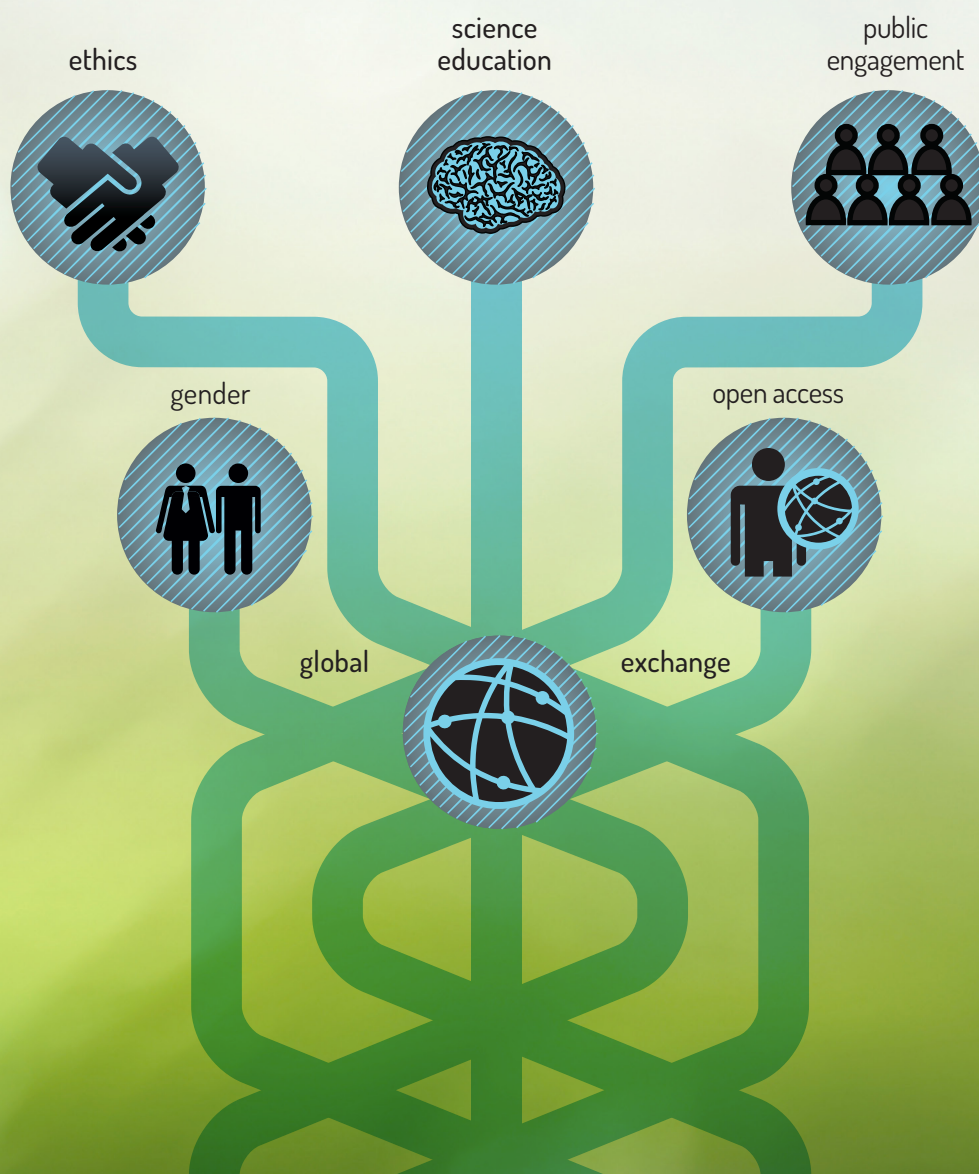


CASE STUDY PART 1: RRI GOALS AND PRACTICES

DELIVERABLE D9.1





JERRI – Joining Efforts for Responsible Research and Innovation

Deliverable D9.1

Global RRI Goals and Practices

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PURPOSE

Within the JERRI project, two large European Research Organizations, Fraunhofer (FhG) Germany and TNO Netherlands, have the ambition to further develop their organisational structures and practices towards – what in Europe is called - "Responsible Research and Innovation (RRI)". In this context, the work package called "International mutual learning process" (WP 9) carries out in-depth case studies of two outstanding organizations outside Europe, the Chinese Academy of Sciences (CAS) and Arizona State University (ASU). Two international mutual learning workshops and three reports shall help to share insights from the international cases, to offer interpretations for implications in the European context, to support international mutual learning between the participants of this exercise and to facilitate institutional change at Fraunhofer and TNO.

This is the first report of this work and it summarises the first round of the case studies which focussed on goals and practices related to RRI at CAS and ASU with the intention of learning from their experiences as inputs for shaping the RRI goals, as well as RRI action plans of FhG and TNO. This report also includes a series of good practice examples and reflections on the benefits of the first workshop.

In essence, D 9.1 "Global RRI Goals and Practices" makes a strong case for the different meanings and facets of RRI around the globe. The term RRI is not in use internationally, so reflecting on the essence of RRI needs to be the basis of each exchange. What is shared around the globe and what kind of themes (dimensions/ fields of action) are associated with responsibility in science and innovation? In the outstanding institutional ethos of CAS and ASU the need to better link research to society is an important driver of activities. The "institutionalization" of RRI, which means that RRI becomes an integral part of the practices of an organization, requires in most cases institutional change, which is why leadership, the culture of an organization or incentives and rules need to be in the focus. To develop new RRI processes or tools along the five action fields in the focus of H2020-RRI will not be sufficient to make RRI come to life in an organization.

EXECUTIVE SUMMARY

Intention and structure of this report

Organizations, whose aim is to work based on the ideas coined by the term Responsible Research and Innovation (RRI), can be regarded as travellers finding their own routes towards RRI. RRI provides a set of concepts, virtues, tools and practices designed to closer align both the orientation and the effects of research and innovation (R&I) processes with societal needs and values. Given such a broad working definition, organizations need to find their own RRI practice and culture. For that RRI journey, two central questions have to be answered by each organization individually: Where do we want to go? (Or: What do we want to achieve?) and second: How do we get there?

Within the JERRI project, two large European Research Organizations, Fraunhofer (FhG) Germany and TNO Netherlands, have the ambition to further develop their organisational structures and practices towards RRI. In this context, the work package called "International mutual learning process" (WP 9) aims to inspire their processes of goal setting and institutionalising RRI by studying two outstanding organizations outside Europe, the Chinese Academy of Sciences (CAS) and Arizona State University (ASU). As institutionalising RRI means that RRI becomes an integral part of the practices of an organization, we aim at understanding with the aid of these two case studies how ASU and CAS have established their organizational culture, how they are managing institutional change and in how many different ways they are engaging with society.

Our report is structured as follows: The first chapter provides information about the whole planned international mutual learning process, its objectives and our experiences with it so far. Chapter 2 presents the findings from the first round of case study research at CAS and ASU. It summarises their main characteristics and functions within their research and innovation systems and provides relevant context information in order to understand organizational structures and cultures as well as processes of change. The chapter also presents individual and organizational attitudes towards responsibility in science, and the appraisal of the RRI concept and RRI-related practices from a European perspective. It offers insights into factors, which drive or hamper institutional change and in particular the institutionalization of RRI. Chapter 3 concludes and draws conclusions on potential implications of this work for JERRI and beyond.

Methodology

Two case studies based on document analysis and two rounds of in-depth interviews shall provide the basis for understanding CAS and ASU and drawing relevant conclusions for Fraunhofer and TNO. Project partners from Fraunhofer and Manchester University had previous contacts to ASU and CAS who had committed themselves to act as main contact persons for this study and to provide access to documents as well as interview partners. This proved to be very helpful. Interview partners were chosen to provide a large variety of information from different parts of the organizations, academic as well as administrative. Interviews took place during on-site visits in Beijing and Phoenix as well as by phone. Practical experience in the first round showed the identification of interview partners is only possible using a snowball principle and ask first contacts to provide information about other potential contacts. It is particularly difficult to identify interview partners who do not (yet) practice RRI and who are interested to reflect about potential barriers (and levers) for RRI in their working environment. As it is easier to observe what is there as compared to what is not (yet) there, we are aware of the fact that our samples of interview partners have a bias towards the faculty and staff who are engaged more actively in responsibility issues.

Two international mutual learning workshops serve as complementary elements in the methodological approach of this work package. They shall help to transfer results from the international cases to Fraunhofer and TNO and they shall offer spaces for international exchange and mutual learning. Our report from the first workshop shows that this concept has borne fruit and in particular helped to inspire participants and to take home new ideas for their work.

Results

The Chinese Academy of Sciences (CAS) is the highest research institution and the key player in China's S&T landscape. CAS has been involved actively in the science community globally and holds a significant position. Its international engagement and importance will increase further in the future.

Arizona State University (ASU) is with 70.000 students one of the largest universities in the U.S.. It has become a major site for academic research in the US and a top place for innovation. In 2002, ASU initiated a radical institutional redesign. On the basis of this blueprint ASU has committed itself to highly inclusive higher education and to research and outreach activities of public value.

This report has given insights on a global rri “cosmos”, where rri stands for de-facto responsible research and innovation as opposed to Responsible Research and Innovation (RRI) as it is coined by the European Commission in Horizon2020. ASU and CAS do operate based on rationales which increasingly respond to new understandings of responsibility, and for both organizations this means a new or adapted conceptualisation of their roles within society and their linkages to society. In their operations however, there is no reference to the five key fields of action as in the European approach. Dominant fields of action of this de-facto rri include for CAS science popularization, societal responsibility of scientists and open access. ASU operationalises its activities along eight design aspirations, which are “Leverage our place”, “Transform society”, “Value Entrepreneurship”, “Conduct use-inspired research”, “Enable student success”, “Fuse intellectual disciplines”, “Be socially embedded”, and “Engage globally” with a priority on accessibility to a diverse student body.

Both, CAS and ASU have developed new practices in response to changing rationales (see also Annex III for good practices), and both show evidence for “deep institutionalization” as the maturation process has also touched upon organizational design or incentive structures. Organizational change was smaller at CAS, where new units were added to the Institute for Policy and Management (IPM). At ASU, in contrast, this meant a rigorous re-organization of a large number of academic and research units into transdisciplinary schools and centers.

External requirements were for both institutions a driving force. A new legal framework required CAS to commit to science popularization, while the state of Arizona developed a new strategic approach to higher education, which meant for ASU to significantly increase the number of enrollments. At the same time, both institutions have committed pro-actively to other developments such as open access (CAS) or sustainability (ASU).

Change processes need institutional entrepreneurship. We find this in both international examples in the leadership of the organizations, which has a central role in engaging the organization for change, in particular through a consistent communication of the narrative that provides legitimacy for change. However, in China catch-up processes in science performance are a central motive for policy makers, and top-level policy makers at the ministries prioritize this over science-society-relations.

As both organizations are large and complex, institutional entrepreneurship is also needed decentrally at lower levels of hierarchy in the organization. There are manifold examples of “ambidextrous PIs” at ASU, who are able to deal with a large set of different

performance criteria. Also, at CAS, senior level academicians are acting as multipliers of new understandings of responsibility. However, it has also become clear that there are a number of units in both organizations, where thinking and operations hardly have been touched by de-facto rri developments. This is in particular the case for units which perform mainly theoretical (basic) research. We will try to advance our knowledge about these units at CAS and ASU in the second phase of the case study.

We find in both organizations boundary spanners, who connect units within the organization and outside the organization with different cognitive frameworks. In CAS, this is the Institute for Policy and Management (IPM), however outside IPM, many researchers seem to be concerned about science popularization and civil participation. At ASU boundary spanning is fulfilled by several central service units and has at the same time proliferated to the PI level – at least in the interdisciplinary schools and research centers.

Individual level capabilities are certainly as important as organizational capabilities. We find at ASU and CAS a high differentiation of individual orientations and responsibility conceptualisations. This is certainly a logical consequence of the fact that in particular principal investigators are confronted with a diverse set of performance requirements in particular at times, when existing rationales of an organization co-exist with new understandings which rather add to the organizational self-conceptualisation than replace it. Nevertheless, the new rri-type narratives are shared by many in the organizations. However, we also find that still after several years of evolution, shared understanding remains often at the surface. Central terms are rather serving as umbrellas for a diverse set of activities. ASU has acknowledged this as a weakness in the context of its sustainability efforts. In the second phase of our case studies, we will further investigate whether there are remarkable exceptions to this finding and how in these cases mutual understanding has been established.

DELIVERABLE REPORT

1 Introduction: International mutual learning – why and how?

1.1 Objectives of the international mutual learning process

JERRI's international mutual learning process aims to analyse RRI-related practice in two international organizations, the Chinese Academy of Sciences (CAS) and the Arizona State University (ASU), in order to learn from their experiences as inputs for shaping the RRI goals, as well as RRI action plans of the Fraunhofer Gesellschaft (FhG) and TNO.

The analyses have the following focuses:

- 1) Learning from different meanings and facets of RRI
- 2) Measures to institutionalise RRI
- 3) The reasons to/not to implement RRI, as well as obstacles and response/reaction in implementing RRI within the organization
- 4) Identifying international "good practice" examples

Moreover, an exchange of expertise and experiences with the international partners in the whole project process can facilitate the realisation of mutual learning effects. By these means, the results of the JERRI-project can also be evaluated and disseminated internationally.

Responsible Research and Innovation (RRI) is a widely known term – as a political idea and an established funding paradigm in Horizon2020 it has gained some prominence. However, at the level of actors, in particular at the level of organizations performing research and innovation, the term has rarely been taken up, despite the fact that many organizations have started a large number of activities of RRI relevance in addition to many in place already. Outside Europe, the term is almost non-existent, although again one can find a large array of activities that fit the label (de-facto rri, Randles et al 2013, 2014, 2016). So, the search for rri in an international context has to start very broadly, examining documents, institutional units, processes, projects and activities which might be of relevance. Naturally, in absence of a common label, what we find, addresses different facets of rri and might be driven by factors different from those that drive RRI in Europe. So, in this report we have to open up our understanding of RRI and go beyond

the conceptual elements of RRI discussed in Europe – based on the following working definition: RRI means to align research and innovation better with societal needs and values. De-facto rri approaches and practices are designed to increase mutual benefits of research and innovation – and society, both by underpinning better R&I processes and better R&I outcomes.

Focussing in our search on two individual organizations, we find a kind of caleidoscope of activities for each of them, depending on whether we look at each element from the organization's perspective or from a European RRI perspective. In this report, we try to do both: to sketch each of our cases, i.e. the organization as such, its vision, aims and strategies, as well as to analyse the organization through the European "lens" of RRI.

Understanding the organizations as such will allow us to identify key areas of responsible action and the narratives around them, and moreover the important factors that drive or hinder the institutionalisation of organizational innovation. When looking at the organizations from the RRI point of view we can assess the appraisal of the RRI concept and how practices with RRI relevance come into place or develop into successful instruments of the organization. In this report, we will share first insights into the institutionalization of RRI-related practices at CAS and ASU. The second phase of the case studies will further deepen this analysis and identify levers and barriers of institutionalization.

Our analysis of the organizations in this volume is complemented by a collection of good practices, which might inspire the RRI journeys at FhG and TNO. We have collected these good practices in the Annex, where we provide fact sheets for each practice and sources where to find more information about them.

Another source of evidence which we present in this report is the reflection of the first workshop held in December 2016. It brought together representatives from CAS and ASU with those from FhG and TNO. The workshop's objective was to transfer knowledge generated from the case studies and to start communicating about different ways of looking at RRI and share good practices. The overall objective of this workshop was to inspire participants and enable them to take home helpful ideas for further RRI development in their own organizations – in particular Fraunhofer and TNO, whose next steps in JERRI will be to develop ideas and input for RRI-related visions and goals.

During the second phase of the international mutual learning process, when the institutionalization of RRI is in the focus of the research, a second workshop will take

place at the end of this phase. There, experiences from the pilot cases at Fraunhofer and TNO will be made available to the international partners and discussed from their external perspective. The next steps for a long-lasting mutual international exchange beyond the project will be envisaged.

1.2 Methodology

The above-mentioned objectives are to be achieved methodologically through in-depth case studies, i.e. desk research and interviews, as well as workshops. Steady and active interactions between the consortium and the international partners characterise the whole exchange process as well.

In total, two rounds of interviews and two workshops are planned for JERRI. This report synthesises the main findings from desk research, the first round of interviews and the first international mutual learning workshop.

1.2.1. Case selection

RRI is a European answer to questions present around the globe, so it is worthwhile to include an international dimension in RRI projects in order to broaden our view. From among the list of countries suggested in the call we have chosen the United States of America and China. This implies a study design, which looks at very different cases. What unites our chosen cases though is their outstanding role within their research systems. Like Fraunhofer and TNO, ASU and CAS are major players in their countries with excellent research output. All four organizations have missions broader than science, which ties them in various ways to society, such as innovation activities, teaching and further outreach activities. Moreover, in the past 10-15 years ASU and CAS have both witnessed striking developments in the normative debates that provide legitimacy for their mission. Key to these rather different narratives is an increasing importance of responsibility towards society. ASU and CAS have taken different approaches to react to these challenges and provide therefore rich experience to learn from for Fraunhofer and TNO.

The Chinese Academy of Sciences (CAS) was selected as one of the associate partners. The reasons were based mainly on the following considerations: first, CAS is the highest research institution and the key player in China's S&T landscape. CAS has been involved actively in the science community globally and holds a significant position. The international engagement and importance of CAS will increase further in the future.

Second, there is an existing long-standing cooperation between Fraunhofer ISI and the Institute of Policy and Management (IPM), CAS, which is an important bridge for approaching potential interview partners.

Arizona State University (ASU) is with 70.000 students one of the largest universities in the U.S.. It has become a major site for academic research in the US with research expenditures ranking 17th of 768 U.S. universities without medical schools according to data from the National Science Foundation (for 2015). According to a reputation-based ranking by U.S. News & World Report, ASU is a top place for innovation, ranking #1 followed by places like Stanford and MIT (2016). In 2002, ASU initiated a radical institutional redesign, following a conceptual model for state-owned universities which ASU president Crow and other proponents called the "New American University" (Crow & Dabars 2015a). On the basis of this blueprint ASU has committed itself to highly inclusive higher education and to research and outreach activities of public value. Against the backdrop of RRI, this makes it a highly relevant case to look at. Similar to the case of CAS, existing networks and personal relationships between JERRI partner Manchester Metropolitan University and ASU served as a bridge-builder.

1.2.2. Desk research of key RRI-related documents

In task 9.1, which began in the first project month, at least three kinds of documents related to the international partner organizations were gathered and studied:

- 1) Documents regarding RRI/rri, e. g. strategy / position / discussion papers, mission statements, speeches, etc.
- 2) Documents related to the five RRI key dimensions, which are not necessarily put in an RRI-context already, e. g. action plans, codes of conduct, platforms, portals, regulations, etc.
- 3) Information regarding RRI/rri-related events, e. g. workshops, forums, dialogues, seminars, etc.

The results of this task have provided the project team with a first understanding of RRI/rri practices at ASU and CAS. Some possible "good practice" examples were identified.

1.2.3. In-depth interviews during on-site visits

Taking the desk research (Task 9.1) and the conceptual foundations into the deep institutionalisation of RRI (Task 1.2, Randles 2017) as a starting point, Fraunhofer ISI carried

out and comparatively analysed interviews with selected representatives / members of ASU and CAS in the first interview round.

The goal of the first interview round was to generate in-depth insights on the RRI-related organizational goals and practices of the international partners. Besides, the interviews aimed at learning about the success factors for the institutionalization of RRI-related activities, possible obstacles and ways of coping with these barriers, too. It is planned that the main results are to inspire the development of RRI goals at Fraunhofer and TNO (WPs 2 and 3).

Interview guidelines of the first round

The conceptual work on deep institutionalization and the related interview guidelines for European organizations developed in work package 1 served as a blueprint for the interview guidelines used in the international comparison. Section 1 of the guidelines has a narrative nature, as questions start from the context and history of the interview partner. The guidelines comprise five sections:

- Section 1 "The interviewee and his/her organizational context": aims to acquire background information on the interviewee and her / his organizational context and to analyse her / his statements against this background.
- Section 2 "De-facto rri": aims to acquire information on the interviewees' individual understanding of 'responsible research' and 'responsible innovation', and what they are already doing to enact this understanding.
- Section 3 "RRI": aims to acquire information on the interviewees' understanding of the concept Responsible Research and Innovation (RRI) and of the differences / tensions with other understandings of 'responsibility' described in section 2.
- Section 4 "RRI practices": aims to acquire information on existing RRI practices specific to the respective RRI key dimension, as defined by the European Commission (Ethics, Gender, Open Access, Societal Engagement or Science Education) plus other important RRI practices as defined by the organization (e.g. with respect to sustainability, social inequality, etc.).
- Section 5 "Issues for the institutionalization of RRI": aims to identify the issues and challenges for RRI institutionalization within the organization related to the respective RRI dimension. It can be focused on specific aspects, depending on the RRI practices mentioned in the section "RRI practices".

Reflections on the approach

According to JERRI's description of work, interview partners may comprise the central administration of each international partner as well as experts for "good practice" and "no RRI practice" examples. In order to get a comprehensive picture regarding RRI/rrri for each organization, 20-25 interviews were planned for each partner and interview round.

Our main contact person of each associated partner helped to establish the connection to the international partner organizations, i.e. besides providing existing RRI-related documents; they also helped to find suitable interviewees. To enhance the quality of interview information, the initial interviews took place face-to-face and on-site at CAS and ASU. Interviews during the second round are planned to be carried out with the same persons by phone.

Practical experiences with this approach showed that due to some limitations certain adjustments had to be made.

In the case of CAS, email communication has proven not to be effective, especially for establishing the first contacts. As a rule, without a personal relationship, emails are not answered in China. Instead, ways of communication, which function are face-to-face communication, communication by landline phone, mobile phone or instant messaging applications like "wechat". The last two communication channels imply again the personal relationship, which is the key to the required private data. Besides, it is not the norm in China to arrange an appointment at a fixed time several weeks in advance. People act very spontaneously and flexibly to an invitation to an interview. Thanks to the personal relationship of our contact person at IPM, CAS, 7 interview appointments on site could be arranged before flying to Beijing. On-site, one week in September 2016, further 9 interviewees could be identified by means of snowball effects: these additional interviewees were introduced by the interviewees, who had already been found. However, it is remarkable that there is reluctance to recommend further interview partners. Interview partners only made exceptions in the case of close colleagues or friends. As a result, the snow ball effect has not been as strong as expected. The second set of interviews (9) were carried out in Germany between October and November 2016 by phone, skype or wechat.

Due to this limitation, the following spread of interviews across the organization was reached: Among these 16 interviewees (8 male and 8 female), 6 work at IPM, 3 at the

National Science Library (NSL), 2 at the Chinese Association of Science and Technology (CAST) and 5 with other CAS research institutes, mainly in basic research. IPM and NSL play a special role at the CAS. IPM serves as a think-tank for issues such as "ethics" and "science education" and NSL is in charge of "open access" for CAS. Considering the size of the CAS -104 research institutes in total-, these 5 interviews with CAS researchers demonstrated only some individual and exemplary opinions from the basic research area. In the second interview round, the project team will try to reach more researchers from the applied research area to adjust this bias.

During the on-site visit at ASU, we met 15 people for an interview. Also in this case, it turned out to be a complicated issue to win interview partners, in particular those interview partners who do not apply RRI-related thinking or practices in their daily work. To identify this potential group of interview partners some assistance from interview partners during the on-site visit was needed. We talked to two deans from larger schools, who reported about the diversity of faculty motivations. Moreover, one principal investigator (PI) from the engineering school, gave a personal account of his way of living up to the overall mission and a diverse set of incentive schemes. Besides, we talked to seven experts of RRI-type of approaches, who belong to the "Center for Nanotechnology in Society" (or the related School for the Future of Innovation in Society) – a center funded by the NSF within the National Nanotechnology Initiative for around 15 years which has served to bridge technological development with societal expectations and needs. The set of interviews is completed by five interview partners from the university administration: experts for university strategy, gender policies, social value and societal engagement, open access and ethics.

The snowball-method helped us in the ASU case to identify at least 20 more names who can be potential interview partners in round 2. We will try to broaden our interviewee-pool in phase 2 and talk in particular to those, who will help to gain more insights into ASU institutes and schools so far not covered. With so many potential interview partners, it is likely that more than half of the interviews in phase 2 will be done with interviewees who have not taken part in round 1. Thus, a face-to-face-interview situation is preferable to a telephone interview. Moreover, as a practical consideration, the time difference between central Europe and Arizona is 9 hours, which makes only very small slots for interview dates during working hours. Thus, in the case of ASU, it seems more adequate to plan a second on-site-visit for the second round of interviews.

ASU and CAS are both large complex organizations. Can we be sure that we observe RRI-relevant developments without bias? As it is easier to observe what is there as compared to what is not (yet) there, we are aware of the fact, that our samples of interview partners have a bias towards the more actively in responsibility issues engaged faculty and staff. This is important to bear in mind for the interpretation of our results.

Interviews were recorded and notes were taken. In line with the EU directive on data protection, the contents of the interviews were analysed, aggregated and documented in this report anonymously.

Visiting events relevant in the RRI-context during our stay at ASU and CAS turned out to have a rather illustrative and exemplary role. At ASU, for example an event of the Faculty Women Association took place, where ASU president Crow gave a small speech. One of the schools, the School for Human Evolution and Social Change, was in preparation of its 10th anniversary. It was one of the first interdisciplinary schools founded at ASU and today serves as one of the success examples of the transition process. The anniversary brochure "100 at 10" is a good example for the high dedication to social value and impact of research at ASU. An experience that allows more generalisation than these examples, although both relevant, was just being on campus and realising how present the ASU mission (the charter) is there thanks to extensive marketing, that places motto posters and principles of good conduct everywhere.

In brief, summarising the above said, this means for the **second round of interviews**:

- The set of interviews per case will again comprise 15-20 interviews. By the end of round 2, we will have reached at each organization at least 20 interviewees.
 - o In the case of ASU, it is expected that less than half of second round interviews will be follow-ups with first round participants, the majority will be new ones. In total we will have collected at the end of round 2 the perspectives of around 25 interview partners.
 - o Within CAS, in round 2 we intend to widen our set of interviewees by a few additional ones on top of around 10-12 follow-up interviews with round 1 participants, thus planning to arrive at a total number of interviewees of about 20 at the end of round 2.
 - o The purpose of follow-up interviews is in brief to discuss advances in RRI-type practices, potential new initiatives, update our knowledge on levers and barriers of institutionalising RRI. Interviews with additional interview partners shall help to cover institutes of CAS and schools at

ASU so far not covered and thus help to broaden and complement our knowledge base and to validate our results.

- In the description of work, second round interviews shall take place by phone. We plan to do CAS interviews that way, however, consider it to be necessary to organize a second on-site visit at ASU for two reasons: We will have many new interview partners, where speaking face-to-face makes a difference. Moreover, with a nine-hour time difference, timeslots for phone conferences within working hours are rare and make the whole interview process long-lasting and ineffective. Again, like in the first round the focus of the visit will be on interviews and less on visiting RRI-related events on campus.

1.2.4. Two international mutual learning workshops

The international workshops – designed for mutual learning about RRI in research organizations – bring together representatives of the international partner organizations with consortium members of Fraunhofer ISI and TNO. Workshops aim to share project results, but leave most of the time to discussion and the exchange of experiences.

The **1st international mutual learning workshop** of JERRI took place on 15 December 2016 in Munich, Germany. As a leader of WP9, Fraunhofer ISI carried out the workshop with 19 participants. Two representatives of the JERRI international partner institutions, the Chinese Academy of Sciences (CAS) and Arizona State University (ASU), as well as consortium members from Fraunhofer-Gesellschaft (FhG), Netherlands Organization for Applied Scientific Research (TNO) and Institute for Advanced Studies (IHS), took part.

Both, WP 9, and in particular its first work-shop, are expected to benefit JERRI partners in the following aspects:

- 1) to be inspired by the international partners.
- 2) to broaden their understanding of RRI in general.
- 3) to broaden their understanding of one or more particular RRI themes/fields of action.
- 4) to get more insight into what it means to make RRI an integral part of the practices of an organization.
- 5) to share the good practices identified in Europe (in WP 1) and at the first stage of case studies outside Europe (in WP 9) with each other.

The overall objective of this workshop was to enable all participants to take home helpful ideas for further RRI development at their own organizations – in particular Fraunhofer and TNO, whose next steps in JERRI were to develop ideas and input for RRI related visions and goals (WP 2 and 3).

On this one-day workshop, the participants exchanged as a warm-up their personal experiences with RRI-related topics. After that, the four institutions, FhG, TNO, CAS and ASU, introduced their organizations and the RRI-related understanding and practices. By means of a joint session, these various RRI-related themes/fields of action were selected, clustered and prioritized. This result served as input for the following discussions, which were organized in three groups. In order to open up for a global perspective of (de-facto) rri, all of the RRI-related discussions at this workshop were inspired by the RRI defined by the European Commission, but not limited by that.

In order to embrace the full variety of responsibility, societal links and embeddedness of the research organizations FhG, TNO and CAS and Arizona State University, the working definition of RRI introduced at the workshop was: "RRI means to link research and innovation better with society. RRI approaches and practices are designed to increase mutual benefits of research and innovation – and society, both by underpinning better R&I processes and better R&I outcomes."

Reflections on the approach and evaluation by participants

At the end of the workshop, all of the participants evaluated the workshop regarding the following five statements:

- This workshop has inspired me
- I've got a broader understanding of RRI in general
- I've got a broader understanding of one or more particular RRI themes / fields of action
- I've got to know more insights into what it means to institutionalize RRI within an organization
- I can take home some ideas for further RRI development at my organization

By means of placing dots in a spider web with five degrees from "not at all" to "exceedingly", participants shared their high satisfaction with this workshop. It is remarkable to note that the majority of the participants mostly agreed that the workshop had inspired them.

We asked participants to share with us some thoughts about what they had learned at the workshop. Here is a summary of the answers:

Generally speaking, it is very appealing for them to learn what other countries or institutions have been undertaking in the context of RRI or responsible organizations. The exchanges of relevant aspects such as understanding, concepts, dimensions, measures for implementation as well as barriers and levers are very inspiring. Mutual learning was especially strengthened by the detailed presentations, discussions in the group work and informal conversations.

A sense of change could be recognized at the workshop. Research and innovation organizations around the world are caught up in a combination of both pressures and aspirations to perform in a more socially transparent, accountable and responsible manner. These four organizations are responding to these changes, albeit in unique and different ways. Also, within the project team, there is a broad understanding of responsibility, accountability and openness, naturally with slightly different key aspects.

In addition, culture might be an important dimension to consider when examining RRI. For example, it seems that ASU (perhaps American culture more generally) has an unusual appetite for disruption for the sake of innovation, a tolerance for challenging the status quo, almost romanticising grassroots innovation from those with less



authority/experience, while hierarchy in other cultures might play an essential role to push new concepts. However, sustainability and responsibility are still often an afterthought in ASU's corporate cultures, while this appears to be more fundamental in the efforts rooted in German and Dutch cultures. Therefore, the environments necessary to achieve efficiency, responsibility, and innovation might be very different.

The main results of this workshop are summarised in the minutes, which are attached in the annex. The second workshop will take place at the end of the implementation processes at Fraunhofer and TNO (WPs 6 and 7) in January 2019 (Month 32). Experiences and lessons learned from the pilot cases at Fraunhofer and TNO will be made available to the international partners and discussed from their external perspective. Next steps for a long-lasting mutual international exchange beyond the project will be envisaged.

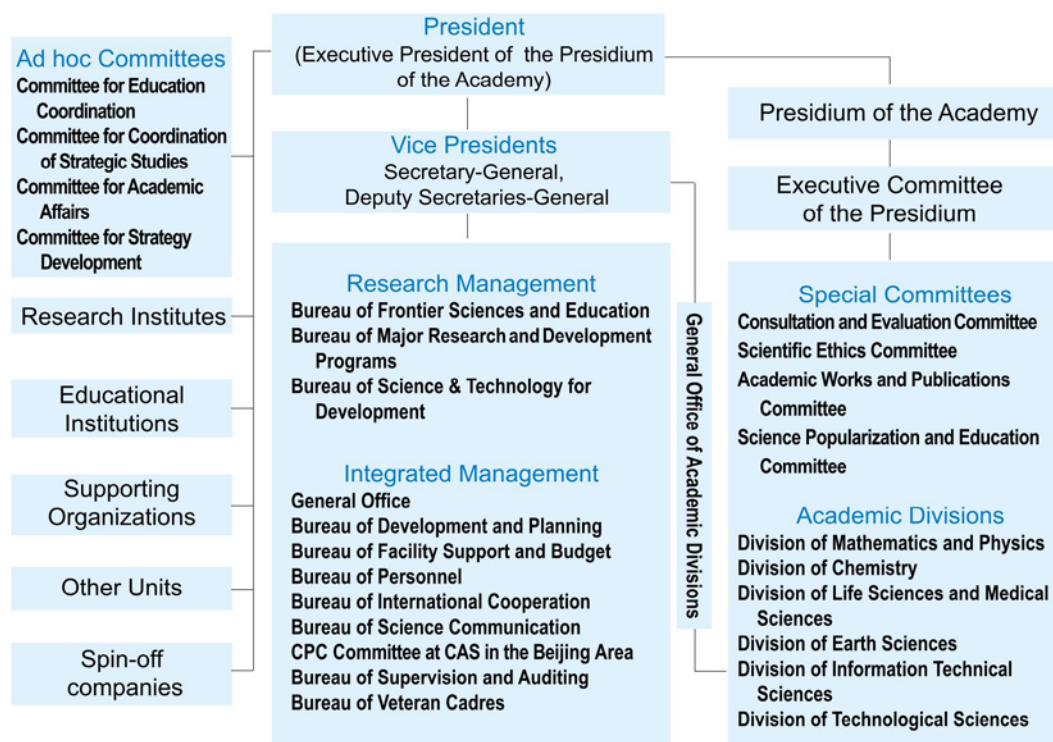
2 RRI from a global perspective: main findings from the case studies

2.1 CAS

2.1.1. About CAS

The Chinese Academy of Sciences (CAS) is the key player in China's drive to explore and harness high technology and the natural sciences. As the largest national scientific institution, CAS comprises three major parts – a comprehensive research and development network, a traditional merit-based academic society like the US National Academy of Science, and a system of higher education¹. Figure 1 below illustrates the organizational structure of CAS:

Figure 1: Organizational structure of the Chinese Academy of Science (CAS 2013a)



¹ <http://english.casad.cas.cn/>

The merit-based part of CAS is represented by the Academic Divisions of the Chinese Academy of Sciences (CASAD). Since its foundation in 1955, CASAD has served as an advanced national think-tank for the Chinese government on major science and technology issues. The government attaches high importance to this scientific community. Today this learned body consists of six divisions with more than 700 Academicians, respectively in mathematics and physics, chemistry, life and medical sciences, earth sciences, information technical sciences and technological sciences, which help to organize and carry out strategic studies and offer advice on different topics².

Besides this think-tank function, CAS has undertaken other roles — as a national team and an engine driving national technological innovation, a pioneer in supporting nationwide S&T development, and a community for training young S&T talent. To fulfil these tasks, CAS is composed of 124 units with 64,700 members of staff: for example, 104 research institutes (including three key botanical gardens), two universities (the University of Science and Technology of China and the University of the Chinese Academy of Sciences) and 12 management organizations at the headquarter and branch levels (CAS 2013a). Besides, 22 commercial enterprises stemmed from CAS, with Lenovo being one of the most famous.

In the context of its administration, a "Scientific Ethics Committee" and a "Science Popularization and Education Committee" have been established under Special Committees. This indicates that these two aspects have already been highlighted as main issues on S&T governance of CAS.

The empirical part of this case study is based on 16 interviews with the researchers of the Institute of Policy and Management (IPM), the National Science Library (NSL) and researchers from other research institutes. IPM provides, amongst others, decision-

² <http://english.casad.cas.cn/>

making information for the above-mentioned Committees³, and NSL is tasked with, amongst others, addressing questions regarding open access/open science⁴.

2.1.2. Pre-existing rationales

At organizational level

The comparable discussion at CAS refers mainly to the "(societal) responsibility of scientists". As CAS stands for the highest position in the S&T landscape nationwide, members (Academicians) and researchers of CAS perceive high respect and are faced with high expectations from society. Accordingly, they (presumably) take high societal responsibility for granted.

This kind of discussion can be traced back to the 1970s with the issue of "technology assessment". Since 2004, the focus has been switched to scientific morality, which mainly refers to scientific norms and research integrity. On 26 February 2007, the CAS published a "关于科学理念的宣言" (Declaration of Scientific Ideology) and set up a commission for scientific integrity to promote transparency, autonomy and accountability of scientific research in the country. The Ministry of Science and Technology (MOST) at the same time had also initiated measures to address misconduct in state-funded programs (Lancet 2007). Since 2010, the scope of the discussion has been extended to include S&T ethics and the (societal) responsibility of scientists initiated by some prominent Academicians in the research area of "life sciences" due to the rapid developments in this area such as genetic engineering, stem cell research and new drugs. In April 2013, the CAS published "关于负责任的转基因技术研发行为的倡议" (Code of Conduct for Responsible Development of Transgenic Technology) (CAS 2013b).

³ Established in June 1985, the IPM is devoted to the studies on the strategy and policy issues for S&T development, innovation development, sustainable development, and the public security administration and management science. It offers high-caliber research consultative services to central authorities, CAS, local governments and business firms. See <http://english.ipm.cas.cn/au/bi/>

⁴ NSL is the public library service system of CAS as well as the National Library of Sciences in the Chinese National Science and Technology Libraries (NSTL) system. NSL is actively participating and leading national efforts to build a powerful National Scientific Information Infrastructure. As the key member of NSTL, it serves as the national reserve library for natural sciences and high-tech literature, offers inter-library loan services to the nation's researchers and libraries, organizes promotion and dissemination activities for the public, initiates strategic planning and system development projects for NSTL, and collaborates with major domestic and foreign libraries for resource sharing and research collaboration. See <http://english.las.cas.cn/au/>

According to this document, the scientists should undertake two kinds of responsibilities in this research area: on the one hand to benefit society to the maximum extent, on the other hand to be aware of injustice and to avoid the possible risks of using this technology. In this context, four general principles were set up: responsibility, sustainability and serving the societal needs and fostering the economic development. Responsibilities are defined from two aspects in this document: from the research process (research integrity) and from the view of society. Concerning societal responsibilities, scientists should be aware of their responsibilities in political decision-making consultations, in science communication, in teaching young researchers about S&T ethics and in avoiding conflicts of interest. In October 2014, the CAS also published the normative reading "如何开展负责任的科学研究" (how to conduct responsible scientific research)⁵ (CAS 2015).

In parallel, IPM researchers have been starting their STS studies such as "sociology of sciences", "science and technology studies", "science and society", ethical issues on emerging/frontier technologies, as well as risk management on emerging/frontier technologies. In the era of "big science", the importance of inclusion of multiple stakeholders, societal participation, inter-disciplinarity as well as science popularization and education are also highlighted among the research issues.

Regarding science education, the term "science popularization" has been used extensively in China. In fact, science popularization belongs to one of main tasks of CAS. In 1996, CAS, cooperating with the Chinese Association of Science and Technology (CAST) and the Chinese Academy of Engineering (CAE), gave around 200 speeches in 20 first-tier cities to report the S&T achievement for the public. These activities earned very positive feedback (CAS 2015). Since the end of 2002, as a response to the enactment of the Science Popular Law in 2002, CAS has held numerous educational activities to bring science closer to the Chinese public. According to the interview partners, science popularization consists of three main tasks: dissemination and communication of new discoveries of high-end S&T activities through S&T infrastructures such as museums, planetariums, botanical gardens; strengthening the science education of the young generation by means of summer camps, open days and compilations of teaching materials; spreading scientific culture and spirit such as rational thinking and rational scepticism through public lectures. Because "science popularization" is popular and accepted by the public already, several new ideas and

⁵ The title was translated by the author.

new trials such as a consensus conference are to be held under this term. As a result, societal participation is to be understood as one facet of that.

Open access has been considered as one of main tasks for the future too. Since the "Berlin Declaration" in 2003 CAS has been supporting this idea and undertaking the follow-up steps to push this idea forwards.

According to the interviewees, sustainability is definitely one main issue for CAS. In fact, the Research Center for Eco-Environmental Sciences, the Institute of Geographic Sciences and the Natural Resources Research, Xinjiang Institute of Ecology and Geography etc. have been addressing this issue for a long time. However, this matter is seldom discussed in the context of responsible research and innovation.

It is noteworthy that the mottoes of CAS are 唯实 (addressing concrete issues), 求真 (seeking truth), 合力 (uniting efforts), 创新 (innovating)⁶. According to the annual report in 2013, under the new initiative called "Innovation 2020" CAS will enhance research freedom, improve research quality, deploy resources more efficiently and bring greater benefit to society. The emphasis on contributions/linkage of scientific activities to society is very obvious.

At individual level

It is interesting to hear the responses of the interviewees to the question: "what does it mean to act responsibly?" The answers reveal which values are shared by the individual researchers in their professional lives.

Not surprisingly, the opinions of IPM researchers are slightly different from the opinions of other scientific researchers because they have carried out STS studies approximately for a decade. To them, "blue sky" scientific activities should be bounded with "responsibility", which mainly refers to ethical issues. This means that S&T ethics are to be defined according to different contexts, times and technological stands. Consequently, S&T ethics vary from time to time. In the era of "big science", the opinions of multiple stakeholders should be included in the process of discussing the ethics-related issues.

⁶ http://www.cas.cn/jypx/CASJYZI/2010BY/2010BYSZJY/201007/t20100709_2899954.html.
The mottoes were translated by the author.

Besides responsible conduct research/research integrity, most of the interviewees viewed quality of research, contribution to scientific further development and possession of the sense of mission towards society and humanity as responsible. When it comes to the last issue, there are several different interpretations: for example, rebuilding the trust of society in scientists/researchers, bridging different disciplines, creating added-values for society, being aware of impacts of scientific output on society which result in conflicts or revolutionary change, and being aware of impacts on the natural environment. One interviewee put it this way: scientists should steadily examine the aim and the meaning of their research and reflect if the well-being of society and humankind could be improved by their work.

According to the interviewees, there are several ways to inspire this kind of sense of mission towards society: dialogues between relevant stakeholders such as scientists, policy-makers and citizens; S&T ethical education for young researchers; embedment of a sense of responsibility in culture such as research culture, institutional culture and societal culture.

To researchers outside IPM, "responsible research" means mainly research integrity. But some other aspects were mentioned too. For example, selecting appropriate research methods, quantity and quality of their output in terms of projects, publishing papers and supervising PhD students, contributing to the further scientific development in his/her own professional field and finally, providing explanations or solutions to societal challenges.

It is worth mentioning that many interviewees consider the training and mentoring of young talents as one of their main responsibilities.

2.1.3. Appraisal of the RRI concept

Because researchers at IPM already have expertise in STS studies, it makes sense to demonstrate their views about RRI separately. These views can serve as experts' opinions for the further development of the RRI concept.

Researchers of IPM

Some of them have been exchanging this issue with von Schomberg since the very beginning. Some of them have already learned from the discussion in Europe, e.g. in the

UK and Denmark (e.g. consensus conference). Therefore, the EU-RRI is not totally unknown to them. Pros and cons were mentioned:

- "Responsibility" is already embedded in the culture/education, both in China and in Europe. This is not a new idea. This kind of promotion of RRI can however again trigger the discussion concerning the definition of responsibility and then clarify the definition for different stakeholders among academia, industry, public authority, etc.
- RRI could be seen as the extension of responsible conducts. The dimension of societal participation corresponds to their understanding of "science governance", which puts forward the participation of social scientists and the public.
- The concept is very inclusive and is not in conflict with the pre-existing understanding of responsibility. However, it is not systemic enough, lacks internal logic and therefore lacks a core common understanding. The concern remains how to operationalize this concept.
- The five dimensions have no strong linkage to responsible research and innovation. When examining the five dimensions closely: gender could be viewed as a sub-dimension under ethics; open access (OA) refers only to public research and does not mention the responsibility of industrial research activities; the aim of public engagement (PE) is not clear.

Researchers outside IPM

Some researchers outside IPM are aware of similar ideas due to their advanced studies in the USA. In order to conduct their post-doc research projects, they have to sign the agreement regarding responsible research activities.

Basically, interviewees agree with the definition of RRI. But they also emphasise that this definition hardly suits all disciplines or research directions. In general, there are two aims of scientific research: to explore new knowledge and to make the scientific work useful to society. However, the new explored knowledge, especially in basic research, is often ahead of the times. This means that the connection between research activities and societal needs will be discovered much later. It seems that RRI is focusing only on the second aim.

Concerning the five dimensions, besides ethics and science education, interviewees agree strongly with some dimensions, such as societal participation and OA. To them,

societal participation goes beyond ethics and enriches the content of responsibility. All of them are willing to see the further development of OA for reasons such as knowledge sharing and in particular, cross-cutting interdisciplinary exchange. One OA expert viewed the implementation of OA/open data as urgent. In the era of "big data", data sharing is the precondition for useful research outcomes: only by means of a huge amount of data, scientists can conduct meaningful analyses (also from different aspects) and make precise prognoses for the future. Besides, science popularization, open science, open access and societal participation have close connections with each other. Open access might provide the framework for other activities.

2.1.4. Translation into practice: Issues of institutionalization

State of the play

In the case of CAS, most interviewees consider "ethics" (research integrity, risk management in emerging/frontier technology, ethical issues on emerging/frontier technology and societal responsibility of scientists), "societal participation" and "science popularization" to be at the core. Promotion of open access is also in progress. However, some difficulties in implementing this idea have been recognized too.

In the following, the translation of RRI-related issues will be depicted at national policy level, at institutional level, at disciplinary level and at educational level. The relationship between different levels reflects on the one hand the top-down political system in China, on the other hand the bottom-up influence of CAS on the policy makers as well as the decentralised structure within CAS, which enables every institution to implement individual measures to realize its own "science popularization" programs.

✓ At (national) policy level

Societal responsibility of scientists

The Chinese government has recognized the importance of the "(societal) responsibility of scientists". Therefore, in this regard different activities have been organized between high-level national authorities.

It has been observed that cooperation and coordination efforts between "CAS, National Natural Science Foundation of China (NSFC), the Chinese Academy of Engineering (CAE), the Chinese Association of Science and Technology (CAST), the Ministry of

Science and Technology (MOST) and the Ministry of Education (MOE)" have been started. The interviewees mentioned several examples:

- 1) CAS and NSFC organized the discussion between scientists from different disciplines to decide the strategic research fields for the future. In the process, the economic and societal needs and impacts on other disciplines were considered (the two main criteria are: scientific meaning and societal values). This kind of decision-making process is to be applied further.
- 2) Regular exchanges within the "science and society" community: not only IPM, but also MOST has one task force to make STS studies. By means of nationwide conferences the scientists from CAS, NSFC, CAE, CAST, MOST and MOE are coming together to strengthen and deepen exchanges.
- 3) NSFC has placed the issue "ethics" into the 13th Five-Year-Plan as one of the main strategic points.

Science popularization

Regarding "science popularization", a legal framework has been set up since 2002. The foundation for science popularization has been laid down by the so-called two outlines and two laws: the "Popular Science Law" was enacted in 2002 (chinanet 2002), "Outline of Action Plan of Scientific Literacy for the population (2006-2010-2020)" in 2006⁷ (the state council 2006a), "Outline of Medium - and Long - term National Science and Technology Development Plan" in 2006⁸ (the state council 2006b), "Law on progress of science and technology" revised in 2007 (The Central People's Government of the P.R.C 2007). The rationales of Science Popularization are to improve the quality of life, to achieve all-round development, to enhance national independent innovation ability, to build an innovation-oriented country, and to achieve comprehensive and coordinated economic and social sustainable development (the state council 2006a)⁹. Based on the "Popular Science Law", MOST and CAST are in charge of Science Popularization nationwide. In 2016 CAST announced a series of documents to push forward activities related to the popularization of science further such as the "Science Popularization development plan 2016-2020" (CAST 2016b) and "Measures of promoting Construction of Community Universities for Science Popularization" (CAST 2016a).

⁷ The title was translated by the author.

⁸ The title was translated by the author.

⁹ Based on interviewees, due to a disappearing population dividend, the promotion of science popularization has its important strategic meaning.

Besides, cooperation between CAS and MOST as well as CAS and MOE to promote science popularization has been settled.

Open access

In May 2014, at the Global Research Council 2014 Summit Meeting in Beijing, Premier Li Keqiang announced that the Chinese government supports policies and mechanisms for open access to publicly funded knowledge. Li indicated that "Knowledge is a public good. A more open environment will enable everyone to share the fruits of knowledge and promote inclusive development" (Ku 2016b). This government's commitment provides the legitimacy for CAS to promote OA-related ideas further.

✓ At IPM/CAS level

A new organizational structure was set up at IPM in January 2016. The "Research Support Centre of Scientific Norms and Ethics" as well as "Research Support Centre of Scientific popularization and Education" have been built up to support and consult the respective CAS committees, i.e. "Scientific Ethics Committee" and a "Science popularization and Education Committee", directly. IPM's role as a direct think tank for the committees has been concretized.

Regarding **ethics-related issues**, a series of activities has been put in place:

- 1) Since 2010, research on ethics has been started due to a debate about genetically manipulated rice and some nanotechnology-related issues. The focus has been set on ethics and the responsibility of scientists.
- 2) Since 2011, different actions have been launched. The aim is to create a platform between (natural) scientists, STS researchers and policy-makers for effective ex-changes. Since then, the S&T ethics symposium has been held once a year and the topics discussed include genetic engineering, stem cell research, the internet, artificial intelligence, nano-technology as well as research integrity.
- 3) In 2013 IPM supported the Academic Divisions in publishing the "Code of Conduct for Responsible Development of Transgenic Technology". This is the outcome of the above-mentioned S&T ethics symposium on the issue of genetic engineering.
- 4) Different pilot projects: in 2008, a consensus conference was held to discuss genetically modified rice. This was a very successful experiment to test the potential and capability of societal participation in S&T ethical issues.

- 5) The journal "Science and Society" has been published since 2011. This journal focuses on discussions on ethical issues on new/frontier technology and the responsibility of scientists from the perspective of highly respected "Academicians" and STS researchers. In addition, it aims to disseminate relevant concepts and academic discussion regarding STS studies, Ethical, Legal and Social Implications issues (ELSI) in S&T and S&T policy etc.¹⁰.
- 6) Ethical issues have been addressed in "High Technology Development Report". For instance, one sub-topic in the report in 2014 was "high-tech and society". The High Technology Development Report is one of a series of annual reports by the CAS for policy makers and the public, which is focused on one topic each year. Since 2000, the "High Technology Development Report" has been issued 15 times, with topics such as "information technology", "biotechnology", "materials and energy technology" and "aviation, space and marine technology" respectively. Not only new progress of high-tech research domestically and abroad is introduced, the authors also discuss the profound impact of high-tech on society (sina 2014; xinhuanet 2003).

According to the interviewees who are in charge of scientific norms and ethics, further efforts will be put into strengthening dialogues between Chinese scientists and foreign scientists in order to participate in setting up international ethical rules jointly with international partners. Especially in a research area like life sciences, China has been undertaking the leading role globally and has to consider how to act responsibly toward the international scientific community and society. Only through increasing dialogues and exchanges with international partners, trust could be built up because of more common understanding and mutual respect. To them, the next logical step is to establish ethics management or ethics governance in China at the national level¹¹. In order to achieve this, not only further STS research should be deepened, the organizational support, the commitment of the higher management level and the awareness of society are needed too. Therefore, they view it as a very positive sign that the "ethics" issue appeared on the agenda of the 13th Five-Year-Plan.

¹⁰ <http://kxxy.cbpt.cnki.net/WKD/WebPublication/wkTextContent.aspx?navigationContentID=db922688-adf9-430b-94cd-def1f4845b4d&mid=kxxy>

¹¹ According to their opinions, ethical issues also have their strategic importance in attracting international experts.

Regarding **science popularization**, the administration unit "Bureau of Science Communication, CAS" was set up in 2013. This bureau is mainly in charge of strategic planning, coordination, and management of science dissemination/communication-related activities¹².

A series of different activities are already taking place. In 2012, for example, to celebrate the 10th anniversary of CAS's "Science and China" lecture series, CAS members and experts delivered more than 140 lectures to more than 25,000 persons in several cities, including Wuhan, Guangzhou and Hangzhou. CAS also held a regular weekly science forum at the China Science and Technology Museum. As part of the forum, CAS members and experts gave over 50 lectures on science. CAS sponsored its Eighth "Public Science Day" in May at nearly a hundred CAS research institutes across the country. A total of 15 CAS members, 1,500 scientists and experts, and more than 2,000 volunteers participated in the event, which attracted 260,000 attendees. The academy also launched an exhibition on S&T innovation that travelled to Beijing, Lanzhou, Chengdu, Wuhan, Guangdong, Shanghai and Hefei, attracting a total of 100,000 visitors. In addition, the academy published more than 30 books on popular science, with sales close to 700,000 copies. Three of the books won state-level awards. Moreover, CAS produced more than 60 videos, with the total airtime exceeding 300 hours, and presented more than 50 displays related to science at national-level venues and events.

CAS took advantage of various newspapers and websites, including *China Science Daily*, *Science China*, *Chinese Science Bulletin* and *Science Museum of China*, to popularize science. CAS also had 24 websites which focused on conveying scientific knowledge during the year (CAS 2013a). When visiting the website of CAS, under category "Science Popularization" ¹³, different science dissemination activities can be seen: summer camps or winter camps for children, discussions about different issues, popular science articles and pictures and two direct links with science popularization websites such as "中国科普博览" (Virtual Science Museums of China)¹⁴ and "明智科普网" (Smart Science Popularization Network)¹⁵. The former was founded in 1999 and is China's first comprehensive popular science website which is spreading scientific knowledge in form of virtual museums. Relying on the abundant scientific resources of

¹² <http://www.chuanbo.cas.cn/>

¹³ <http://www.cas.cn/kx>

¹⁴ <http://www.kepu.net.cn/gb/index.html>

¹⁵ The English name was translated by the author. <http://www.caskepu.cn/gb/index.html>

the CAS, this website has applied the concept "dissemination, interaction, exchange and service" to turn itself into one of the most famous scientific communication portals of CAS, which was honored by the World Summit Award in 2005¹⁶ (World Summit Award).

It is remarkable that science popularization-related activities are among the obligatory tasks for all CAS institutions such as research institutions, museums, botanical gardens, herbariums, laboratories, large-scale research infrastructures, planetarium etc. Every institution has the freedom to organize its own activities with special characteristics. For example, the Institute of Atmospheric Physics has used the internet to communicate very successfully with the public regarding the weather forecast, smog issue etc.¹⁷. The public can also follow the latest research outcomes and scientific discoveries in this area by subscribing to its news via the official "wechat" account^{18 19}.

✓ At NSL/CAS level

As mentioned before, NSL is in charge of open access (OA)-related activities and OA-related activities stem from another rationale and initiative.

NSL, CAS has started its OA concept since joining the "Berlin declaration" in 2003. In 2010, the 8th meeting of the Berlin declaration took place at NSL in Beijing. In 2014, after the government announced its support of OA in May, CAS published an OA policy statement to support the OA movement in August. According to this statement, CAS is going to undertake OA for articles from publicly funded scientific research projects at the present stage. Four approaches are planned (CAS 2014):

- 1) CAS requires its researchers and graduate students to deposit an electronic version of the final, peer-reviewed manuscripts of their research articles, resulting from any public funded scientific research projects, submitted and consequently published in academic journals after issuing this policy, into the

¹⁶ The evaluation of jury is as follows: "the Virtual Science Museums of China website 'translates' scientific information into content that can easily be shared and appreciated by people who are not professionals. VSMC also makes an effort to establish a virtual community space, where both scientists and the general public can meet in order to better understand each other, by means of open and unbiased communication. Also aimed at fostering better understanding between China and the world at large, VSMC actively develops international partnerships." (World Summit Award)

¹⁷ <http://www.iap.cas.cn/kxcb/kpwz/>

¹⁸ The function of „wechat“ in China is comparable with that of “whatsapp” in Europe.

¹⁹ This is its wechat QR-code .

open access repositories of their respective institutes at the time the article is published, to be made publicly available within 12 months of the official data of publication. CAS encourages its authors to deposit those articles published before this policy into the respective institutional repositories and to make them open access in the same way.

- 2) CAS authorises its department responsible for library and information services to develop detailed guidelines for open access deposit of the above-mentioned research articles in accordance with copyright laws. CAS requires its institutes to set up repositories to preserve research articles authored by their members that resulted from publicly funded research projects, and to provide open access through the Internet to the public.
- 3) CAS supports its authors in publishing research articles from publicly funded research projects in open access academic journals with reliable quality control and reasonable article processing charges. CAS authorises its responsible departments to establish selection guidelines for open access academic journals eligible for article processing charge funding, and to experiment with ways to transform its high impact academic journals into open access journals.
- 4) CAS realizes that open access will continue to evolve for further improvement, policy harmonisation, and new sustainable models. CAS asks its relevant departments to actively collaborate with the concerned domestic government agencies to facilitate open access to research articles supported by national research programs and foundations, and to cooperate with international scientific communities to promote an international convention for open access to achieve coordinated efforts towards healthy and sustainable development of open access.

Corresponding to these approaches, the main tasks in this regard, which have been carried out up to now, are:

- 1) Building up the infrastructure such as institutional repositories (IR)²⁰: until the end of 2016, 102 IRs have been built up. The CAS IR grid, a kind of collaboration of CAS IRs, was also set up to provide a comprehensive knowledge service²¹. To achieve deepened knowledge service and Open Science, NSL is calling for China's IRs collaborations.
- 2) Carrying out open publishing²²: because CAS committed to support publication in open-access journals and to make its own journals open access²³, a series of efforts have been in place: assessing and ranking the international OA-journals, making the guidelines for researchers to publish in international OA-journals with good reputation, disseminating the idea "open publishing" etc. Besides, there is cooperation with OA-journals like BioMed Central (BMC). Training for national journals has been undertaken as well. Both the CAS and the NSFC (and most research funders in China) allow researchers to use grant funds to cover publishing costs — including in open-access journals (Ku 2016b).
- 3) Researching on OA policy: NSL is taking OA-related policy research further (e.g. international benchmarking) to provide their experts' opinions for the decision makers.
- 4) Participating in international cooperation and alliances: in 2014 CAS/NSL and Deutsche Forschungsgemeinschaft (DFG) jointly initiated a multinational collaborative project "OA policy research platform"²⁴. NSL is also a member of

²⁰ This refers to Green OA.

²¹ <http://www.irgrid.ac.cn/>

²² This refers to Gold OA.

²³ The CAS now has two OA portals, namely the Institutional Repository Grid of Chinese Academy of Sciences, and the China Open Access Journal Portal which contains hundreds of journals (Ku 2016a).

²⁴ This platform aims at providing information on global development of open access to all those who are interested in open access. Visitors can explore all activities, policies and supporting mechanisms from the world by country, institute, policy, and other aspects. The information on the platform is from the Survey of the Implementation of the Action Plan towards Open Access to Research Publications endorsed by the Global Research Council (GRC). The platform is organized by the National Science Library, the Chinese Academy of Sciences, with the help from Deutsche Forschungsgemeinschaft (DFG), and with funding by the Chinese Academy of Sciences. See <http://www.grc-oa.org.cn/OA/index.php/welcome/about>

arXiv, SCOAP3 etc. It has long-standing exchanges with the Max-Planck Society, University of Cornell, University of Bielefeld etc.

- 5) Conducting regular training, dissemination and communication of OA: for example, the "Chinese Data Librarian Seminar" is held for librarians, the "Chinese IR Conference" for institutions at OA community and "China OA Week²⁵" for researchers, different stakeholders and the public.

According to one interviewee, open data has been implemented by the Computer Network Information Centre (CNIC), CAS. Based on investigations on the internet, in the context of Chinese Scientific Data, a bilingual open-access journal publishing data papers of multidisciplinary fields, has been published in English and Chinese quarterly²⁶. However, the acceptance of open data is not so high amongst CAS researchers that the shared data cannot be updated quickly enough. NSL, CAS is currently discussing open research data policy internally, which will support the creation of new services in the areas of data science and big data (Ku 2016a).

✓ At research disciplinary level

Regarding science popularization, all of the CAS research institutes have the freedom to shape their own programs and have indeed conducted different activities in this regard.

In fields such as nanotechnology, life sciences and medicine, researchers are very aware of responsibility-related issues. There are also rules for societal security. The ethics committee has to prove that the projects and papers meet the security criteria.

Some institutes take ethic-related initiatives. For example, the Shanghai Institutes for Biological Sciences have organized an interdisciplinary salon (20-30 participants) to discuss gene editing technology and ethics. IPM's ethical expert was invited to give a keynote speech.

Concerning innovation, some institutions are involved in technology transfer, spin-offs and cooperate with local governments to create new bio-tech industries or build centres of big data to assist hospitals in personalising medicine.

✓ At educational level

²⁵ In 2006, the discussed issues were amongst others "the challenge and practice of open publishing" and "the challenge and practice of open data" (Ku 2016b).

²⁶ See <http://www.csdata.org/p/>

At the University of CAS, "ethics in science and research" is one of the common elective courses. Because the University of CAS is the largest graduate education institution in China and tasked with training advanced young scientific talents²⁷, this course provides the fundament for the ethical education of researchers for the future²⁸.

Besides, the Shanghai Institutes for Biological Sciences also provide a lecture on "bio ethics" for additional reflection on this research area²⁹.

Success factors

To sum up, the following drivers and factors contribute to the institutionalization of the "EU-RRI-like" activities:

1) *Institutional entrepreneurs*

Concerning "societal responsibility of scientists" at CAS, **Academicians** have the vision and willingness to reflect their societal responsibility at national and international level.

Academicians and senior researchers at CAS broaden their own horizons due to their profound experiences and extensive international exchanges. They are able to examine the ethical issue beyond their own discipline and professional scientific field. Some of them have undertaken the decisive role of promoting the importance of societal responsibility of scientists. Others are willing to follow up this issue because they can perceive the strategic meaning of communication with society.

As a rule, the recommendations from the Academicians are taken seriously by the science community and the government in China. Therefore, this group of prominent and

²⁷ Being the largest graduate education institution, UCAS' main task has long been graduate education. Up to December 2015, the number of postgraduate students was 44,500, including 22,300 doctoral students, 22,200 master students, and 1063 international students including 749 doctoral students, ranking first in China. See <http://englishucas.ac.cn/index.php/about-ucas/introduction>

²⁸ According to several interviewees, „scientism“ is still quite widespread in China. This means that science leads only to „progress“ for society and has absolute priority. Therefore, it is time to include ethics in science education to inspire the young generation to reflect on the possible negative impacts of scientific research on society. Science could also harm society if ethical issues are not considered.

²⁹ According to interviews, MOE has also cooperated with Tsinghua University to provide the required course "Engineering Ethics". See also <http://search.tsinghua.edu.cn/web?query=%E5%B7%A5%E7%A8%8B%E4%BC%A6%E7%90%86&ie=utf8>

dedicated scientists is an essential lever to push forward the issue on "societal responsibility".

Regarding OA, the former director (2004-2015) is the key person to promote and design OA policies of CAS³⁰. He is also connected very well with relevant stakeholders internationally. According to interviewees, this concept could not have been kept alive for such a long time without his endeavour, before the central government gave its commitment to this issue.

2) ***Organizational design, capabilities and capacities: the role and function of IPM, NSL and Bureau of Science Communication, CAS***

Overall, the interviewees view the organizational design, which accompany the funding, personnel and clear division of work, very positively for further work in the future.

IPM: Researchers of IPM are undertaking the role as a bridge between different stakeholders successfully.

The STS researchers are working together closely with the Academicians of the Scientific Ethics Committee, sharing mutual understanding and are able to consult the committee with their latest STS research outcomes. STS researchers are able to communicate with other natural scientists in the language which they can understand and accept at different events such as S&T ethics-related salons, forums and conferences. STS researchers are also able to disseminate ethical ideas by means of their teaching at the University of CAS and other institutes. On top of that, this think-tank has been planning strategically to give impetus to this issue: from awaking the awareness, disseminating the ideas to realize concrete actions. Furthermore, they aim to facilitate substantial changes at CAS in this regard.

NSL: As to the issue of OA, the key to success is the combination of clear commitment from the management level, institutional culture and the strong and enthusiastic project team dedicated to this area.

3) ***External requirements and pressures are also playing an important role***

For instance, the international requirement regarding ethics and public opinions about internet security push CAS to deal with the issue of "societal responsibility", too.

³⁰ Dr. Zhang, Xiaolin. See also <https://or2017.net/speakers/>

According to researchers from other CAS research institutions, the following factors are key to their success:

- 1) Institutional culture and sense of honor: as members of a national top team, most researchers have high demands on themselves and want to contribute to society with what they perceive as their societal responsibility.
- 2) Organizational structure: for example, established special office in charge of science dissemination helps promote science popularization
- 3) Selection of research topics for the public: the topics which are close to public life and society were chosen for science popularization. The public's responses were very positive.
- 4) Willingness of researchers to share their scientific results with the public in "everyday" language: although activities for science popularization are not measured as a working performance, most researchers are willing to participate in science popularization when they have been asked to do so. One interviewee pointed out that in preparing the public lecture, he had the chance to reflect on his research trajectory and summarise his research achievement in the past. This kind of reflection could stimulate new ideas for future research.
- 5) In case of innovation activities, the important factors mentioned are commitment of the leading position, support of local government and the strong dedication of project investigators.

Challenges

In general, the contextual factor is turning out to be the greatest challenge. After all, China still is in a catch-up process regarding S&T development. The common opinion is to continue to strive for scientific progress. Societal values have had low priority. So, it is very challenging to receive substantial commitment from policy makers at ministerial level such as MOST, MOE etc. Even for CAS, excellent output is regarded as more important than societal concerns, especially for basic research activities.

Regarding the individual dimension, interviewees of IPM also highlighted different challenges.

✓ Ethics

It is tricky to balance the importance between ethics and other political priorities in S&T development. In consulting the Scientific Ethics Committee, IPM's STS experts have to

keep in mind what the current needs are and avoid self-centered judgment. In particular, ethics is a sensible issue in the Chinese science community because some cases in the past have shown that Chinese scientists were indeed treated unfairly by foreign scientists using "ethics" as an excuse to hinder their publication.

As a result, it will take time to transform the passive and reactive attitude to an active attitude at policy level. The aim to set up the ethics governance (e.g. rules and laws enacted by the central government) at national level is ambitious.

✓ Science Popularization and societal participation

Regarding science popularization it is important to find appropriate forms and language to communicate with the public. Not all scientists are able to translate their professional jargons into everyday language. Therefore, it is necessary to train scientists in science communication if good results from science popularization are expected. However, activities for science popularization are not counted as a performance indicator for researchers and the culture to promote science popularization is not accepted widely. Some scientists view this as a factor which keeps them from their "real" scientific work. Therefore, systematic institutional measures are still needed.

Regarding societal participation, there are two main concerns. The first is how to communicate with policy makers and with society. The second is how to bring the public's opinions into scientific policy decisions. Besides, based on their experimentation of "consensus conference", a great amount of time and efforts have to be invested in preparing and conducting the conference. If there is no permanent organizational setting, it will be difficult to realize this idea on a regular basis.

To the researchers from other CAS institutes, the concern remains resource allocation in training and fostering young talents or young PIs. To them, one of the most effective mechanisms to deliver the "responsible spirit" is making use of the "master-disciple-system". This means that CAS researchers should be allowed to supervise more master and PhD students and to influence these young researchers personally and directly. Another wish is to have an environment and culture, in which scientists from different disciplines could come together and discuss one special topic from different perspectives. The preference for this kind of exchanges is that they are informal and free such as exchanges in the coffee break. And this freedom could stimulate interdisciplinary cooperation in an effective way.

✓ OA

The general opinion is that open access is a good idea, but the question remains how to realize this idea. Several questions were raised by the interviewees:

- 1) Which data should be shared? This implies how to deal with the potential conflict between knowledge sharing and competition.
- 2) Who should pay? Many interviewees questioned why authors should pay and publishers earn high profits and have quasi monopoly power.
- 3) How much should be paid? It is more expensive to publish in the OA- journal than in a conventional journal. It is not fair that scientists from developing countries pay the same amount as scientists from developed countries.
- 4) The quality of OA journals is still not as good as conventional journals. This means that publishing in OA journals leads to a negative effect on scientific reputation. This also implies that the amount of publications have to be bought.

For the experts at NSL, communication is the biggest challenge over all: how to convince diverse institutions and their researchers to understand the significance of OA for their research work and support this idea, how to communicate with involved stakeholders such as data/information centers, funders, publishers, corporate and information networks, librarians etc. and solve the potential conflict of interests between them. Therefore, the communication efforts at China OA Week are of high importance.

2.1.5. Potential links to the EU RRI approach

From the case study of CAS, it can be observed that firstly, the shared concepts between CAS and EU-RRI are (societal) responsibility of scientists, science education/science popularization and open access. Secondly, societal participation is viewed at CAS as one facet of science popularization. Finally, the linkage between open access, open science, societal participation and science popularization is very strong: some aspects of these ideas are overlapping and at the same time, some aspects of these ideas have the "mean-aim" relationship.

The main findings are summarised in the following table.

Table 1: Potential links between CAS priorities and the European RRI approach

RRI-related issues in China	Rationale / Definition	Key words	Good practice (selected)
(societal) responsibility of scientists	✓ Research integrity ✓ S&T ethics (to benefit society, to be aware of injustice and to avoid the possible risks of using new technology, sustainability) ✓ Science governance	✓ transparency, autonomy and accountability ✓ Responsibilities in political decision-making consultation, in science communication, in teaching young researchers about S&T ethics and in avoiding conflict of interest. ✓ inclusion of multiple stakeholders, societal participation, inter-disciplinarity	• Scientific Ethics Committee • Task force at IPM for STS study (think-tank for the Committee) • Code of Conduct for transgenic technology • Ethics is one main issue in the 13th Five-Year-Plan • Regular S&T ethics symposium • Journal "Science and Society" • Course "ethics in science and research" at the University of CAS

RRI-related issues in China	Rationale / Definition	Key words	Good practice (selected)
Science Popularization	✓ to improve the quality of life ✓ to achieve all-round development, to enhance national independent innovation ability ✓ to build an innovation-oriented country ✓ to achieve comprehensive and coordinated economic and social sustainable development	✓ dissemination and communication of new discoveries of high-end S&T activities (through S&T infrastructures such as museums, planetariums, botanical gardens) ✓ strengthening the science education for the young generation ✓ Spreading scientific culture und spirit such as rational thinking and rational scepticism through public lectures.	• Science Popularization and Education Committee • Management unit: Bureau of Science Communication • Laws and outlines at policy level • Obligatory task for all CAS institutes • Diverse activities (Public Science Day, S&T innovation exhibition, summer camps, public lectures) • Using diverse media: websites, newspapers, books, videos, periodicals, social medias like microblog, wechat
Open Access	✓ Sharing the values of the Berlin Declaration ✓ Knowledge is a public good. A more open environment will enable everyone to share the fruits of knowledge and promote inclusive development	✓ Building up institutional repositories (IR) ✓ Open publishing ✓ Open science ✓ Open data	• Supporting organizations: NSL, CNIC • CAS Open Access Policy Statement • Diverse OA guidelines • International cooperation/network • Dissemination activities (China OA Week, Chinese IR Conference, Chinese Data Librarian Seminar)

2.2 Arizona State University (ASU)

2.2.1. About ASU

Arizona State University (ASU) in Phoenix started a radical organizational transformation process in 2002, when Michael Crow took over the presidency of the university. Previous to this engagement and during his first years at ASU, he and a few other strategic thinkers developed a vision for public higher education in the U.S. called the "New American University" (Crow & Dabars 2015a). Based on the principles of inclusion, sustainability and excellence and committed to contributing to public value, this concept served as a blueprint for ASU's redesign. The concept, the still ongoing transformation process at ASU, its achievements and caveats and what can be learned from this for RRI transformation processes in European research organizations, are in the focus of this chapter.

With 70,000 students ASU is today among the largest universities in the US. It has climbed up major higher education rankings for the U.S. and worldwide in the past decade. For example, in the Shanghai ranking of world universities, ASU, in 2014, "was ranked 88th among the top 100 universities in the world. ASU is 48th among all universities in the United States and 26th among U.S. public universities." (ASU 2015a: 45). Following a clear higher education policy that combines inclusion and excellence, ASU has achieved remarkable results. Thanks to new programs and an increase in financial aid, today the number of students from families with financial needs has grown enormously as well as the ethnic diversity of the student body and of faculty and staff. Levels of achievement, degree attainment and freshman persistence have been growing continuously, assisted by a growing number of faculty, higher faculty excellence, and support programs such as the ASU's University Student Success Centers (ASU 2015a: 5ff).

In the past years, ASU has also become a major site for academic research in the US with research expenditures rapidly growing and now ranking 17th of 768 U.S. universities without medical schools according to data from the National Science Foundation (NSF, for 2015). Research expenditures for the humanities and social sciences are particularly high according to the NSF ranking (ASU 2015a: 11). The increase in research expenditure follows a clear growth strategy (see below) and an application- and solution-oriented ambition, summarised as dedicated research "to confronting challenges, finding solutions and making them reality for the benefit of all" (ASU 2015a: 14).

According to a reputation-based ranking by U.S. News & World Report, ASU is a top place for innovation, ranking #1 for the second consecutive year in 2016 followed by places like Stanford and MIT. ASU refers in this context to its cross-disciplinary approach in teaching and research, to its activities, which integrate education, research and innovation, and to its outreach activities in particular with local public, non-profit or corporate partners (ASU 2016a). Part of the overall approach of ASU is the establishment of favourable support structures within the past years such as the intellectual property management and technology transfer organization AzTE (Arizona Technology Enterprise) established in 2003, the innovation and entrepreneurship hub SkySong, established in 2008 and today hosting 40 companies, or the Office for Entrepreneurship and Innovation (E&I). The office's main task is to create a university-wide culture that values entrepreneurship by encouraging students, faculty, university units and communities ASU serves.

ASU is responsible to the Arizona Board of Regents (ABOR), who adopted the "Changing directions" report in 2002, which identified ASU as the primary locus of expanding the state's higher education capacities. ABOR's vision document of 2008 established specific ABOR goals for 2020 for degree attainment and research and intellectual property output. The ABOR Enterprise Plan of 2009 "established the strategic university relationships and governance to achieve the ABOR goals". Since 2010 an annual Strategic Enterprise Plan, endorsed by ABOR, has guided ASU in accomplishing its goals (ASU 2013: 26ff.)..

ASU defines itself as a knowledge enterprise. The move towards an enterprise model means to "reject the status of being no more than agencies of the state and to move toward [...] a mindset that is energetic, responsive and adaptive" (Crow 2010: 12). ASU's "products" are people and ideas. It has the goal to award 25.000 degrees in 2020, which would mean more than a 100% increase as compared to 2002 (ASU 2014a: 19; ASU 2015b). Research activity as a proxy for ideas has increased exponentially since 2002 with research expenditures more than tripling from 123 million US-Dollars to 426 million US-Dollars in 2014 (ASU 2015a: 11). As a strategic goal, research expenditures shall reach more than 700 million US-Dollars in 2020 (ASU 2015b).

ASU has 17 colleges and schools, among them the college for arts and sciences, the schools for business, design and the arts, engineering and a number of professional schools for journalism, law or the college for nursing and health innovation and a teachers' college. ASU does not have a medical school, which is why it has established

a close cooperation with the Mayo Clinic. In the course of the transformation process since 2002, ASU has reorganized a large part of its academic organization, leaving behind traditional disciplinary structures. A number of new schools have been established such as the school for sustainability, the school of human evolution and social change, the school of aging and lifespan development, the college of interdisciplinary arts and sciences, the college of health solutions and a large number of further schools for example in the business department, the engineering department or the design and arts department (ASU 2015a: 53ff).

Research is organized in an evolving number of centers, institutes and initiatives, many of them on a non-permanent basis depending on third-party funding. In the course of expanding ASU's research capacities, 162 new units were established or re-organized now representing transdisciplinary spaces for research as well as spaces for collaboration and innovation with university partners. Many of them have gained national and international visibility such as the Biodesign Institute, Center for Nanotechnology in Society, Arizona Center for Algae Technology and Innovation, Decision Theater, Julie Ann Wrigley Global Institute of Sustainability, Quantum Energy and Sustainable Solar Technology Engineering Research Center or the Global Security Initiative (ASU 2015a: 12f.).

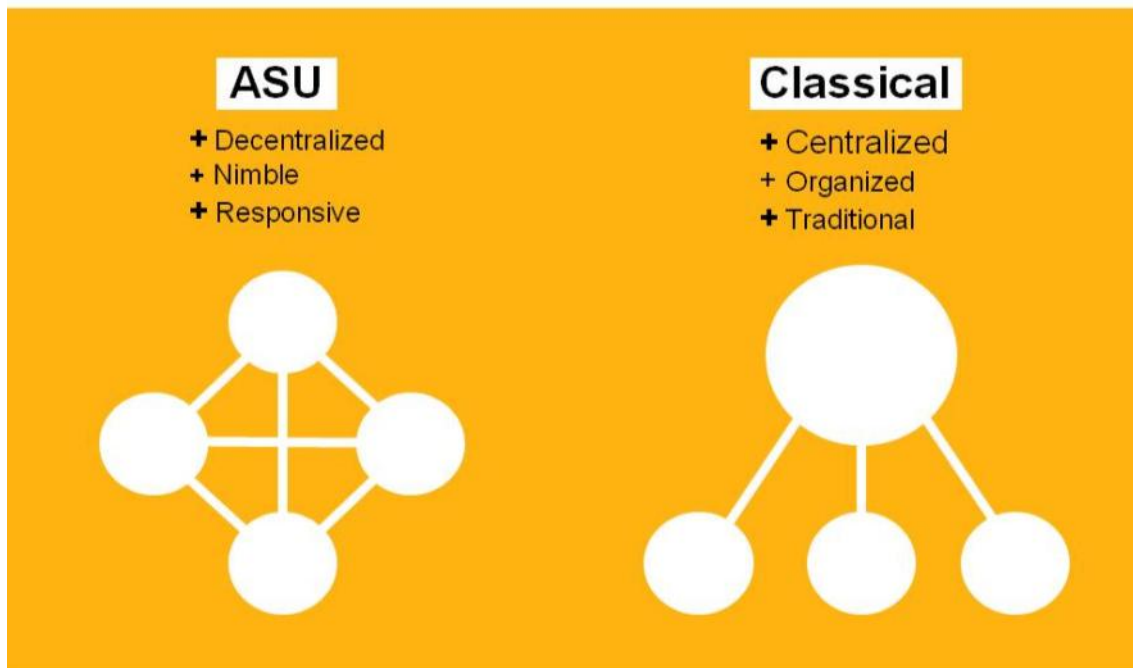
University organization as a whole does not follow classical hierarchical principles, but rather a network structure which is to support nimble and responsive action. The most important feature of this structure is that horizontal activities are not centrally governed, but rather facilitated or supported by the university administration (see Figure 2). Horizontal activities in this context especially refer to all activities which contribute to realizing ASU's mission along the eight so-called design aspirations (see next chapter). As one interview partner puts it:

'We operate kind of like a federation of colleges, each governed by these design principles but free to adopt their own character, approaches, priorities, and free to leverage their assets/strengths differently. So, ALL colleges/schools are conducting use-inspired research, valuing entrepreneurship, are socially embedded and engaging globally. Very few rules about HOW to work with one another, freedom to combine and re-combine across disciplines in rapid response to opportunities or urgent community needs. As a result, you see very different models and approaches [for example] to community engagement.'



Figure 2: Arizona State University's functional structure

**ASU's functional structure is optimally designed to support innovation,
operating in liquid networks instead of hierarchies**



This chapter is based on document research and 15 semi-structured interviews, 10 with faculty from different colleges and schools and 5 with staff from the university administration (see chapter 1.2.3).

2.2.2. Pre-existing rationales

At organizational level

The year 2002 when ASU president Crow came into office, is the most important reference date, for more or less everything ASU stands for today. Since then, ASU has reinvented itself, following a conceptual model, which later was named the "**New American University**". The NAU breaks with elitist higher education and with research that only strives for academic impact. It puts forward a view on higher education embedded into human life courses and into society. Assuming that the chance to learn and to earn an academic degree can make a difference to a life and that academically produced knowledge can make a difference to society, the proponents of the New

American University argue that state-owned universities must adopt new rationales and ways of working, which put these embedded views on teaching and research at the center (Crow and Dabars 2015a, 2015b).

In 2014, the ASU Charter was coined with the following words:

"ASU is a comprehensive public research university, measured not by whom we exclude, but rather by whom we include and how they succeed; advancing research and discovery of public value; and assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves."

Accessibility, complemented by creativity, excellence, innovation and impact are integral to ASU's mission. The narrative highlights in particular the core role of inclusion. As Michael Crow puts it:

"Accessibility is by no means the sole dimension to the New American University model, nor the exclusive focus of our book. But inasmuch as access to knowledge underpins every societal objective in a pluralistic democracy, accessibility is at the core of the reconceptualisation of Arizona State University (ASU), which represents the foundational prototype for the New American University." (Crow and Dabars 2015b: 60)

Eight institutional objectives, so-called "design aspirations", guide the university's ongoing evolution [see 2.2.3]. A set of goals and correspondent qualitative and quantitative indicators supports the operationalization of the vision. ASU's goals follow partly classical higher education orientations such as top placements in academic rankings, but to a larger part they reflect the novelty of ASU's approach, for example as regards the diversity of the student body, interdisciplinarity of research and the social value of ASU.



For the period of 2015-2020, selected goals/ indicators are (see ASU 2015b):

- Demonstrate leadership in academic excellence and accessibility
 - o Maintain university accessibility to match Arizona's socioeconomic diversity
 - o Improve freshmen persistence to 90%
 - o Enhance university graduation rate to 75%-80% and 25,000 graduates
- Establish national standing in academic quality and impact of colleges and schools in every field
 - o Attain national standing in academic quality for each college & school (top 5-10% for each college)
 - o Attain national standing in the learning value-added to our graduates in each college & school
 - o Become the leading university academically (faculty, discovery, research, creativity) in at least one department or school within each college & school
- Establish ASU as a global center for interdisciplinary research, discovery and development by 2020
 - o Become a leading global center for interdisciplinary scholarship, discovery and development
 - o Become a leading American center for discovery and scholarship in the social sciences, arts and humanities
 - o Enhance research competitiveness to more than \$700 million in annual research expenditures
- Enhance our local impact and social embeddedness
 - o Provide Arizona with an interactive network of teaching, learning and discovery resources that reflects the scope of ASU's comprehensive research enterprise
 - o Develop solutions to real-life challenges (Ex. Reducing the Urban Heat Island Index and improving long-term air quality in metropolitan Phoenix)
 - o Increase the number of qualified K-12 teachers by 25% and develop a tool for teachers and administrators to evaluate educational performance and outcomes

President Crow has reportedly proven excellent talent in communicating his ideas and engaging people to join him in his vision of ASU. An uncounted number of faculty and staff members share his vision and work towards making it reality in their operational and

strategic work. The importance of leadership, engaged communication and a change in attitudes are undoubtedly important aspects of the transformation process. At the same time, this would not have worked without an enormous financial investment (and in particular the acquisition of new sources of funding and an increasing need to operate highly cost-effective given shrinking public budgets), essential structural changes in the organization and in the internal performance measurement and reward system, as well as a partly painful exchange of about 1.800 faculty and staff who felt they were less committed to this organizational transformation path (Randles 2015).

Sustainability is another relevant rationale pushed by ASU. Although highly compatible with the New American University mission and the eight design aspirations, sustainability efforts are communicated separately, but include relevant linkages to the eight design aspirations of the New American University. ASU's Global Institute of Sustainability is the hub of the university's sustainability initiatives. The strategic plan for sustainability practices and operations (ASU 2011) outlines four overarching goals: (1) carbon neutrality (see also the action plan, ASU 2010), (2) zero solid/ water waste, (3) active engagement and (4) principled practice. The operationalization of the strategic plan, in particular the list of measures and the formulation of sub-goals and of ways how to achieve them, give an idea of the fact that sustainability at ASU is far from being rhetoric. The chapter about "translation into practice" below will give examples how ASU works to spread the idea of sustainability to its whole community of students, faculty, staff and numerous community partners. In principle, with the sustainability plan, ASU has formulated its ambition to make sustainability a central aspect of its teaching, research and community engagement.

At individual level

The **normative orientations** presented by the university leadership and consistently repeated and reinforced throughout the past years are shared by ASU faculty and staff. Randles (2015) found in her case study of ASU's transformational journey high consistency among interview partners in explaining ASU's mission. In this study and in our interview study, we find interview partners from ASU faculty and staff consciously reflecting their personal normative orientations and ASU's vision and mission. Individual values and understanding of acting responsibly are highly consistent with organizational orientations.

“I see different aspects of it. So, one: scientific responsibility or responsibility in research means [...] – and I speak not just for myself, I mean as a whole research group – being as thorough an investigator as possible, always communicating to others the most honest and truest story that we are able to do about research – even if it doesn’t get us into the highest impact journal or sound the most exciting. [...] Being a responsible teacher, that’s of course a really critical part of my job, I think it means, being consistent with ASU’s mission. I am really 100% behind president Crow when he talks about us as a university seeing our value as the difference between students walking in the door and students walking out of the door. That’s our value-added, right? So, part of the responsibility as an instructor is being accepting of all the students who walk in the door and seeing my job to give them as much information and prepare them as best as I can before they walk out of the door. [...] And then, there is other things, responsibility in terms of culture, which could be the departmental culture, it could be the culture of my research group and largely said that it could be the culture of my classroom [...] and I think in all of those cases the culture should be one of inclusiveness. Again, this is an ASU core mission, which nobody forces me to do it. It’s easy to go behind these values. So a culture of inclusiveness, of open dialogue, one which nobody feels hesitant to speak, one in which we foster creativity and one we are creating an environment in which everybody feels they participate and they have something to add. So, I could think of others, but these are some ways I think I do act responsibly. [...] I would not say as a general rule that the position of professor requires you to do work which is relevant for or needed by society. However, to be a professor as ASU automatically sweeps you up into doing that.”

“The way that I think about responsible research and innovation is, it’s this impetus to frame your question with multiple time horizons, right? So, you’ve got your immediate research outcome what your statistics show you, but then trying to think through, so if I project this outcome, what’s going to be the impact in five years? What’s going to be the impact in ten years? So, that broader time horizon, but also a broader impact horizon, so to think about the impact of a research question on a broader socio-technical system [...].”

Next to normative orientations, organization theories³¹ find **individual entrepreneurs** to be highly relevant if not the most important drivers of change. ASU offers rich empirical evidence for this statement through the leadership qualities of its president and in the intentional promotion of individual level changemaking – including students, faculty and staff.

During the first round of interviews we found most of our interview partners, faculty as well as staff, showing a high ability to transfer organisaitonal-level goals to their own working context and to define their individual contribution to the overall mission.

Randles, in her ealier study of ASU (Randles 2015), notes the same observation about her interviews with principal investigators (PIs). However, she notes that this does not apply to all ASU faculty.

"The ASU study finds that the Principal Investigator, or PI, locates at a particularly important level within the University, for intermediating the normative orientations of the University, articulated by the university leadership, and their enactment in terms of translating those normative steers to local context and bottom-up enacting them as entrepreneurial responses.

However not all the faculty interviewed at the Principal Investigator level interviewed for this study shared either these motivations or capabilities. The Principal Investigator is therefore found to be a differentiated actor, some maintain legacy characteristics of the model of the traditionl university, whilst others illustrate a set of characteristics which below I disentangle as the motivations and capabilities of the *Ambidextrous PI*." (Randles 2015, p. 21).

The Dean of a large School reflected during the JERRI interview on the issue and considered it to be a realistic and a functional model to work with such a differentiated spectrum among PI orientations – however, he added that embedding more creative

31 This refers for example to Randles' (2015) analysis of ASU's transformational journey. She highlights four cornerstones of the theoretical construct of the "Normative Business Model" (Randles and Laasch 2015). Normative orientations and institutional entrepreneurialism are in this model two of the explaining factors next to (de)institutionalization processes, such as organizational reforms and new governance mechanisms, which both will be discussed in the following chapters.

thinking and interest in transformational research in faculty mainly works through hiring – a costly and lengthy process:

"We have limited amounts to hire people. I have 200 faculty members. If there are 30 of them that are committed to think creatively about their research, we really need 50 or 60. We don't need all 200, we really need 50 or 60, and that is going to take 5 or 10 years."

2.2.3. Appraisal of the RRI concept

Responsible Research and Innovation (RRI) is not a term or concept referred to at ASU. However, the notions of responsible science or responsible innovation appear in various contexts.

The ASU **Charter** refers explicitly to responsibility for the description of its "third mission", next to its education and research missions. However, ASU has expressed many times, that it strives for an integrated view on its missions. So, when the charter reads: "ASU is [...] assuming fundamental responsibility for the economic, social, cultural and overall health of the communities it serves," this means that the university seeks to serve the communities in all its activities.

The term "**responsible innovation**" is being used in external presentation, e.g. in a presentation by president Crow (ASU 2016b: 27). There, it links to transdisciplinary research in general and to the School for the Future of Innovation in Society in particular. The most important thing about the school is according to Michael Crow that people there are thinking differently and thus can help to bring about a whole new way of ideas and innovation.

The school has been established against the background of the **Center for Nanotechnology in Society** (CNS), which was established at ASU in 2005 under the roof of the National Nanotechnology Initiative (NNI). The rationale of the NNI for funding two such centers³² in the US originates from **ELSI** – ethical, legal and societal issues of emerging technologies (or ELSA in Europe, A for aspects), an approach that was coined at the end of the 1980ies in the US in the course of the Human Genome Project. ELSI/ELSA programs have appeared since then around the globe in the wake of funding measures that support the development of emerging technologies.

³² The other center is located at the University of California Santa Barbara. See <https://www.nano.gov/you/ethical-legal-issues>

"The purpose [of ELSA] has been to provide a knowledge base for developing emerging science and technologies in a responsible way and with an awareness of the ethical, legal and social aspects and impacts of such developments. ELSA studies have bordered on, and to an increasing extent included, Science and Technology Studies (STS), with a broader social and cultural perspective on the relation between science, technology and society." (Forsberg 2015)

From this perspective, RRI is a more practice-oriented approach and moreover integrating more dimensions as ELSI/ ELSA does (e.g. gender or open access). The concept and the European discussion are known to a few key faculty members of the Center for Nanotechnology in Society (CNS) and the respective School for the Future of Innovation in Society. There is academic exchange and ASU faculty is involved in European-funded research projects on RRI such as JERRI.

In line with the ELSI tradition, and hence different from the RRI approach, CNS has defined two major goals for its work: "The guiding conceptual goals of CNS-ASU are two-fold: to increase reflexivity within nanotechnology research and to increase society's capacity to engage in anticipatory governance of nanotechnology and other emerging technologies."³³ To this end, CNS has focussed in the course of its research activities on a broad range of engagement activities, such as training an interdisciplinary community of scholars, engaging the public, policy-makers, business leaders and researchers in dialogues, partner with cutting-edge laboratories to cultivate reflexivity, and engage in foresight activities to increase awareness for alternative future developments.

There is a third example of the appraisal of RRI, which is part of ASU's research integrity policy. This policy is not explicitly linked to ASU's mission, but it operates like RRI based on a pre-emptive understanding rather than mitigating unwanted consequences. One feature of this policy is **responsible conduct in research** (RCR), which is an ethical training following requirements by the National Science Foundation (NSF). US universities and research institutes have some degrees of freedom in the way they implement the NSF requirements. ASU in that case takes a specific approach by requiring researchers to complete it regardless of the sponsor. It is designed in different phases and uses different instruments for training for undergraduates, graduate students

³³ See CNS webpage at <http://cns.asu.edu/about>.

and postdoctoral researchers, to make sure that all people involved in research activities at ASU have an understanding of RCR.

One of the big questions of RRI in Europe is that the concept entails normativity. RRI can be understood as a set of principles for research and innovation processes, however, ultimately these processes shall help to align R&I with (future) societal needs. It has often been acknowledged that there must be a basic **shared understanding** among R&I actors about this **direction**, and this understanding must be more specific than an agreement to meta-level goals such as sustainability or inclusiveness (e.g. Lindner et al. 2016). RRI governance which assists the search for direction and achieving shared understanding among diverse actors is perhaps the most complicated thing about RRI. On the one hand, ASU has addressed this dilemma and tries to make a virtue out of it by allowing explicitly all university units to find their own interpretations of the ASU mission and design aspirations and address the overarching goals based on each unit's strengths. On the other hand, past the first years of **sustainability** efforts, ASU has found it to be a weakness that it has not settled (yet) on a single organizational definition of sustainability and that there are many competing values in the community of stakeholders (ASU 2011, p. 26).

The operationalization of European RRI into **five key dimensions** is not known at ASU. In the interviews at ASU, often clear linkages between ASU's mission and some of the RRI keys appeared. Regularly, these were "Science Education" and "Engagement". There are also efforts at ASU regarding ethics (see above, RCR) gender and open access, however these are not linked explicitly to ASU's mission (see also below, chapter 2.2.5). The following table displays ASU's eight design aspirations, which serves as principles or virtues of the transformational journey. As such, they are not directly comparable with the European RRI keys, which are rather themes or fields of action. Nevertheless, the table indicates for each design aspiration the relevant RRI key words in order to give a quick overview of the appraisal of RRI at a more operational level.

Table 2: ASU's design principles and the appraisal of RRI keys

ASU's design aspirations	Linkages to RRI keys
Leverage Our Place ASU embraces its cultural, socioeconomic and physical setting.	Sustainability and social inclusion (in the metropolitan region of Phoenix, the state of Arizona and the Southwest).
Transform Society ASU catalyses social change by being connected to social needs.	Responsibility for societal well-being by way of science education: main themes are educating teachers for the region and advancing learning and teaching methods.
Value Entrepreneurship ASU uses its knowledge and encourages innovation.	Innovation for social development and economic competitiveness. Establishing a culture of entrepreneurship among faculty staff and students (including science education and engagement activities and innovation support structures).
Conduct Use-Inspired Research ASU research has purpose and impact.	Balance basic research with research focusing on actual and immediate problems – this includes many engagement activities with the communities ASU serves.
Enable Student Success ASU is committed to the success of each unique student.	Science Education: main activities focus on seamless transfer of students from community colleges to university (i.e. engagement with community colleges) and on freshman persistence.
Fuse Intellectual Disciplines ASU creates knowledge by transcending academic disciplines.	Reorganization of academic units, with the aim to design the new entities around questions of societal relevance, e.g. the School of Human Evolution and Social Change, the School for the Future of Innovation in Society (→ Science Education).
Be Socially Embedded ASU connects with communities through mutually beneficial partnerships.	Many different forms of engagement and amplifying impact for society.
Engage Globally ASU engages with people and issues locally, nationally and internationally.	Transcultural teaching and collaboration with academy, business and industry, society and governments worldwide (Engagement and Science Education, see also portal for massive online education "ASU Online").

2.2.4. Translation into practice: Issues of institutionalization

JERRI builds on a set of four conceptual insights about institutionalization of responsible research and innovation, which have been distilled from the literature and discussed in Randles 2017. This report has touched upon them in various ways already. In this chapter, we will report relevant indicators for ASU roughly along these four lines and analyse the institutionalization process. In the end of this chapter, success factors and challenges to institutionalizing responsible action at ASU are summarized.

Building legitimacy for transformation

The first dimension of institutionalization processes is according to Randles (2017, p. 27) a historical process, in the course of which new rationales of acting responsibly start to spread within the organization and its environment. They do not replace existing rationales but rather come along. In a longer period of time legitimacy must be built for these new rationales.

In the case of ASU, this chapter has shown that the beginning of this historical process can be dated to the time when Michael Crow took the helm as ASU president. An important external source of legitimacy for his vision of the New American University (NAU, see chapters 2.2.2 and 2.2.3) was the new strategy of ABOR for Arizona's higher education. Along with this came recurrent public budgets in the course of the financial crisis. Together, this created the need to remarkably scaling up numbers of student enrollments and degrees and at the same time to deliver education in a highly efficient manner. To make ASU an attractive place both for students and faculty and to make the inclusiveness promises of the NAU strategy a success, ASU engaged in an enormous growth and excellence strategy. It launched (and is successfully on track with) a research budget growth, which mainly builds on new sources of funding (e.g. from corporate and community partners) and on large-scale projects. This allowed to heavily invest in building and technology infrastructure along the so-called Comprehensive Development Plan (ASU 2013, p. 49, ASU 2015a, pp. 49, 57). It also allowed to hire new and excellent faculty and to develop new teaching and learning techniques as well as to engage in a massive online education program (ASU 2015a, p. 24ff.).

Success reports such as "Is College Worth It" (ASU 2015c) or the "Impact Phoenix report" (ASU 2014b) show clearly the economic benefit for the region of Phoenix and the state of Arizona and help to further build legitimacy for the strategy and the still ongoing transformation process.

Maturation processes: everyday practice, organizational change, and new incentive structures

In our working definition, we have defined the institutionalization of RRI as making RRI an integral part of the practices of an organization. Hence, everyday practices are central indicators for the maturation of institutionalization. Normally, they are strongly linked to organizational change or changes in the incentives structures.

ASU has undertaken remarkable organizational change. Many academic and research units are now operating in a transdisciplinary way and are oriented towards societal challenges. For example, there is a growing number of sustainability related programs and also a growing number of enrollments in these programs.

“In the course of a decade, ASU reconstituted its curriculum, organization, and operations through a deliberate design process undertaken to build an institution committed to the pursuit of discovery and knowledge production, broad socioeconomic inclusiveness, and maximization of societal impact. The academic community has been consciously engaged in an effort to accelerate a process of institutional evolution that might otherwise have proceeded, at best, only incrementally, or possibly in the face of crisis.” (Crow and Dabars 2015b, p. 60).

Central university administration has partly been reorganized to do away with hierarchical steering of the academic units and to put in place a network type of structure where central units acts as facilitators and amplifiers (see also chapter 2.2.1). In the JERRI interview, the director of social embeddedness reports about how this works in practice:

“My role is to explore this broad landscape of engagement and to understand how ASU is fulfilling our commitment as an institution. At a university with 83k+ students and 8 sites, it's a bit of a fool's errand to track everything. The better we are doing this, the harder it should be comprehensively capture all of these organic engagements and partnerships because they don't have to receive any authorisation to partner or engage. However, I do conduct a VERY large annual survey to capture these activities from each college/school. In doing so, I notice exemplary initiatives and interesting models of engagement emerging from each unit.”

This is not without effect. The annual survey often requires faculty to think about their activities from a different point of view, and to reflect about what is engagement and how they perform engagement activities. More importantly, they get an idea that relationships can be established between their activities and others at ASU. Often, they hear for the first time about similar activities in other parts of ASU and can start a fruitful exchange. By asking questions and bringing in new points of view, the role of central administration staff can be called a “Chief Disruptive Officer” (see Annex III).

For the university to accomplish its mission, this means at the level of individual faculty (and also staff) members that expectations of performance have significantly grown over the past years, with new performance indicators rather being added to than replacing the classical ones. For example, there are now Sustainability Criteria:

“ASU is the first university to integrate sustainability criteria into its staff evaluation program. All employees are evaluated on their contribution to our sustainability efforts.” (ASU 2011, p. 42)

The operationalization of ASU's mission along the eight design aspirations has resulted in numerous dedicated activities, of which this report can only give a small, but illustrative account.

- The Center for Nanotechnology in Society (CNS) and the School for the Future of Innovation in Society are actively breaking up with disciplinary “silo” thinking in various courses for undergraduate, graduate and PhD students. Moreover, activities such as Socio-technical Integration Research (STIR) stretch this out to faculty, mostly outside ASU, but the same thinking is also applied within ASU. STIR is an activity which embeds social sciences and humanities researchers for 12 weeks in laboratories to engage with scientists and engineers and ask questions about the societal relevance of the research activities. The objective is to enhance mutual benefit from cross-disciplinary communication and to feed reflexive capabilities about societal relevance and responsible research and innovation (see also Annex III). Socio-technical integration basically builds on similar ideas like that of the “Chief Disruptive Officer” (see Annex III).
- ASU's commitment to partnerships and outreach programs is part of the definition of “social embeddedness”, e.g. Civil Dialog series is a public dialog to build bridges across polarized viewpoints; the Social Embeddedness report 2016 lists a large numbers of challenges which are tackled by ASU work, e.g. at-risk youth and child safety, environment and sustainability, immigration. A lot

of embedding activities are delivered by students as part of their practice-oriented curriculum with the aim to cultivate civically engaged students (ASU 2016c, see also Annex III for the Mutual Discovery Model).

- Education plays an important role and there are very strong linkages to research and innovation. The varieties of community engagement are fascinating, in particular the pathways-model to higher education for underserved populations and the approach to offer access to higher education along the whole continuum of education (ASU 2016c, p. 12ff.).
- However, there are also examples at ASU of engaging citizens differently in research processes, realizing co-creation and empowerment of citizens (e.g. "Future escapes" at the Center for Nanotechnology in Society, see also Annex III).
- ASU is committed to innovation by creating a culture of entrepreneurship among faculty, students and in the "pipeline" of potential students. "Design thinking" is one approach which is offered in various courses and trainings for these different target groups. Design thinking is a technique for creative problem-solving and prototyping innovative solutions.³⁴
- ASU's sustainability efforts embrace all fields of activity of the university: the School for Sustainability offers a set of interdisciplinary degree and trainings, for example as a part of the teacher education; the Julie Ann Wrigley Global Institute for Sustainability conducts use-inspired research and cooperates with partners to develop solutions for sustainability challenges; outreach partnerships and events on local, national and global basis engage individuals and communities in dialogs and projects, for example the Decision Center for a Desert City; and finally ASU has committed to sustainable operations and practices in its sustainability plan (ASU 2011, 2012, 2015d).

Systemic "overflowing"

Randles (2017, p. 29) describes the systemic "overflowing" character of "deep institutionalized" forms of responsibility as a set of virtues that characterize the ecosystem in which an organization operates, i.e. a mutual understanding, shared norms or governance instruments that characterizes partnerships. The existence of boundary

³⁴ See for example https://lodestar.asu.edu/conference_workshop/conf2016/206, last checked on 13.08.2017.



Fraunhofer



spanners which help connect different cognitive frameworks in professional networks is another indicator for systemic “overflowing”.

ASU has managed to realize this overflow in the past 10-15 years by strategically building partnerships with donors, corporate and community partners, NGOs or other universities. Partnerships that generate mutual benefit are a central goal for example in all its social embeddedness activities. Many “professional” boundary spanners have been put in place such as the Skysong incubator and other service units facilitating entrepreneurship and innovation. Many functions in the university administration have been redefined, being practically now boundary spanners as well (see above the description of the Director of Social Embeddedness). Moreover, ASU has decentralised this task to its faculty members, now requiring them not only to teach and research but to link their operations with ASU’s mission and contribute to its societal impact.

External environment

Important developments in the external environment create pressure for change. ASU has started its transformation process in 2002, partly responding to external developments, such as the exclusive and elitist approach of many leading US higher education institutions (Crow and Dabars 2015a, Randles 2015), partly anticipating them such as the changing expectations of the government of the State of Arizona, which created a highly competitive framework among Arizona’s higher education institutions as regards student numbers and degree awards (ASU 2013). ASU’s location in a desert region and its enormous growth in terms of new buildings and on-site community created challenges which ASU has started to proactively address by its sustainability efforts.

Summarizing the analysis in this chapter on issues of institutionalization, we identify the following success factors and challenges for ASU:

Success factors

- The normative re-orientation has been driven by a high commitment of the university leadership and has been legitimized by a new business model that flooded millions of additional research dollars into ASU's pocket as well as by a clear (number-driven) communication showing the benefits of the approach.
- Maturation processes are taking place, in particular the organizational redesign, new incentives, a consistent communication to support high degrees of shared understanding and cultural change (e.g. entrepreneurial spirit).
- Much has been invested in the systemic "overflowing" character: ASU explicitly engages in achieving mutual understanding, mutual goals and mutual benefit with partners.
- This and many others aspects of change rest on the shoulders of institutional entrepreneurs, in particular decentrally, at the level of principal investigators (the so-called "ambidextrous PIs", Randles 2015).

Challenges

- Goal and incentive structures have not totally been replaced, rather expanded, so there are classical higher education goals and New American University goals simultaneously in place – partly producing high pressure on individual faculty members.
- Shared understanding remains often at the surface, with central terms rather serving as umbrellas for a diverse set of activities. ASU has acknowledged this as a weakness in the context of its sustainability efforts.
- Radical de-institutionalization and re-orientation required about 1.800 faculty members to leave ASU throughout the years – a partly very painful process (Randles 2015).
- Not all merger decisions originated in the bigger idea of leveraging transdisciplinary creativity. Some schools were simply merged for the sake of efficiency in the wake of the 2008 financial crisis. This resulted in slow adaptation to these new structures, which took sometimes a couple of years.

- Understanding is not shared in all schools equally, some still being in their "old" organizational shape and hardly involved in engagement activities or integrated approaches based on the design aspirations.

2.2.5. Potential links to the EU RRI approach

Table 3 below summarises the ASU case study from the point of view of RRI as it is operationalised in EU's H2020 program. It displays information which has been presented in this case study about ASU's mission and activities. Looking at it from the European "RRI lens", the focus of ASU's actions is in the key dimensions of science education and engagement.

Moreover, ASU is also active in the fields of ethics, gender equality and open access, although the rationale for these activities does not originate in ASU's mission. The table summarizes information about Ethics, in particular the Responsible Conduct in Research (RCR) training, which has been introduced in chapter 2.2.3. Finally, the table adds some information and examples about gender equality and open access policies and activities at ASU. They are not discussed in depth in this chapter, as in both fields, discussions at ASU and in Europe seem to focus currently on different aspects: gender-sensitive R&I as well as open science or open data are hardly addressed by current efforts at ASU.

Table 3: Summary of main findings about RRI-related issues and good practices at ASU

RRI key	Rationale / Definition at ASU	Key words	Good practice (selected)
Science Education	– ASU focuses on all levels of tertiary education, undergraduate, graduate and PhD students with the aim to - scaling up the number of student enrollments with a particular focus on socially disadvantaged groups; - ensuring high quality education (which is at the same time more efficient) by employing technology and being innovative in new teaching and learning methodologies; - fusing intellectual disciplines by offering interdisciplinary degrees and encouraging graduate students in taking courses in other schools; - cultivating civically engaged students and student level changemaking – There is also a strong commitment to earlier phases of education by way of teacher education and by engaging in a broad number of projects with elementary education in the region.	– Accessibility / Inclusion – Excellence – Fuse intellectual disciplines – Reflexivity – Social value – Transform Society – Value Entrepreneurship	– Socio-technical integration (STIR), see Annex 3 – Recruitment and access programs, financial aid and mentoring – ASU Online (Campus)

RRI key	Rationale / Definition at ASU	Key words	Good practice (selected)
Engagement	– ASU's commitment to partnerships and outreach programs is part of the definition of "social embeddedness", mutually beneficial partnerships at local, regional, national and international level. – The ambition to engage non-academic actors in research processes is not made as explicit as it is in Europe. "Use-inspired research" means for ASU problem-driven research and the ambition focuses on treating use-inspired research at eye level with basic research. This may include (but not necessarily) collaboration with business and industry and other users of knowledge.	– Social embeddedness – Mutual benefit – Social value – Integration with teaching and (partly with) research activities – Use-inspired research – Local/ regional engagement, but also national and global. – Addressing diversity – Inclusion – Sustainability	– Futurescape, see Annex 3 – Engaging external partners – decentrally – facilitated by internal network structure, instead of hierarchical organization, see "Chief Disruptive Officer", Annex 2 – Mutual discovery model, see Annex 3
Ethics	– Research integrity policy implementing federal state and university regulations governing research. – ASU is rolling RCR training regardless of sponsor.	– Animal care, biosafety, involvement of human subjects, responsible conduct in research (RCR), objectivity in research, security and exports control, and scientific diving.	– Responsible conduct in research (RCR) is an ethical training following requirements by the National Science Foundation (NSF), see Annex 3.
Gender Equality	– Gender policies are closely linked to diversity policies at ASU. The commitment to inclusion and diversity in the student body is central to this policy. – Most important topics in gender policy and activities are (research) career opportunities for women.	– Diversity, Inclusion – (Research) career opportunities – Dual career support.	– The Faculty Women Association provides career development, networking opportunities and an award for outstanding faculty mentors.

RRI key	Rationale / Definition at ASU	Key words	Good practice (selected)
Open Access	– ASU supports Green Open Access by its Digital Repository (including data). – There is also support for Gold Open Access through a number of memberships with open access publishers. – Open access activities are linked to the ethical principle of information being unchained, but they are not explicitly linked to the mission of ASU.	– Green Open Access – Gold Open Access – The main target group of the repository is the research community. – Unchained access to information.	

3 Conclusion

This report has given insights on a global rri “cosmos”, where rri stands for de-facto responsible research and innovation as opposed to Responsible Research and Innovation (RRI) as it is coined by the European Commission in Horizon2020. ASU and CAS operate based on rationales which increasingly respond to new understandings of responsibility, and for both organizations this means a new or adapted conceptualisation of their roles within society and their linkages to society. In their operations however, there is no reference to the five key fields of action as in the European approach. Dominant fields of action of this de-facto rri include for CAS science popularization, societal responsibility of scientists and open access. ASU operationalizes its activities along eight design aspirations, which are “Leverage our place”, “Transform society”, “Value Entrepreneurship”, “Conduct use-inspired research”, “Enable student success”, “Fuse intellectual disciplines”, “Be socially embedded”, and “Engage globally” with a priority on accessibility to a diverse student body.

Both, CAS and ASU have developed new practices in response to changing rationales (see also Annex III for good practices), and both show evidence of “deep institutionalization” as the maturation process has also touched upon organizational design or incentive structures. Organizational change was smaller than at CAS, where new units were added to the Institute for Policy and Management (IPM). At ASU in contrast this meant a rigorous re-organization of a large number of academic and research units into transdisciplinary schools and centers.

For both institutions external requirements were a driving force. A new legal framework required CAS to commit to science popularization, while the state of Arizona developed a new strategic approach to higher education, which meant for ASU to significantly increase the number of enrollments. At the same time, both institutions have committed pro-actively to other developments such as open access (CAS) or sustainability (ASU).

Change processes need institutional entrepreneurship. We find this in both international examples in the leadership of the organizations, which has a central role in engaging the organization for change, in particular through consistent communication of the narrative that provides legitimacy for change. However, in China catch-up processes in science performance are a central motive for policy makers, and top-level policy makers at the ministries prioritize this over science-society-relations.

As both organizations are large and complex, institutional entrepreneurship is also needed decentrally at lower levels of hierarchy in the organization. There are manifold examples of “ambidextrous PIs” at ASU, who are able to deal with a large set of different performance criteria. Also, at CAS, senior level academicians are acting as multipliers of new understandings of responsibility. However, it has also become clear that there are a number of units in both organizations, where thinking and operations hardly have been touched by de-facto rri developments. This is in particular the case for units which perform mainly theoretical (basic) research. We will try to advance our knowledge about these units at CAS and ASU in the second phase of the case study.

In both organizations we find boundary spanners, who connect units within the organization and outside the organization with different cognitive frameworks. In CAS, this is the Institute for Policy and Management (IPM), however, outside IPM, many researchers seem to be concerned about science popularization and civil participation. At ASU boundary spanning is fulfilled by several central service units and has at the same time proliferated to the PI level – at least in the interdisciplinary schools and research centers.

Individual level capabilities are certainly as important as organizational capabilities. We find at ASU and CAS a high differentiation of individual orientations and responsibility conceptualisations. This is certainly a logical consequence of the fact that in particular principal investigators are confronted with a diverse set of performance requirements in particular at times, when existing rationales of an organization co-exist with new understandings which rather add to the organizational self-conceptualisation than replace it. Nevertheless, the new rri-type narratives are shared by many in the organizations. However, we also find that still after several years of evolution, shared understanding remains often at the surface. Central terms rather serve as umbrellas for a diverse set of activities. In the context of its sustainability efforts ASU has acknowledged this as a weakness. In the second phase of our case studies, we will further investigate whether there are remarkable exceptions to this finding and how in these cases mutual understanding has been established.

By broadening perspectives towards a global rri "cosmos" the JERRI partners and target groups may benefit from these results in various ways. For the subsequent participatory development of goals in the rri-subfields related to the "RRI dimensions" (Work Packages

2 and 3) in particular, Fraunhofer and TNO will benefit from the results both at the procedural and conceptual level.

At the procedural level, it turned out that discussions and negotiations around responsibility goals can hardly be separated from the levers and barriers of institutionalization. The rich and detailed experience of success factors and challenges for institutionalization in the CAS and ASU chapters are transferable to the situations of Fraunhofer and TNO. Moreover, as "governance virtues", such as organizational re-design, new incentive structures or new integrative practices proved to be effective for ASU and CAS, goal development workshops of TNO and Fraunhofer may make efforts to discuss governance issues. As governance is context-sensitive, European institutions might want to employ European good practices, such as the governance categories presented in the Res-AGorA Responsibility Navigator.

At the level of rri conceptualisations, results may open up perspectives beyond the official EC definition fragmented into five RRI dimensions, thereby helping to set individual and organization-specific emphases of "what should be reached". In particular, concepts such as "empowering citizens", "open science" and "social value" can help to shape the discussions around common values underlying specific goals for the institutionalization of rri. Not least, existing rationales and long-standing experience in rri-relevant fields are the points of departure for both, Fraunhofer and TNO. In that respect, CAS and ASU developments are similar to them, and their experiences and good practices after at least a decade of change might provide inspirational sources for Fraunhofer and TNO.

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ABBREVIATIONS

ABOR	Arizona Board of Regents
ASU	Arizona State University
AzTE	Arizona Technology Enterprise
BMC	BioMed Central
CAE	Chinese Academy of Engineering
CAS	Chinese Academy of Sciences
CASAD	Academic Divisions of the Chinese Academy of Sciences
CAST	Chinese Association of Science and Technology
CNIC	Computer Network Information Centre
CNS	Center for Nanotechnology in Society
DFG	Deutsche Forschungsgemeinschaft
E&I	Entrepreneurship and Innovation
ELSI	Ethical, Legal and Social Implications issues
FhG	Fraunhofer-Gesellschaft
Fraunhofer ISI	Fraunhofer Institute for Systems and Innovation Research
GRC	Global Research Council
IPM	Institute of Policy and Management
IR	Institutional repositories
JERRI	Acronym for the project Joining Efforts for Responsible Research and Innovation
MIT	Massachusetts Institute of Technology
MOE	Ministry of Education
MOST	Ministry of Science and Technology



NAU	New American University
NSF	National Science Foundation
NSFC	Natural Science Foundation of China
NSL	National Science Library (at CAS)
NSTL	National Science and Technology Libraries (China)
OA	Open acces
PE	Public engagement
PI	principial investigator
R&I	Research and Innovation
RCR	Responsible conduct in research
RRI	Responsible Research and Innovation
S&T	Science and Technology
STS	Science, technology and society studies
TNO	the Netherlands Organisation for applied scientific research TNO
UCAS	Universities & Colleges Admissions Service
VSMC	Virtual Science Museums of China

ANNEX I

Interview Guideline

JERRI – Joining Efforts for Responsible Research and Innovation

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

Interview Guideline

Background information

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

In this first stage of the project we are organizing interviews within representatives from the Chinese Academy of Sciences (CAS) and Arizona State University (ASU) in order to enable bottom-up insights on the actual state of play of organizational orientations and practices which can be attributed to Responsible Research and Innovation. Your input is very valuable in order to understand how different practices are perceived and apprehended by stakeholders inside your organization.

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

Proposed interview structure and topics

Section 1 “The interviewee and its organizational context”

- Background, responsibility and tasks
- Understanding of what it means to ‘**act responsibly**’

Section 2 “De-facto responsible research and innovation”

- Discussion of individual understanding of responsibility in research and/ or innovation and consequences for own work

Section 3 “Responsible Research and Innovation (RRI)”

- Awareness of RRI terminology, discussion of different understandings of RRI in Europe as compared to other places in the world
- Rationales driving the practices of responsibility within [unit / department / institute / organization as a whole]

Section 4 “RRI practices”

- Information on existing RRI practices specific to the respective RRI key dimension, as defined by the European Commission (Ethics, Gender, Open Access, Societal Engagement or Science Education) plus other important RRI practices as defined by organization (e.g. with respect to sustainability, social inequality, e.g.)
- Influence of RRI practices on research planning (agenda), research practices and further processes at [unit / department / institute / organization as a whole]; plans for the next months and years
- Further units, departments, institutes or other levels of the organization particularly active in RRI practices

Section 5 “Issues for the realisation of RRI within organizations (“institutionalization”)

- Examples of successful realisation of RRI within attitudes and practices of the organization
- Reasons for success and for remaining challenges to a successful institutionalization
- Desirable further transformation(s) within organization and resources needed for this



Fraunhofer



ANNEX II

Minutes of the first international mutual learning workshop



**JERRI – Joining Efforts for Responsible Research and
Innovation**

**Minutes of
the 1st international mutual learning
workshop**

15 December 2016

Munich

Cheng Fan, Stephanie Daimer, Ana
Rasenescu, Benjamin Teufel, Ralf Lindner



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1 Introduction

The 1st international mutual learning workshop of JERRI took place on 15 December 2016 in Munich, Germany. As a leader of WP9, Fraunhofer ISI carried out the workshop with 19 participants. Two representatives of the JERRI international partner institutions, Chinese Academy of Sciences (CAS) and Arizona State University (ASU), as well as consortium members from Fraunhofer-Gesellschaft (FhG), Netherlands Organisation for Applied Scientific Research (TNO) and Institute for Advanced Studies (IHS), took part.

Within the JERRI project, FhG and TNO have the ambition to further develop their organisational structures and practices towards what is being phrased in Europe "Responsible Research and Innovation (RRI)". In this context, the work package called "International mutual learning process" (WP 9) carries out in-depth case studies of two outstanding organisations outside Europe. Both, the WP, and in particular its first workshop, are expected to benefit JERRI partners in the following aspects:

1. to be inspired by the international partners.
2. to broaden their understanding of RRI in general.
3. to broaden their understanding of one or more particular RRI themes/fields of action.
4. to get more insight into what it means to make RRI an integral part of the practices of an organization.
5. to share the good practices identified in Europe (in WP 1) and at the first stage of case studies outside Europe (in WP 9) with each other.

The overall objective of this workshop was to enable all participants to take home helpful ideas for further RRI development at their own organisations – in particular Fraunhofer and TNO, whose next steps in JERRI will be to develop ideas and input for RRI related visions and goals.

On this one-day workshop, the participants exchanged with each other in terms of their personal connection to the "RRI"-related topics at first. After that, the four institutions, FhG, TNO, CAS and ASU, introduced their organisations and the RRI-related understanding and practices. By means of a joint session, the RRI-related themes/fields of action were selected, clustered and prioritised. This result served as input for the following discussion in group work (see the agenda in the annex). In order to open up for a global perspective of "RRI", all of the RRI-related discussion at this workshop was inspired by the RRI defined by the European Commission, but not limited by that.



In order to embrace the full variety of responsibility, societal links and embeddedness of the research organisations FhG, TNO and CAS and Arizona State University, the working definition of RRI introduced at the workshop was: "RRI means to link research and innovation better with society. RRI approaches and practices are designed to increase mutual benefits of research and innovation – and society, both by underpinning better R&I processes and better R&I outcomes."

2 Main results

2.1 Round of Introductions

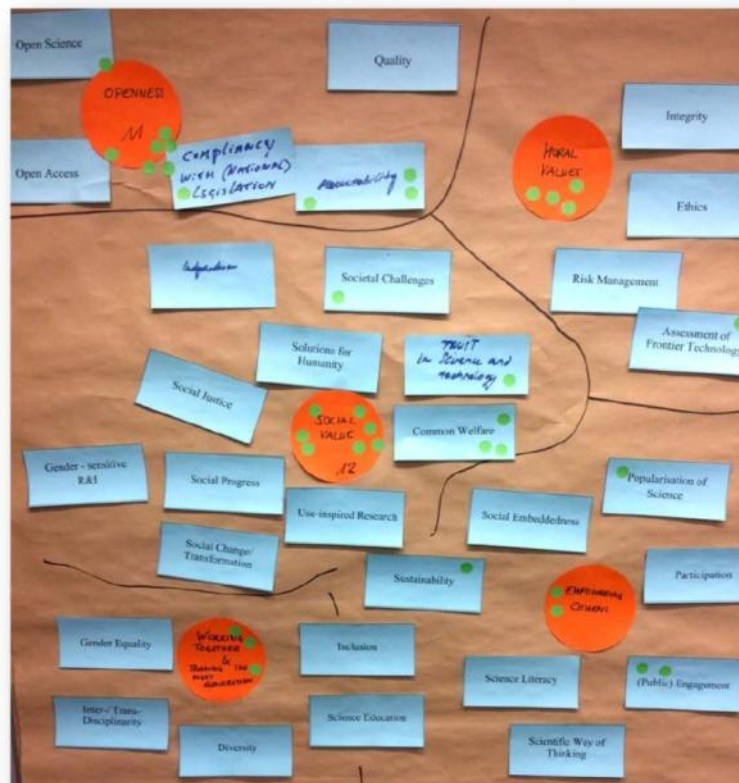
The first task in the JERRI workshop was to choose one term that describes best each participant's connection to the topic of the workshop. For this purpose, the project team provided the participants with several fields of action (resp. "themes") and quality criteria of RRI governance (resp. "virtues") regarding RRI to choose from or add to.

The following fields of actions (blue cards in the picture below) were selected by the participants: societal challenges, sustainability, science literacy, inclusion, open science, social change/ transformation, ethics, quality, participation, gender equality, social progress, open data, integrity, open access, social embeddedness, public engagement, RRI in general. Among the RRI virtues (yellow cards) participants selected reflexivity, adaptability, bridging between "silos", conflict moderation, responsiveness, openness, and diversity. **The most frequently mentioned terms were open access/open science, sustainability, ethics and reflexivity.**



2.2 Joint session

In a second step, a closer look was taken at different fields of actions, which are core to the four institutions' self understanding and mission. In presentations, representatives of the organisations highlighted how selected themes relate implicitly or explicitly to the RRI concept.



With the aim to return at the end of the morning session to a bird's eye view on RRI around the globe, the themes presented in the presentations and a complementary set of themes identified by JERRI research in and outside Europe were assembled to-



gether on a brown paper wall (see blue cards). This set was discussed and further amended by some dimensions (compliance with (national) legislation, accountability, independence and trust in S&T). There are strong links between many of these themes/ fields of action, and some even mean exactly the same thing while using different terms for it.

Building on the thematic links between the fields of actions, a pattern emerges, which we call a global RRI "cosmos". Five clusters (orange cards) were suggested:

- Social value
- Moral values
- Openness / Open Science
- Working together
- Empowering citizens

Participants were asked to vote for clusters or individual fields of actions that they wished to be discussed in more depth in the afternoon group work. From this voting the following three clusters were selected: **empowering citizens, open science and social value**.

2.3 Group Work

The group work focussed on the selected clusters or on relevant selected fields of action within these clusters. Discussions aimed at identifying levers and barriers towards a deep institutionalization of RRI in organisations, in particular at FhG and TNO. Groups were asked to reflect about similarities and differences of levers and barriers in the four organisations. The results reflect the opinions of the workshop participants and these should not be representative for the whole organisations, FhG and TNO, respectively.

A. Empowering Citizens

When discussing the "empowerment of citizens", participants primarily focused on **public engagement and participation** in the broader sense. It became clear quite quickly that the representatives of the organisations (FhG, TNO, ASU) in this group are confronted with very similar challenges and barriers.

Challenges refer mainly to the interface of science and society, which has been debated since more than thirty years. In the perspective of many researchers, the problem is up to science communication, as it appears that the public does not always understand what scientists, engineers and researchers are doing. The organisations are

often confronted with mixed responses to their publications. Therefore, it seems expedient to reflect on how to deal with these issues concerning the different spheres of science and society. The answer must be participation and public engagement. Another justification for the need of public engagement was to renew the "social license to operate", a term introduced by Arie Rip. The research organisations have to ask themselves what can be done to make sure that society supports their actions and to make convincing claims that the public funds provided to research organizations are well invested.

However, how to perform public engagement in a constructive way is very challenging. This depends on the organisation and the type of research and the phase of the innovation process. Besides, the question which parts of the public should be engaged has to be answered too.

Regarding possible solutions, in general, it was found out that the organisations are in desperate need of capacities at two levels: first, capabilities at the organizational level which enable the organizations to deal with these issues and to show that these matters are welcome, important and needed for the well-being of the organization; second, capabilities and skills at the level of the individual researchers.

Furthermore, it was observed that public engagement has become the "new science communication". What happens quite often is that public engagement is misused as a uni-directional type of marketing and public-relations strategy, instead of being a science-communication activity. The organisations should be prepared to deal with these kinds of abuses. On the practical side, it can be very helpful to identify already existing processes, procedures and activities in terms of public engagement that already exist in each organisation. Especially in the large organizations a lot is already happening. If the hierarchy of an organization is supportive, this can be a very good starting point to nourish the aim of public engagement.

Another good practice is to make available a pool of experts who are able to organize participation processes and who provide the skills and methodology for procedures that foster public engagement. There is plenty of information about public engagement available, but it has not been taken up by the organisations. The necessary public engagement expertise can be provided in-house or from external sources.

An important governance issue relates to the advisory boards of the research organisations. Increasing the level of diversity in these boards might be a good stepping stone to develop an improved understanding of the value of opening up to different perspec-

tives and different stakeholders, as well as to enhance the openness of an organization in general.

It was also stated that when public engagement is to be improved in the research organisations, funding rules might have to be modified. For instance, public engagement requirements could be part of research proposals. However there is a risk to that. It might remain on a very superficial level, in terms of relabeling the activities which might not change the practice and attitude.





B. Open Science

This group work concentrated on the differences between TNO and Fraunhofer in the context of open science, open access and open data. Although these two organizations share some similar barriers, like typical conditions of contract research, that sometimes don't allow results to be published, it was found that some obstacles are specific to the respective organisations.

Compared to TNO, it seems Fraunhofer researchers are less willing to support open access. An important reason for that is to be seen in the typical career paths of Fraunhofer scientific staff, who after fixed-term contracts often leave for positions in the industry, and some at universities. At TNO, most scientists have positions for life. Thus, Fraunhofer researchers are concerned on the one hand with the classical indicators that still dominate researcher performance measurement, both within Fraunhofer but also in the different scientific disciplines. On the other hand they need to do good project work in order to make their names known among the customers of their studies, who are at the same time potential future employers. Open access is against this background not the only – and often not the best – vehicle for that.

Besides the passive attitude towards OS/OA, some other barriers are for example, lack of the awareness of the possibilities and potentials of OS/OA, lack of time or interest to learn about OS/OA, lack of incentives to change their behaviours etc.

TNO faces as a major barrier the legislation in the Netherlands, because it causes many restrictions on publishing. The main question for them is if everything can be published.

Open data is also dealt with differently by Fraunhofer and TNO. TNO does see one very important lever: high demand by scientists. There are researchers who want to publish their data. They believe very strongly that this cooperation is the science of the future. However, this is a very young development in the Netherlands.

The greatest obstacle at Fraunhofer is the attitude of their scientists toward this issue, who are sceptical about open data. They are afraid that people might take advantage by freely using their data or misuse their work.

In total, there are some mechanisms set up already for the institutionalisation at both organisations: for instance, OA Strategy at Fraunhofer, OA Working group at TNO, different approaches of Fraunhofer IRB in promoting OS/OA.



C. Social Value

The third group concentrated on social value as a field of action. Members of Fraunhofer, TNO, ASU and CAS were involved in this group work.

Social value is a cross-cutting issue. First of all, the group came across the issue of empowerment. These four research organizations face various external pressures. They asked themselves about the room for manoeuvres and the degrees of freedom to

live up to their own, individual values, which may be opposed to some of these pressures. The issue how to foster the empowerment of researchers was raised.



Some levers they identified were to allow for some discretion and to enhance the freedom of expression within organisations. A practice that resolved from this point is creating space for reflexive discussion and argumentation, where people can detach and deliberate themselves from their initial roles and reflect on restrictions. This might break up exiting power-structures and increases the empowerment.

When it comes to CAS, the organisation is much more linked to the political executive functions. However there is less ambiguity about the value system, because there are



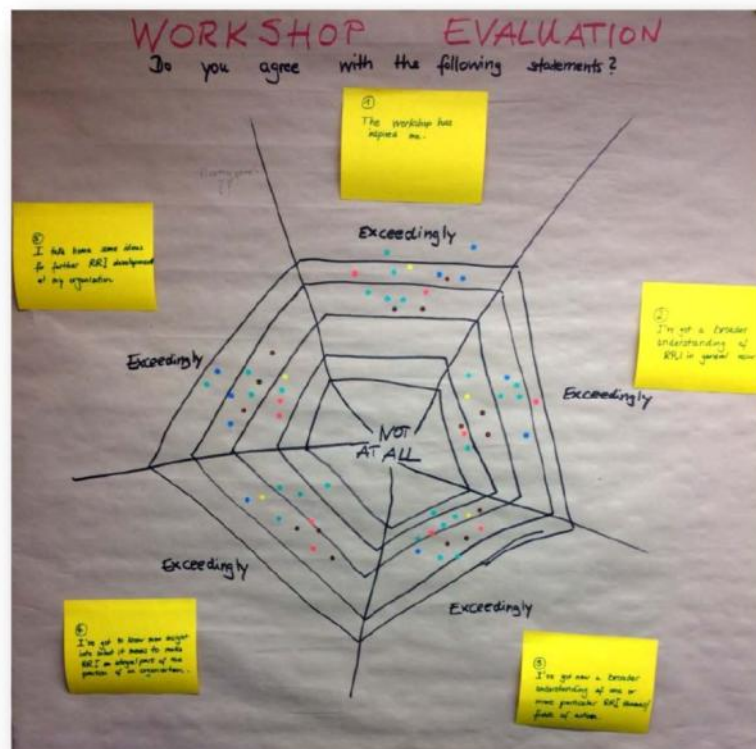
strong norms. Value systems are provided mostly top-down. On the other hand, due to the political executive functions of CAS there is the possibility to influence STI-policy. This brought the group to the question of how institutions like Fraunhofer and TNO can and must engage and the level of STI policy to empower their own researchers towards their institutional environment, so that they can live up to certain values.

2.4 Feedback

In the end of the workshop, all of the participants evaluated the workshop regarding the following five statements:

- This workshop has inspired me
- I've got a broader understanding of RRI in general
- I've got a broader understanding of one or more particular RRI themes / fields of action
- I've got to know more insight into what it means to institutionalize RRI within an organisation
- I can take home some ideas for further RRI development at my organisation

By means of placing dots in a spider web with five degrees from "not at all" to "exceedingly", participants shared their high satisfaction with this workshop. It is remarkable to note that most of the participants highly agreed this workshop has inspired them.



We asked participants to share with us some thoughts about what they learned at the workshop. Here is a summary of the answers:

Generally speaking, it is very appealing for them to learn what other countries or institutions have been undertaking in the context of RRI or responsible organisations. The exchanges of relevant aspects such as understanding, concepts, dimensions, measures for implementation as well as barriers and levers are very inspiring. Mutual learning was especially strengthened by the detailed presentations, discussion in the group work and informal conversations.



A sense of change could be recognised at the workshop. Research and innovation organisations around the world are caught up in a combination of both pressures and aspirations to perform in a more socially transparent, accountable and responsible manner. These four organisations are responding to these changes, albeit in unique and different ways. Also, within the project team, there is a broad understanding of responsibility, accountability and openness, naturally with slightly different key aspects.

In addition, culture might be an important dimension to consider when examining RRI. For example, it seems that ASU (perhaps American culture more generally) has an unusual appetite for disruption for the sake of innovation, a tolerance for challenging the status quo, almost romanticizing grassroots innovation from those with less authority/experience, while hierarchy in other cultures might play an essential role to push new concepts. However, sustainability and responsibility are still often an afterthought in ASU's corporate cultures, while this appears to be more fundamental in the efforts rooted in German and Dutch cultures. Therefore, the environments necessary to achieve efficiency, responsibility, and innovation might be very different.



3 Annex

3.1 Agenda

December 15th, 2016

Venue: Design Offices Highlight Towers, Munich

Mies-van-der-Rohe-Strasse 8

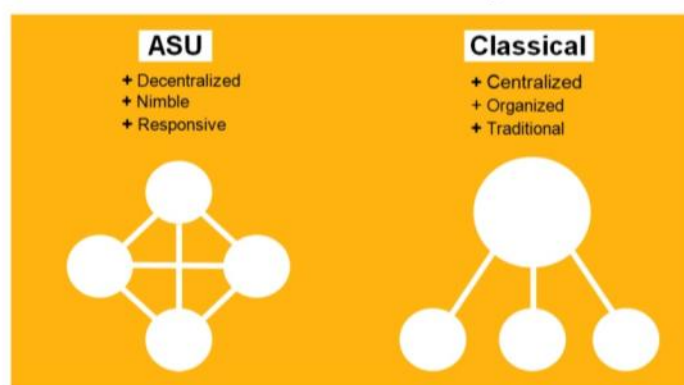
09:00 – 09:30	Arrival and Coffee	
09:30 – 09:40	Welcome	Fraunhofer ISI
09:40 – 10:00	Round of introductions	all
10:00 – 10:30	Presentation of Fraunhofer and TNO: introducing the organizations and state of the art in RRI	Fraunhofer ISI and TNO
10:30 – 11:10	Chinese Academy of Sciences (CAS): Organization, Appraisal of RRI and selected good practices (presentation & discussion)	CAS, Fraunhofer ISI
11:10 – 11:20	Break	
11:20 – 12:00	Arizona State University (ASU): Organization, Appraisal of RRI and selected good practices (presentation & discussion)	ASU, Fraunhofer ISI
12:00 – 12:30	Joint session: Mapping of a global RRI “cosmos”: themes and fields of action	all
12:30 – 13:30	Lunch break	
13:30 – 15:00	Group work: Good practice in selected fields of action: towards deep institutionalization of RRI	all
15:00 – 15:10	Break	
15:10 – 15:45	Wrap-up of group work	Group moderators
15:45 – 16:00	Conclusion and feedback round	all
16:00	End of the workshop	

ANNEX III

Good practice factsheets

Good practice identified in the international mutual learning process

"Chief Disruptive Officer" (Arizona State University)



Rationale	Mitigate inertia created by hierarchical structures
Main objectives	Embed mission statement into organizational culture; Guide evolution of organizational units towards responsibility for community needs.
Brief description	ASU's functional structure is designed to support innovation, operating in liquid networks instead of hierarchies. No one unit owns the guiding principles of the ASU charter, e.g. "leverage our place", "transform society", "value entrepreneurship", "conduct use-inspired research", "enable student success", "fuse intellectual disciplines", "be socially embedded" or "engage globally". ASU operates kind of a federation of colleges, each governed by these principles but free to adopt their own character, approaches, priorities, and free to leverage their assets/strengths differently. Central offices are not owners of the topics. Taking the example of the "Director of Social Embeddedness", the role is to amplify and connect the different and organic engagements, to understand the different forms of community engagement, to notice exemplary initiatives, and ask questions.
Experiences	15 years after the invention of the "New American University" charter, the evolution process is enduring. Remarkable effects are documented in numbers and qualitative developments (see ASU Achievements report 2002-2014). Evidence from interviews at ASU account for the disruptive potential of the role model of the central offices. E.g. the efforts related to social embeddedness, in particular a large annual survey and report, are resulting in increased awareness and reflexivity of researchers and more and better forms of community engagement.
Linkage to RRI-dimension	Engagement, and beyond: Basically this refers to embedding RRI as such into organizations.
Key words	Organizational transformation, Bridging between "silos"
Further sources	ASU Community Engagement https://community.asu.edu/about ASU Achievements 2002-2014 https://president.asu.edu/sites/default/files/ASU_Achievements_Booklet_Final_032615.pdf

Good practice identified in the international mutual learning process

Futurescape City Tours
(Arizona State University)



Rationale	Augment traditional approaches to public engagement in science and technology with visual, digital and experiential methods.
Main objectives	Empower citizens: turn a gaze to the ways in which technologies structure nearly every aspect of contemporary experience, helping to formulate our sense of agency and our ideas about future possibilities; Inclusion: Make sure that more than the most vocal and articulate citizen get heard; Shape directions of innovation: Embed citizens' values into local systems of innovation; Citizens drive the agenda and participate in conversations as active, experienced, and equal contributors.
Brief description	The Futurescape City Tours (FCT) are a constellation of public engagement activities composed of an urban walking tour, interactions between members of the public, stakeholders and experts, and image-based deliberative sessions developed by researchers at the Center for Nanotechnology in Society at ASU. The FCT seek to better understand the value and functionality of public engagement activities that integrate diverse stakeholders and publics, tend to the politics of place, rigorously trigger imagination, and creatively use multi-media tools. Effort to mobilize citizens included recruiting them downtown or in shopping malls.
Experiences	An interdisciplinary team of STS researchers conducted the Futurescape City Tours in 6 North American cities in 2013 and concludes that FCT can help to build civic capacities to contribute productively to innovation.
Linkage to RRI-dimension	Engagement
Key words	Inclusive and sustainable public engagement; Empowering citizens
Further sources	http://www.futurescapedcitytours.org/ ; Download Guidebook for practitioners at http://www.cynthiaselin.com/uploads/4/6/5/7/4657243/futurescapes_full_web_r4.pdf

Good practice identified in the international mutual learning process

Mutual Discovery Model (Arizona State University)



Rationale	Traditionally, universities think of community engagement in the sense of student engagement with community through volunteerism and experiential/service-learning. However, ASU expands its engagement to not just students, but mutually beneficial partnerships at every level of the university.
Main objectives	Conduct broad-based field work Increase community access to services (health, social, legal), in particular for deprived populations Respond to community needs and study effects of interventions Cultivate civically engaged students/ researchers
Brief description	The "Mutual Discovery Model" describes a type of partnerships between ASU and local organizations • to conduct community-based research • in which interventions can be offered, and • community can inspire and inform ongoing scholarship. FitPHX Energy zones is an individual example for a good practice. The programme offers free fitness and nutrition education to middle school students at public libraries in vulnerable neighbourhoods.
Resonance	Observation and evaluation of the intervention allow for improving the programme; increased capacities among participants and all partners (schools, families...).
Linkage to RRI-dimension	Engagement; Gender/ Diversity in research and innovation content
Key words	Community-based research, Societal needs and challenges, Inclusion
Further sources	"Building capacity through community partnerships", in ASU Social Embeddedness Report 2016, p. 18f. https://issuu.com/universityinitiatives/docs/asu_social_embeddedness_2016_-_coll

Good practice identified in the international mutual learning process

Responsible Conduct in Research (Arizona State University)



Rationale	Achieve and maintain ethical principles and compliance with federal, state, and university regulations governing research.
Main objectives	Beyond requirements posed by regulations, roll out trainings in responsible conduct of research to all members of research teams, from undergraduate to post-doc; Cover all disciplines with RCR training, not only natural or engineering sciences; Bring RCR into the daily research routine.
Brief description	Three phases: • Phase 1: (Mandatory) Online Training For all Undergraduate, Graduate Students & Postdoctoral Researchers involved in a research project at ASU. The courses provide a foundational basis for RCR: Undergrad Training; Grad & Post-doc in different disciplines, i.e. Biomedical, Social & Behavioral, Physical Science, Humanities, Engineering; • Phase 2: Seminars and Colloquia (Mandatory for post-docs to attend at least one): 10 topic areas: Data Acquisition, Management, Sharing and Ownership; Conflict of Interest and Commitment; Human Subjects; Animal Welfare; Research Misconduct; Publication Practices and Responsible Authorship; Mentor / Trainee Responsibilities; Peer Review; Collaborative Research; Responsible and Safe Laboratory Practice; • Phase 3: RCR in the research setting led by principal investigators: As part of ongoing educational activities the PIs are encouraged to hold interactive discussions during (laboratory) meetings.
Experiences	Awareness raising about the importance of ethics in research is the most important thing, according to evidence from interviews at ASU. The earlier in their career researchers are confronted with ethical topics, the more open and excited they are. Moreover, ASU practices a strict enforcement policy of the RCR programme (phases 1 and 2): not taking part or delaying the training can effect salary payment.
Linkage to RRI-dimension	Ethics
Key words	Training (next generation) researchers
Further sources	Responsible Conduct in Research (RCR) Training https://researchintegrity.asu.edu/rcr

Good practice identified in the international mutual learning process

Socio-technical integration (Arizona State University)



Rationale	Empower scientists and engineers to integrate the societal dimension into their work
Main objectives	Develop skills & capacities • Individuals: Care, curiosity, creativity • Academic/ Research Institutions: Responsiveness, inclusiveness Shape research & technological trajectories towards social needs & aligned with social values Build trust & social capital: Across the 'two cultures' divide (Social sciences and humanities – SSH as opposed to technical and life sciences); and across 'expert/lay' divides
Brief description	Socio-technical Integration is "any activity whereby scientists and engineers take into account the societal dimensions of their work as an integral part of that work" Three-part-method • Embedded humanist: SSH researchers visit labs for 12 weeks, embedded in lab routines; • Decision protocol: Visitors engage lab researchers in semi-structured interactions designed to enhance reflection upon research decisions in light of broader considerations; voluntary: lab scientists can opt out; Protocol maps changes over time • Midstream modulation: Analytical framework to assess socio-technical integration (de-facto modulation, reflexive m. & deliberate m. reflecting different stages of awareness and learning)
Experiences	Learning/ Reflexivity: Post-study, all project leaders view integration as "part of the job" (pre-study only 1 out of 5); Overall: Strengthened individual and institutional virtues (see above)
Linkage to RRI-dimension	Science Education
Key words	Social value, Fusing intellectual disciplines, Training (next generation) researchers, Reflexivity
Further sources	https://cns.asu.edu/research/stir , including video, training how to "STIR" and further publications on a set of 30 engagement studies

Journal "Science and Society"
Chinese Academy of Sciences



Rationale	Facilitate interdisciplinary exchanges on ethical issues on science, technology and innovation as well as the interaction between science and society.
Main objectives	Highlight the importance of research integrity and S&T ethics; Raise awareness of societal responsibilities of scientists: e.g. to benefit the society, to be aware of injustice and to avoid the possible risks of using new technology, sustainability
Brief description	The journal "Science and Society" has been published quarterly since 2011. This journal focuses on discussions on ethical issues on new/frontier technology and the responsibility of scientists from the perspective of highly respected „Academicians“ from diverse disciplines and STS researchers. In addition, it aims to disseminate relevant concepts and academic discussion regarding STS studies, Ethical, Legal and Social Implications issues (ELSI) in S&T and S&T policy etc.
Experience	By means of the free, open and constructive exchanges from different disciplines, the journal is playing a kind of bridge role between diverse stakeholders in science and society. Besides, it is providing a platform for STS researchers to share and exchange their research results.
Linkage to RRI-dimension	Ethics, Society Participation, Responsible Research, Research Integrity
Key words	S&T Ethics, , Multi-stakeholders, Interdisciplinary Exchanges
Further sources	http://kxsy.cbpt.cnki.net/WKD/WebPublication/index.aspx?mid=kxsy;

"Science and China" Lecture Series Chinese Academy of Sciences



Rationale	Popularise science
Main objectives	Disseminate science knowledge, improve science literacy, spread scientific culture and spirit such as rational thinking and rational scepticism through public lectures.
Brief description	In 2012, CAS celebrated the 10th anniversary of CAS's "Science and China" lecture series. Till then, 847 CAS members and experts delivered more than 672 lectures to more than 3,850,000 persons in 32 cities. All of the lectures have been gathered and published in 7 volumes. Besides, CAS senior members hold also face-to-face dialogues with the students at primary and high schools.
Experience	According to interviewees, the challenge for public lecture is to use "everyday" language to explain scientific knowledge to the public and young people.
Linkage to RRI-dimension	Science Education, Science Literacy, Science Communication, Societal Participation
Key words	Communication Skills, Interactive Exchanges
Further sources	http://cs.kepu.cn/ ; http://cs.kepu.cn/jz/hd/ztxj/

Good practice identified in the international mutual learning process

China Open Access Week *Chinese Academy of Sciences*



Rationale	Promote the Open Access (OA) related ideas and trends
Main objectives	Dissemination and communication of OA
Brief description	Since 2012, China Open Access Week has been held once a year by the National Science library (NSL), CAS. The aim of the event is to communicate, disseminate and discuss the OA-related issues with different stakeholders such as researchers, research institutions, higher education institutions, publishers, librarians and the general public. For example, the topics which were chosen in 2016 were "development trend of the global Open Access Institutional Repository", "the challenge and practice of Open Publishing" and "the challenge and practice of Open Data".
Experience	For the experts at NSL, communication is the biggest challenge over all: how to convince diverse institutions and their researchers to understand the significance of OA for their research work and support this idea, how to communicate with involved stakeholders such as data/information centres, funders, publishers, corporate and information networks, librarians etc. and solve the potential conflict of interests between them. Therefore, China OA Week provides a very useful and important platform for better communication.
Linkage to RRI-dimension	Open Access, Open Data, Open Science
Key words	Dissemination, Exchange, Service, Openness
Further sources	http://search.cas.cn/search ; http://www.openaccessweek.org/events/open-access-week-2013-in-china

Good practice identified in the international mutual learning process

S&T Ethics Symposium *Chinese Academy of Sciences*



Rationale	Strengthen dialogues and research on S&T ethics to cope with the rapid development of science and technology
Main objectives	Create a dialogue platform between natural scientists, social scientists, STS researchers and policy-makers for effective exchanges; Demonstrate concerns and actions regarding societal impacts of frontier and emerging technologies and S&T policies from the highest academic level.
Brief description	Since 2011, the S&T ethics symposium has been held once a year by "Scientific Ethics Committee", CAS, with assistance of editorial department of Journal "Science and Society". The topics discussed up to now include genetic engineering, stem cell research, the internet, artificial intelligence, nano-technology as well as research integrity.
Experience	Due to the special role and position of CAS, the outcomes of the S&T ethics symposium have large influence on scientific landscape in China. For example, "Code of Conduct for Responsible Development of Transgenic Technology" was published by the Academic Divisions, CAS in 2013, which was resulted from the discussion of the S&T ethics symposium on the issue of genetic engineering.
Linkage to RRI-dimension	Ethics, responsible research and innovation
Key words	S&T ethics, interdisciplinary exchanges, societal responsibility of scientists
Further sources	http://search.cas.cn/search/ ; CAS Annual report, 2013.

Good practice identified in the international mutual learning process

Virtual Science Museums of China, VSMC Chinese Academy of Sciences



Rationale	Popularise science; Societal responsibility in promoting the public's understanding of science, participation in science and the use of science.
Main objectives	Spread scientific knowledge in form of virtual museums
Brief description	Founded in 1999, the VSMC has turned itself into one of the most famous scientific communication portals of CAS, which was honoured by the World Summit Award (WSA) in 2005. This website comprises 60 Chinese virtual museums and 13 English virtual museums, covers the knowledge of the vast majority of natural science disciplines and part of social scientific fields. Six exhibitions like "the way of things", "the story of the Earth", "the mystery of life", "the dust in cosmos", "highlight of science and technology" and "sparks in the civilisation" have been constructed and communicated with the public by a high variety of channels such as reading, videos, gallery, interactive activities, etc.
Experience	According to WSA's jury, VSMA demonstrates good practice especially in 'translating' scientific information into content that can easily be shared and appreciated by people who are not professionals. Besides, VSMA is able to establish a virtual community space, where both scientists and the general public can meet in order to better understand each other, by means of open and unbiased communication.
Linkage to RRI-dimension	Science Education, Science Literacy, Science Communication, Societal Participation
Key words	Dissemination, Interaction, Exchange, Service, Openness
Further sources	http://www.kepu.net.cn/gb/index.html ; http://www.kepu.net.cn/english/