the dimensions have to come bottom up. This was stressed by all interviewees who described that top down measures cannot work in the HGF system of independent centres. The researchers themselves have to have an awareness of the dimensions in order to promote them internally. On the other hand, the HGF president was described as being able to push issues and make them part of the HGF agenda.

The issue of indicators was seen as very complex in relation to the dimensions. Since dimensions are steered from within the organisation and require organisational culture change, it remains unclear how indicators can be developed and used in a meaningful way. In this context, the respondents stressed that the dimensions should be something which comes from within and not connected to performance goals. The qualitative level remains important here. If indicators are used, there has to be a constant dialogue on what they mean and combined with qualitative reporting.
The RRI keys were seen as useful because respondents knew the terms and what activities are done in each specific key. For a large organisation like HGF, dealing mainly with natural science research, the dimensions often remain too abstract to be relevant in the daily work.

An idea by one of the respondents was to create a “check-box” approach as an implementation instrument for aspects of RRI. This was described as a useful tool because it has a low threshold to start with and can be later further adapted. For the dimensions, this tool can start a process, including trial and error (responsive in itself). In order to have a low threshold, one should introduce the dimensions one at a time. This would enable a way to inform people in the organisation about the dimensions and what they could mean for their daily work.

The gender key is the best established one regarding concrete activities and key figures. This comes from clear political demands for organisations such as HGF to take this up. Legitimacy comes from the political pressures and expectations.

Dimensions such as anticipation and reflexivity appear in form of the TIS program and are therefore a legitimised form of research. Yet, as the smallest and most isolated programme of all, its relevance remains somewhat limited.

8. Summary and Discussion of findings on each responsibility dimension

8.1 The concept of responsibility

Throughout this study, in the national context as well as in the organisations we studied, the notion of responsibility is of high importance. There seems to be a widespread awareness and agreement among the individuals and throughout the organisations that responsibility is a key aspect of science, research and innovation. This is understood as being responsible for doing research as well as in a trustworthy way. Implied in this is also the need of research and science (organisations and individual researchers) to communicate and interact with society. In Germany, the demands for activities to include the wider public have increased over the years and many initiatives in this area have taken place, yet standardised and comprehensive methods or processes as well as impact assessment are still missing. This rise in engagement, communication and interaction can be interpreted as an indicator for an increased sensitivity towards responsibility issues.

Overall, public funding of S&T in Germany is closely connected to societal challenges which should be solved through innovation and strives in S&T. In this way, research should not be without boundaries. At the same time in Germany, the autonomy of science and research is an important factor, even guaranteed in the Constitution. Responsibility in our findings, is also connected to how research itself should be conducted to ensure standards and progress. In this way, research organisations such as HGF and KIT in Germany have to ‘balance’ their actions in the context of responsibility: on the one hand they should take up societal challenges, on the other they should remain autonomous to a certain degree. The close connection of the organisations HGF and KIT to the political sphere (Ministry) make this balance especially relevant.

Perhaps most important for the understanding of responsibility in Germany is the notion of sustainability, as we have repeatedly seen above. It has influenced the German socio-political landscape over the past decades and is often contextualized as being responsible towards future generations. Prominent examples in this context are the energy transition or the ongoing search for a nuclear waste disposal site. We see that often, responsibility is ‘manifested’ as sustainability, which establishes a normative framework as well as concrete measures, tools and standards. An example
here is the LENA project in which HGF, next to other large research associations, developed detailed guidelines for sustainability within their organisational context.

8.2 The notion of ‘RRI’

As described above, the notion of sustainability is highly relevant for responsibility understandings in the German context. Thus, other concepts like RRI are practically unknown and not necessarily needed. Because well-established concepts like sustainability have developed over decades (including awareness among key actors, measures, tools which are specifically adapted to various contexts and uses) and issues of Gender or Open Access are well addressed and regulated, RRI does not seem to be needed, according to our findings. The term is known to some from EU projects, supporting the critique that it mainly remains a distant EU policy concept. Therefore, we conclude that the added value of the term RRI for the German S&T research setting is very limited.

Useful for explaining the concept of RRI were the keys, as these are fairly well-known and established in Germany. In some keys, such as Gender or Open Access, HGF and KIT were very pro-active and awareness of their importance was high. Others, such as Engagement or Science Education remain rather dispersed, often depending on individuals who take the initiative. Overall, during our national workshop, interviews and focus group the keys were discussed mostly independently and their connection as a holistic concept of RRI was not regarded.

We could find notions of transparency, integrity, inclusion or equal opportunities in the documents of HGF and KIT as well as in the interviews and discussions. These of course can be connected to RRI, yet in a more general way. Still, one can conclude that RRI is currently being implemented in Germany, yet without this explicit label. This shows in more regulated keys such as Gender, where laws and guidelines prevail and also in keys such as engagement, which aren’t strictly controlled, but make up many current debates in S&T funding (e.g. Citizen Science).

The future of RRI in the Germany thus remains unclear. As part of EU projects, RRI will continue to be relevant and influence activities in the national context. Yet, since the keys, as well as concepts like sustainability are individually (more or less) established, it seems unclear if or how RRI will play a comprehensive and embedded role in research organisations, both on the funding and on the conducting level.

If keys or aspects of RRI would be incorporated into evaluation processes and RRI criteria or indicators would play a role, then a more meaningful implementation of RRI would be possible. In our study, we saw some interest in this, yet it seems the well-established and fine-tuned funding and evaluation processes are generally agreed on and not necessarily open for this.

8.3 Ethics

In Germany, we find established ethics in the form of advisory and controlling bodies and since the 1997 the BMBF has supported ELSA research especially within health research. This also shows in the fact that ethics is perhaps most established in the areas of medicine and life sciences. In the context of RRI, going beyond ethics as a mere check-box exercise is important. Here, there is still potential to improve activities in Germany, particularly in integrating this key into practice as a continuous aspect throughout research activities. Another aspect of ethics comes from the research field itself, in the form of research integrity. In Germany in past years, several prominent cases of plagiarism have come up, resulting in an increasing awareness among researchers and funders as well as the public. As a result, recommendations for good scientific practice as well as ethics committees were established as instruments for ensuring quality control.
Within HGF one can localise ethics in the research programme TIS, which is concerned with the social and ethical aspects of S&T and aims at supporting decisions in the political sphere as well as wider society. This also presents a barrier of ethics we think is relevant here. In this programme, ethics is “out-sourced” into a separate activity with limited budget. A cross-cutting ethical reflection within HGF would imply a strong increase in budget and resources.

As part of HGF, the situation at KIT is similar. Ethics is mainly represented in compliance and research integrity; further ethical research is conducted within the TIS programme via ITAS. A barrier here is also the current scientific system in which these activities are not necessarily rewarded. A main driver in the key, is the existence of an institute like ITAS which explicitly takes up research and advice in this area. Furthermore, guidelines for research integrity also ensure awareness and compliance. Overall, we find that widespread ethics trainings could be a point of improvement.

8.4 Societal engagement

In Germany, we find a long standing debate on the inclusion of the wider public in S&T developments. A rising critical public, uncertainties on technological developments as well as the governing structures surrounding them and sustainability as an increasingly important notion, led to engagement becoming part of the political, scientific and public agenda.

This was also eventually taken up by the BMBF, which has initiated engagement processes and Citizen Science activities. Yet, we conclude that the inclusion of the public or important stakeholders in the agenda setting of research is often lacking, even if the research priorities are often framed according to societal challenges. For instance, HGF negotiates its strategic programmes directly with the Ministry. The argument in support of this process is that these are elected representatives and as such represent a kind of inclusion or engagement of society. This points to a prevailing issue regarding engagement in Germany, as in many other countries: How to initiate and structure meaningful inclusion in a representative democracy. In this question, RRI does not offer any substantial improvement beyond the demand for increasing engagement of all relevant stakeholders.

This overall situation also reflects in our focus organisations. In HGF we find a certain tension in the sense of political and societal expectations for inclusion and engagement as well as established processes of agenda setting. Knowledge transfer for instance, can also be regarded in the context of engagement, yet it remains somewhat limited to communicating activities or transferring knowledge from research into society. In KIT, we find that a reflection and an overall strategy in this key is missing, also resulting in a lack of a common understanding of this issue. This results in the general barrier of lack of a location where engagement can actually take place in the organisational structure. This remains unclear and results in individual initiatives in the field but no general meaningful strategy.

A possible good practice is to be found in the Urban Transition Lab created by ITAS as it offers an extended understanding of engagement, as described above. This initiative brings together citizens and researchers in a productive way and through this foster transformative research (especially in the area of sustainability).

8.5 Gender equality and diversity strategies

Gender is a well-established concept in Germany and correspondingly in its science policy system. In the 1980s legal obligations for universities were adopted, resulting in an overall top-down approach in this key. Diversity on the other hand is still fairly underrepresented in Germany, which is currently changing due to (controversial) debates in various areas of the German public. First indicators for a
rise in diversity issues shows in the general act for equal treatment, signed by the BMBF and aimed at stopping discrimination.

Even though the issue of Gender is well-represented, the targets for, for instance, female professorships remain below European average. This is presumably because such a top-down approach only results in formal adoptions but does not necessarily change everyday practices and cultural norms (i.e. unconscious bias). This is also of course relevant for Diversity.

In HGF and KIT Gender strategies are in place and well-implemented. Clear political goals are formulated and translated into cross-cutting programmes such as talent management. Still, we see that barriers exist, mainly in the everyday practices as, for instance, there are too few female researchers in technical disciplines. Drivers are the legal requirements, clear targets and financial incentives set by national regulations. A good practice can be found in the cascade model which represents a central benchmark and is widespread in S&T institutions. Regarding diversity, Germany overall and our organisations are lagging behind, which the representatives we interacted with were clearly aware of. HGF was described as a mainly “German” organisation, which should be actively changed in the future also in order to remain competitive. Strategies were mentioned similar to Gender ones, which are not yet in place.

8.6 Open access and open science strategies

Open Access is a top issue in the German research setting. The Berlin Declaration on OA shows the pro-active role of large research organisations such as HGF in positioning themselves in this area. Higher journal subscription prices have made the issue of OA an “ethics” one in the sense that we heard from respondents that science and its outcomes, which is funded by the public, should also be open to it. This gives an intrinsic value to OA, which makes it almost mandatory to have an OA strategy in an organisation such as HGF. Publicly funded research organisations are therefore themselves drivers for increasing OA.

In the German discussions approaches like Open Science or Open Data are also becoming more relevant and present a widening of the key. Using open information as a resource and driver for better innovation capacities has become a common political narrative and has led to the support of such initiatives. In this sense, OA and the surrounding activities can be seen as top down as well as bottom up. Still, we observe a certain gap between these agendas and those actually researching and publishing, which also has to do with the dominant quantitative evaluation criteria, which still do not incorporate OA publications adequately.

Within our organisations we can see an active approach to OA. HGF was one of the first supporters of the Berlin Declaration and KIT’s library serves as a contact point for OA within the organisations (with its own publishing house). Guidelines, an overarching OA policy of HGF as well as an Open Science office, serve as drivers. Furthermore, we witness a cultural driver which comes from the inherent ideal of making research open to everyone. Clear barriers are the publishing traditions in some disciplines as well as the still fairly small number of well-ranked OA journals for publishing.

8.7 The inclusion of science education into research

Science Education is not as prominent as other keys in Germany, yet plays an important role regarding technical literacy and the often-stated shortage of skilled workers and its repercussions for Germany’s economy and prosperity. The link between Germany’s importance as a place for innovation with a strong competitive position and scientific and technical education is often made in policy debates and
strategies. Also, relevant for this key is the political structure of federalism in Germany which makes education a administrative matter in the individual states. This creates a fragmented field with various frameworks and types. Overarching initiatives such as the 2009 recommendations for strengthening STEM education do exist and have led to specific measures for improvement across the states.

For HGF SE is not a main priority, as its main goals lie in research itself. Therefore, we regard two main addressees of SE within HGF: the wider public and (potential) researchers and employees. Communication and knowledge transfer as well as talent management are all important in this regard and show overlap with other RRI keys presented above. Drivers for SE come from the political agenda represented in the PFI which demand the support of science communication, knowledge transfer and researchers and employees themselves. Good practices we find interesting are the school labs which support interactive SE as well as other dialogue events.

8.8 Incorporation of AIRR dimensions

As regards the incorporation of RRI dimensions (anticipation and reflexivity, openness and transparency, responsiveness and adaptation) the German case reveals a picture of rather well-developed practices and activities in each dimension. From the policy making level (Research Ministry) down to the level of the Research Funding Organisation (HGF) and finally to the Research Conducting Organisation (KIT) the challenges of being reflexive with regard to their own societal role, with regard to applying anticipatory thinking as well as with regard to being open, inclusive and responsive to social demands, are taken account of in mission papers and programmes. This also leads to a significant amount of activities such as codes of ethics, TA programmes, public engagement programmes and projects as well as related advisory bodies (science ethics committees) or specialised research bodies from the national down to the research organisation level. As regards to anticipation, the German network of TA can count for one of the most well developed and well organised in Europe. HGF (with the TIS programme) and KIT (with ITAS) have established “anticipation” institutionally within their organisation.

However, self-reflection and anticipation beyond aspects of strategic development of organisations in terms of improving research excellence or being up to date as regards research issues, is not an integrated part of mainstream activities and R&D management or research practice. Openness towards society as well as responsiveness to societal demands, is to a certain extend provided for by democratic processes of top down decision making. These, for instance, provide that changing preferences or concrete concerns of the public in the long-term, lead to changes of research priorities (clearly so in the case of the so called “Energiewende”). There are however no routines or fixed structures for including societal actors into the day to day practice of R&D policy making, R&D management as well as research projects. This does not exclude that, on an ad hoc basis or in certain especially critical areas (for reasons of critical public awareness), public engagement or public consultation exercise as well as trans-disciplinary research activities are set up. One might indeed conclude that such activities have been increasingly made use of during the last three decades. But there is still a separation between the mainstream following traditional goals and applying well established criteria for self-evaluation on the one hand, and the more (sometimes significant) RRI related activities going on within the same organisation or institution on the other hand. The reasons for this are manifold: There is of course the cultural barrier given by still existing thinking in terms of “we” the scientists and “them” the lay people, and there is also the difficult of overcoming the barrier of “expert” centred ways of decision making in the policy making as well as in the R&D management (including experts from science, politics, and industry but not society). In the interviews, also those participants that were open towards initiatives of inclusion and anticipation, revealed concerns about “natural” barriers for public engagement - on the side of the publics capacities of understanding the
needs and priorities of R&D and on the side of R&D organisations that cannot (and should not) move too far away from its core societal mission of delivering high quality research and innovation. This attitude, coupled with an observable widespread awareness of the embeddedness of science in society, apparently leads to the initiation of respective RRI related activities, but with a certain distance to the “heart” of the R&D institutions.

If any, it is the concept of sustainable development, which for Germany is the umbrella under which discussions and activity related to RRI dimension often take place, that seems to establish approaches that provide for constant reflection of research goals and activities in the light of societal expectations and needs as well as possible unintended future effects and outcomes. In general, those research fields that are clearly driven by socially defined problems (energy) obviously allow for more (and natural) inclusion of RRI dimensions and related practices, than supply driven and/or scientifically defined fields of R&D.

8.9 The integrated or fragmented nature of different responsibility related dimensions

RRI as an integrated concept is known but not widely applied as a concept. Nevertheless, most if not all, of its aspects have been subject to activities and have found institutional support and enactment from the level of national science policy making to the level of research organisations. TA and Sustainability are concepts with high relevance in the German debate that widely cover and integrate anticipation, reflexivity, ethics as well as responsiveness and inclusion of social actors, since these are regarded to be aspects of a deliberative public discourse on future societal development and the role of R&D in it. Issues of risks, possible future effects of advanced technologies, not to speak of ethical questions in e.g. the field of biomedical research, can only be dealt with in a meaningful way when taking into account the scope of societal values and interests involved. Transparency and accountability of R&D institutions towards society are also naturally bound to these aspects. Open access and science education however are only loosely coupled to this discourse. Open access is dealt with as an inner scientific task and process (although aspects of societal access to research are addressed). Science education has some overlap with public engagement, however, it is often coupled with Public Understanding of Science approaches (“deficit model”) that are regarded as being undercomplex with regard to “science in society” problems. Science education thus is mostly not regarded to be a task taken care of by institutions dealing with Sustainability research or TA-like research. Problems of gender inequality are dealt with in widely established programmes in the R&D sectors. The gender question is however regarded to be an overarching societal issue not specific to R&D, and thus usually addressed separately from other aspects of RRI.

Although aspects of RRI are often dealt with in a fragmented way (with some exceptions referred to above) we could not observe any strategies of avoiding an integrated practice of RRI by taken one aspect for the whole of “responsible research”. Fragmented practice appears to be more an effect of research and discourse traditions and separated communities.

9. Conclusions

9.1 Policy recommendations to national policy makers

Considering the fact that the concept of Sustainability is closely related to the perception of RRI in the country, one should include it in the recommendations to national policy makers. One approach in this respect could be to replace the concept of RRI with that of responsibility while keeping the main Dimensions as they stand. Another approach could be to promote both concepts in a parallel manner
by attaching the Dimensions to Sustainability and only the Keys to RRI. The latter would be preferable since Sustainability is already established in the national S&T policy debate. As such, the relevant recommendation to national policy makers are:

- Develop a strategy on sustainability that incorporates the notions of Reflexivity, Transparency and Anticipation. This should be a new procedural approach to sustainability that maximises internal (expert) and external (public) interaction with a view to creating consensual aims and adopting socially acceptable technologies.
- Introduce the concept of responsibility in relation to the programmes representing the RRI Keys. This requires the creation of societal dialogues as to the content and direction of research in each Key.
- Support the development of debates on responsible innovation. This requires the inclusion of private sector R&D players in societal debates with the view of devising innovation processes that are as inclusive and transparent as possible.
- Enhance international collaborations in the above areas. This refers to funding bilateral or multilateral projects that aim at developing a common understanding of sustainability, responsibility, integrity, etc. with the view of further methodological integration.

9.2 Policy recommendations to European policy makers

The current approach to RRI (i.e. Keys based) is developed by the European Commission and being actively promoted within its funding schemes but as we have seen, this is only one approach and it is not widely adopted in Europe outside the Commission-funded projects. In order to allow for a better European integration in the field, one needs to expand the scope of RRI at the European level. The relevant recommendations are:

- Include alternative interpretations of RRI in the funding schemes. So long as the core aspect of it is to enhance responsibility, the Dimensions are as valid as the Keys in describing RRI.
- Associate RRI to similar concepts, such as Sustainability, in the research programmes. This will allow for a better integration of the concept in environment-related research areas.
- Gather and promote results of European projects on RRI. This will involve an assessment of the funding dedicated to RRI so far and will provide an account of existing achievements.
- Assess national programmes on science and society that are independent of the European ones. There is significant experience in national contexts that is evident in national programmes that can eventually be scaled up to multinational/European approaches.

9.3 Recommendations to research conducting and funding organisations

Organisations have a certain autonomy in developing methodologies and programmes that suit their specific aspirations, therefore, there can be no top-down approach to the implementation of RRI in this case. As we have seen in our analyses, both our focus organisations follow the regulations and guidelines developed by policy makers but otherwise have little interaction with them when it comes to devising their approach to responsibility. At the same time, the concept of RRI is neither known nor considered necessary in the development of the relevant aims. As such, we believe that the best way forward is the implementation of the ideas contained in RRI and not the specific approach based on Keys. Our recommendations are:

- Promote a culture of free and transparent exchange amongst staff. This entails the creation of regular meetings focusing on various aspects of responsibility and how this can be understood in each research area.
- Raise awareness on existing codes of conduct and promote further ones related to the research priorities of the organisation. Where code of conducts already exist, organisations can include them in the regular staff training sessions. New codes of conduct can be developed in areas of common interest (e.g. processes of societal engagement within the organisation).
- Develop staff reward structures based on the implementation of responsibility in their work. Whether relating to communication with the public, publishing in open access outlets, or taking into consideration socio-ethical consequences in research, a system of rewards (such as promotion points, prizes, etc.) should be devised in order to provide additional motivation for the incorporation of responsibility in the organisation.
- Create inter-organisational fact-finding missions to learn from the experiences of other organisations. Similar organisations have similar needs but not necessary similar approaches to fulfilling them. Learning from each other’s experience is vital to avoid making the same mistakes. This is particularly important for organisations from different countries with the same aims and functions (e.g. HGF, NSFC, CEA). Exchanges in these cases are rare but can be very fruitful and should be promoted.

9.4 Good practices scalable to European or national level

An outstanding practice within the KIT, which can be transferred to the European level, is the concept of the Living Lab. Under the title "District Future - Urban Lab", such a laboratory was set up in 2011 in a district in Karlsruhe, Germany. The origin for this was an initiative at ITAS. In the years that followed, the concept was constantly developed and expanded, most recently as the "Transformation Center for Sustainable Futures and Cultural Change" with funding from the federal state and KIT. Over the years, the concept has proved very successful and has received numerous awards.

The Urban Lab is a meeting space that serves as an exchange platform for different actors and especially for the community. It is a "common experimental space for technical and social innovation and mutual learning." Accordingly, it is explicitly transdisciplinary in nature and is based on a cooperation between KIT, the City of Karlsruhe, citizens, private sector and cultural workers. It refers to the concepts "Science in Society" and "Society in Science" of the EC. This exchange also serves the purpose of linking the areas of science and technology development back to the needs and concerns of the citizens and shaping them in dialogue. This should enable a co-evolution of technology and society.

The long-term goal of the Urban Lab is to "realize a sustainable district in Karlsruhe" with the active participation of KIT. This will link KIT with the region and the citizenry. This makes it possible to “test, explore and establish new forms of regional policy and social consultation as well as participation in science production and (urban) design”. The "participation in knowledge production" takes place in two ways. First, participatory processes generate transdisciplinary knowledge that can be incorporated into the research process. Secondly, the real laboratory itself offers an object for (accompanying) research.

In terms of content, the Urban Lab in Karlsruhe places a strong focus on sustainability. This is consistent with the specific context (6.2.8), but is closely related to RRI. It is particularly pronounced through the objective of redesigning the relationship with the public. On the one hand, it contributes to science education by making the transfer from the research organisation to citizens easier and more direct. At the same time, it is an element of public engagement as the knowledge generated is channelled back into the organization. In this way, the future district already referred to "Responsible Science" and

http://www.quartierzukunft.de/en/
"Responsible Innovation" in its concept. In principle, this opens up a perspective that contributes to openness and transparency.

The idea of a transfer in European level is already integrated into the concept:

“District Future – a European sustainability model to copy. We can assume that almost two thirds of the world population will be living in cities in 2050. Therefore it makes sense to try and test sustainability right there, in the urban space. Karlsruhe’s Oststadt, a typical European district which has developed over time, can be used as a model for other urban living environments in Europe. The diversity and complexity of communal life in the district is the real ace up the sleeve here: Regarding urban and spatial development, there are quite different structures; people with different backgrounds and life plans come together and form a society. Karlsruhe’s Oststadt becomes a dense microcosm which provides a platform to work on complex interrelations and big questions on the small scale.”

An important element that is conducive to transfer into different European contexts is the fundamentally participatory approach. The concrete design takes place "taking into account the needs and ideas of the citizens and residents and their decisive participation." The structure is context-sensitive and allows a design depending on the regional characteristics. There is also the possibility to deviate from the focus on sustainability and to take a different, more contextual, perspective. In addition, the history of the “District Future” shows that it is scalable in size. Starting with a small, self-initiative project, it has received internal organizational and political support and is increasingly being developed. In summary, a Urban Lab has the potential to contribute to a better relationship between local citizenship and the research organization under different contexts. In doing so, it also contributes to research and innovation more closely linked to society and thus more responsible.
10. References


Websites:


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## 11. Annex: Reviewed documents

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