NUCLEUS	NUCLEUS Deliverable

Survey Concept Report, incl. Survey Design

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Short Description:

The H2020 NUCLEUS project aims to collect data about Responsible Research and Innovation (RRI) which inform implementation plans for the 10 institutionalised NUCLEI (test beds for embedded RRI practice) around Europe, China and South Africa.

The Bielefeld Work Package contains a conceptual and an empirical part. The conceptual part takes up the six elements of RRI that are outlined in the Horizon 2010 program documents (see appendix) and seeks to develop a coherent notion of what RRI could sensibly mean. This conceptual undertaking will be preceded and informed by an empirical survey among high administrative officers in universities and among leading figures of the scientific community regarding what they take to be crucial features of RRI and which obstacles they perceive for their implementation. A third step is to devise strategies that could help overcome such obstacles.

List of Recipients:

Contents

1. Executive Summary

The characteristics of "Responsible Research and Innovation (RRI)," as specified for the European Horizon 2020 program, emphasize "science with and for society." This includes, in particular, doing research in interaction with society, for one, and for the benefit of or on behalf of society, for another. RRI represents a sort of counterweight to the impact of science on society; RRI is a means of shaping science through social forces. The Bielefeld Work Package, implemented together with Twente University, seeks to clarify, elaborate, and make more specific this notion of RRI. This Work Package contains a conceptual and an empirical part. The conceptual part takes up the six elements of RRI that are outlined in the Horizon 2010 program documents (see appendix) and seeks to develop a coherent notion of what RRI could sensibly mean. This conceptual undertaking will be preceded and informed by an empirical survey among high administrative officers in universities and among leading figures of the scientific community regarding what they take to be crucial features of RRI and which obstacles they perceive for their implementation. A third step is to devise strategies that could help overcome such obstacles.

2. Scope: Key Elements of RRI

2.1 Science for Society

One of the key elements of RRI is granting social actors influence on the selection of research topics which are chosen, accordingly, on social grounds such as practical urgency or desirability.

> *Responsible Research and Innovation (RRI) implies that societal actors (researchers, citizens, policy makers, business, third sector organisations, etc.) work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of society. (*http://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation*)*

This definition refers to RRI in a twofold sense, namely, in terms of the processes used for shaping responsible research and innovation and in terms of its outcome. René von Schomberg develops both dimensions further in explaining that the procedural dimension means that the stakeholders involved become responsive to one another (von Schomberg 2013). We will go into this participatory aspect in section 4. The outcome-oriented aspect of RRI means that a socially desirable and beneficial research agenda is supposed to be adopted. As von Schomberg explains, the usual justification for the public funding of certain research endeavours is the general expectation that they promote industrial competitiveness and thereby increase economic growth and contribute to creating jobs. However, RRI should address more specific social goals. As von Schomberg argues, the relevant normative dimension is supplied by fundamental treaties of the European Union. For instance, the European Treaty on the European Union contains a commitment to the promotion of social justice, to gender equality, health, the protection of the environment, sustainable development, and others. More specifically, the Lund Declaration identifies "Grand Challenges" such as global warming, water and food production, ageing societies etc. Such normative commitments provide a basis for favouring certain research goals (von Schomberg 2013). Accordingly, RRI is characterized by a socially beneficial research agenda.

Research that aligns itself with or responds to political, social, and economic demands is called transdisciplinary and is distinguished from fundamental research or epistemic science. In the latter framework, problems are picked for treatment that are significant from a theoretical or experimental perspective and are expected to be solvable within a reasonable time span. By contrast, transdisciplinary research takes up problems posed from outside of science. The research agenda of science as a transdisciplinary endeavour is shaped by extra-scientific influences. The critical factor is the practical relevance or the social and economic importance of a problem. Such challenges are typically imposed on science without regard of their feasibility. Transdisciplinary research is moulded by a strong interaction between science, on the one hand, and social, political, and economic forces, on the other. Political institutions such as foundations or ministries intervene in science and set incentives for specific research endeavours. The preferred means for directing research toward certain ends is calls for research proposals. Environmental technology, for instance, has been promoted by politics in this way.

RRI is a branch of transdisciplinary research that applies, first of all, to publicly funded research. It is contentious whether the notion of RRI is also relevant for projects that are sponsored by private capital. Yet even if such projects are said to legitimately follow purely economic interests, public research money is claimed to be in need of respecting additional, political objectives in any event. The questions we intend to pursue in the Nucleus framework concerns the elements involved in this notion of "science for society" or publicly sponsored transdisciplinary research. We intend to ask which reservations are harboured, or rightly harboured, in the circles mentioned before, namely, university officers and key research scientists. In the relevant literature, four reasons of concern are articulated, and our first ambition is to find out whether such worries are widely shared in the relevant communities.

A first worry arises from the expectation that science loses its autonomy by being driven to address research problems selected according to their societal urgency by political institutions. Scientists rather adhere to the model of selecting research projects by epistemic interest and feasibility, as it is characteristic of fundamental research. In particular, scientists appreciate their freedom of research. A question to be asked is whether RRI is perceived as a threat to the freedom of research or whether, alternatively, scientists see RRI as a mechanism for increasing the odds that research results and technological innovations are accepted and put to use in society.

A second concern is the sustainability of transdisciplinary research. Transdisciplinary projects are targeted on specific, narrowly focused objectives, which, however, may be bound to fail because the necessary basic understanding is lacking. The classical example of such a failed, demand-driven endeavour is the "War on Cancer," declared without success by President Nixon in 1971. This generously funded campaign produced no tangible improvement in cancer therapy. In hindsight, the reason is clear: the required knowledge basis was missing. This is not a singular case. When HIV was identified in 1986, circles in science and politics unanimously expected an upcoming breakthrough in developing an AIDS vaccination. This breakthrough is still urgently called for thirty years later. Speaking more generally, innovations are not infrequently brought about by assuming a knowledge-driven mode rather than a demand-driven mode. That is, practice-oriented innovations are often based on the system of knowledge. Such innovations tap the repository of knowledge and seek to transform it into useful procedures and devices. For instance, liquid crystal screens are based on physical insights from the 1930s. In this vein, practically beneficial research projects do not begin by identifying urgent questions and then launching projects that specifically address such questions. Rather, such research proceeds from asking what practical achievements could be reached on the basis of existing knowledge. If transdisciplinary research, understood as demand-driven research, came to dominate the research process, one would have to anticipate a large number of overambitious, failed research endeavours. The expectation is that sustained transdisciplinary research is in need of explicitly supported epistemic research. This would place serious limitations on the social selection of research topics.

Third, it is a popular worry that the research process needs to be open and that any attempt to channel research into certain narrowly specified directions will only serve to cripple its creativity (Polanyi 1962). This is a more generalized version of the preceding worry to the effect that regulating the research agenda by external forces will not only fail to produce the desired practical achievements but also undermine the epistemic power of research as a whole. The assumption is that the innovative spirit of science cannot be controlled. The only way to make science productive is to leave research to its own devices and to explore afterward to which useful ends its outcome can be put. On this account, there can be no successful socially responsible research but only socially responsible innovation. However, the viability of this account is contentious. Its viability is investigated in the conceptual part of the project and its prevalence is surveyed in the empirical part. In sum, one of the challenges involved in bringing standards of RRI to bear on research projects is to leave epistemic aspirations or the quality of scientific knowledge unscathed.

A fourth worry is that the technological impact of a research endeavour is difficult to assess in advance. For instance, surprise discoveries are not infrequent in medical research. The usefulness of beta blockers against coronary insufficiency was completely unexpected, as was the effectiveness of lithium against bipolar disorders. It is doubtful whether any targeted research endeavour on these diseases would have revealed such unanticipated options. They had not been in view before and could not have been looked for this reason. In addition, technological innovations often result from the accumulation of various small steps so that the final technological achievement could not have been predicted at the outset. This pattern applies to such diverse innovations as the railway system in the 19th century and the emergence of the internet in the late 20th century. In both cases, the dynamics was driven by addressing faults and weaknesses of an existing system. No vision of the final innovation was operative at any point. As a result, complex problems cannot be expected to be solvable by a coherent research process planned in advance.

In the empirical part of the project, we wish to survey whether these worries are actually articulated in the scientific community and to which extent they are shared. In the conceptual and analytical part we will explore, by attending to relevant cases, whether such worries are justified.

2.2 Open Science

In the Horizon 2020 documents, open science figures as a pivotal element of RRI.

> *The global shift towards making research findings available free of charge for readers, so-called 'Open access', has been a core strategy in the European Commission to improve knowledge circulation and thus innovation. … As other challenges need to be addressed such as infrastructure, intellectual property rights, content-mining and alternative metrics, but also inter-institutional, inter-disciplinary and international collaboration among all actors in research and innovation, the European Commission is now moving decisively from 'Open access' into the broader picture of 'Open science'. (http://ec.europa.eu/programmes/horizon2020/en/h2020-section/open-science-open-access)*

The actual practice and the notion of open science merit deeper scrutiny. A first relevant aspect is open access to scientific publications. In the empirical part of the project, data about the present situation are collected; in the conceptual part, key elements of an acceptable system of open access are outlined. The guidelines developed in 2014 by the Berlin-Brandenburg Academy of Science (http://www.bbaw.de/publikationen/stellungnahmen-empfehlungen/wisspublikation) recommend a wider dissemination of open-access formats, but such a reorientation requires a major adaptation of the entire publication system and its economic underpinning. For instance, if open access publications continue to be charged with high processing fees, obstacles for contributions from poorer countries or universities are erected. In addition, fears from within the humanities are articulated to the effect that open access means side-tracking publishing houses and thereby marginalizing the book as research instrument. There is a lot of debate and uncertainty about what a good open access system could be like. Representatives of the scientific community will be asked what they consider stumbling blocks for introducing such a system.

A more specific question is whether an obligation to publish can or should be established in some areas. Such a duty primarily concerns results of clinical trials and can probably not sensibly be included in a general elaboration of the notion of RRI.

Intellectual property rights are widely seen as a chief impediment to open science. They are a by-product of the commercialization of research and are supposed to transform new knowledge into a tradable commodity. The underlying intention is to stimulate research by ascertaining that the benefits of discoveries are reaped by those who made the necessary efforts.

The chief instrument for securing intellectual property rights is patenting. From the perspective of keeping science open, the advantage of patenting is that the research results are demanded to be disclosed publicly. The alternative to patenting in economically promising fields would not be open access but industrial secrets. The latter procedure would arguably be worse than the former. A disadvantage is, for instance, that classified findings are not subject to being tested by other research groups. However, a detrimental side-effect of patenting is blocking pathways of research. The "experimental use privilege" is put into practice in a highly restricted fashion in many countries. As a result, research endeavours seek to circumvent existing patents so that the latter serve to create laborious detours (Radder 2004).

The empirical survey is supposed to find out to what extent academic research benefits from or is impeded by the present system of intellectual property rights. In conceptual respect, the literature in social epistemology examines systems of intellectual property rights that are possibly better suited to preserving the accessibility of research results and to yet fostering innovation. The two wings of the Bielefeld work package pursue the ambition to jointly produce proposals for protecting intellectual property rights without stifling promising research activities.

2.3 Research Ethics

Research ethics is featured in the RRI scheme, as outlined for Horizon 2020:

> *In the work programme 2014-2015 'Science with and for Society', one of the ethics topics, aims at promoting research integrity. … As there is no single approach to research misconduct, the pros and cons of different methods should be assessed. The cases where suspicion was confirmed and lead to sanctions are indispensable. (http://ec.europa.eu/programmes/horizon2020/en/h2020-section/ethics)*

Anecdotal evidence suggests that the willingness among scientists to cooperate has diminished in the past decades. The readiness to share research materials or data has reportedly declined. Self-centered practices of this sort contravene the openness of science. Their prevalence is often attributed to the commercialization of research, but the empirical survey to be undertaken is supposed to estimate the extent to which this is actually true. Similarly, commercialization is a popular culprit of all sorts of fraud, such as fabricating data or plagiarizing. Yet in fact, it is not clear whether economic pressure on science is the chief cause of the frequent violation of standards of research ethics. A competing interpretation attributes this phenomenon to the high and mounting level of competition among scientists. This alternative account suggests that the same breaches occur to a similar degree in epistemic research, i.e., in areas not subject to economic pressure.

A different understanding of research ethics concerns the choice of research problems, as in section 1.1, but is supposed to mean, in contradistinction to section 1.1, that ethically contentious research projects ought not to be pursued. If society considers stem cell research a morally questionable undertaking, then RRI should abstain from such research.

Von Schomberg identifies four major types of ethically irresponsible behaviour. In a "technology push," certain actors attempt to establish favourable conditions on their own and without entering into a debate with relevant stakeholders. The introduction of genetically modified soya in the mid-1990s was of this type and eventually backfired by raising public suspicion. "Neglect of

Fundamental Ethical Principles" means to go ahead on an exclusively technological basis. Early versions of the electronic patient record system in various countries did not take privacy considerations into account and failed for this reason. "Policy pull" designates political pressure to introduce certain technologies. In the past, this has been applied mainly to security technologies. Again, if public concerns are not heeded in the early stages, the implementation of the whole technology may be blocked. "Lack of Precautionary Measures and Technology Foresight" is supposed to be seen as an incentive to spell out unwelcome consequences of an innovation as well. Framed more positively, the impact of research projects should be assessed in advance if possible, and risks should be identified (von Schomberg 2013). As von Schomberg argues, including these four considerations into research increases not only the socially responsible character of the research, but also enhances the odds of getting the corresponding technology implemented. RRI should be seen as a means for improving the social acceptance of novel science-based instruments (von Schomberg 2013).

A contentious question is this respect is how the precautionary principle is supposed to be understood precisely. The prevalent prohibitory interpretation requires us to combat possible risks even without scientific proof. The relevant slogan is "better safe than sorry." It need not be demonstrated beyond doubt that a certain measure produces a certain damage. It is sufficient that the risk of this damage to occur is made plausible. The burden of proof is shifted to those who intend to introduce a procedure or technology. They need to establish that no adverse effects emerge. The problem is that this prohibitory reading of the principle is of no help if different options with different side-effects lie on the table. An alternative balance interpretation of the precautionary principle says that the risks of implementing a measure and of not implementing it need to be assessed in comparison. In case of a serious threat, such as climate change, mere uncertainty about conceivable side-effects of potentially suitable countermeasures is not enough to block such measures (Proelss 2010).

The goal of the empirical survey is to identify the understanding of research ethics in the relevant communities and the causes of violations of its requirements. How open and transparent is the research process? The goal of the conceptual project is to devise routines that are suitable to support ethical standards. The mere appeal to such standards will hardly be successful if the conditions of research set incentives for transgressing these standards. Rather, the system of incentives should be structured such that it encourages cooperation and inhibits fraud.

A second group of questions is directed at exploring examples of ethically irresponsible behaviour. Are the types mentioned before considered plausible in the scientific community or are other kinds of irresponsible behaviour perceived as being more salient? Further, in the opinion of the scientific community, would participation and the inclusion of lay people in selecting and pursuing research projects suitable for enhancing the level of research ethics?

A third group of questions is directed at the content and role of the precautionary principle. Have you heard of the two readings of the precautionary principle? Is one of them suitable for guiding RRI?

2.4 Public Engagement and Participation

This item takes up elements of section 4.1 and emphasizes the goal of implicating stakeholders in the scientific discourse. This dimension emphasizes "science with society" and articulates the requirement that the various actors become reciprocally responsive to each other. The hope associated with participation is that scientific research and results are received in a more welcoming way by a wider lay audience if the public had been granted the opportunity to affect the pathways of research.

> *Public engagement (PE) in Responsible Research and Innovation (RRI) is about co-creating the future with citizens and civil society organisations, and also bringing on board the widest possible diversity of actors that would not normally interact with each other, on matters of science and technology. …*
>
> *PE implies:*
>
> *– the establishment of iterative and inclusive participatory multi-actor dialogues between researchers, policy makers, industry and civil society organisations, NGOs, and citizens; … (http://ec.europa.eu/programmes/horizon2020/en/h2020-section/public-engagement-responsible-research-and-innovation)*

Public engagement is intended to include citizens in designing and pursuing research projects and to thereby enhance the responsiveness of science to social needs and desires.

Von Schomberg envisages a participatory scheme that brings three parties together: industry, civil society, and researchers. They are encouraged to define desired research outcome in a specific field and thus to decide about the research agenda (von Schomberg 2013).

A field that is frequently highlighted when participation is at stake is scientific expertise and expert recommendations. Such recommendations on specific practical problems do not follow from scientific principles alone. Additional knowledge and commitments enter which may emerge from local conditions or be based on social values. Accordingly, public participation can assume two conceptually distinct forms. First, science-based advice on practical matters faces the problem of bridging the gap between the general claims entertained within science and the particular requirements of practice. Local knowledge may acquire a crucial role in conceiving tailor-made solutions to a specific or narrow problem. "Experience-based experts" may be aware of relevant details in virtue of their familiarity with the field at hand. This means that citizens should participate as local sources of knowledge in formulating scientific policy advice. Second, scientific solutions to practical problems should be in agreement with widespread local interests and prevalent value commitments. While appeal to lay expertise may upgrade the epistemic quality of science-based proposals, including local interests and value-attitudes serves to improve social compatibility or social robustness. This political requirement of taking stakeholders' views into account and of respecting normative commitments in society needs to be distinguished from the epistemic requirement to include local knowledge so as to advance the process of deliberation.

Stilgoe et al. (2013) consider two features as being characteristic of such processes of including the wider public. The first one is reflexivity in that experts become aware of the limits of knowledge and of the particular framing of an issue (that may emphasize doability rather than social concerns). The second is responsiveness which involves the willingness to adapt one's research undertaking in view of stakeholder and public values and changing circumstances. This means, in sum, that RRI is prepared to listen to and to heed concerns and considerations from the public.

In the empirical part of the study we wish to obtain information about what administrative officers and representatives of the scientific community think of participatory efforts. Do they regard it as a threat to their autonomy? Do they fear a decline of epistemic research and a degeneration of the epistemic culture in science? Or, conversely, do they see opportunities to the effect that new technologies are accepted more easily in society?

Participatory efforts always include a two-way communication process between science and the public. The conceptual part of the project pursues the question of how such participatory schemes can be structured such that the interaction between science and society and the exchange of arguments assumes an optimum level. For instance, is there a participatory scheme that is capable of distinguishing between local knowledge, local interests, and generalizable social and ethical values? Does a successful participatory scheme demand any tutoring of the public regarding scientific matters (as advocated in the widely received proposal made by Philip Kitcher (2001))? Does a sound participatory procedure need to include epistemic or methodological characteristics of science, such as the assumed limits of controllability of science?

2.5 Diversity

RRI, as specified by Horizon 2020 documents, includes strategies for promoting gender equality. RRI aims to advance gender balance in research teams and remove barriers that discriminate against women in scientific careers (see Appendix 8.5). Our own approach is supposed to be broader and to generalize gender equality to the goal of adequately balancing social diversity. Relevant aspects of diversity include gender, ethnic descent, age, and disability.

Two reasons are advanced for fostering diversity. One reason is political and emphasizes the importance of offering equal opportunities to people from all segments of society. The second reason is epistemic. As the relevant argument runs, social diversity is likely to expand the range of ideas generated and criteria used for judging assumptions (Anderson 1995; Phillips 2014). Assuming that science at the interface with society is interspersed with non-epistemic values and interests, taking a neutral stance is difficult to accomplish. It is easier to implement a pluralistic framework of criticism, in which ideas are explored and judged from a variety of perspectives (Longino 1990, 63-82). A pluralistic setting of reciprocal control approaches the ideal of objectivity to the degree humanly achievable at the intersection of science and society. Social diversity is a repository for strengthening this culture of epistemic pluralism.

Possible questions to be posed in the survey concern the attitude of interviewees regarding social diversity in research. Do researchers and officers welcome diversity and do they actively support it? Would they endorse an incentive structure that places weight on such considerations? Alternatively, do they consider such regulations as a social intrusion in their epistemically driven endeavours?

2.6 Science Education

Horizon 2020 documents rightly emphasize the need to enhance the science-and-technology literacy among the public (http://ec.europa.eu/programmes/horizon2020/en/h2020-section/science-education). However, it is not clear how this goal can be achieved. Simply teaching scientific facts and figures does not seem to be a promising avenue for creating a more welcoming attitude toward science among the public. In fact, a 2010 poll conducted by the journals *Scientific American* and *Nature* among its readership, which can be assumed to be supportive of science and science-literate, showed that ratings of the trustworthiness of scientific statements about agricultural matters such as the use of pesticides or food safety remained well below the "trust" category (*Scientific American* 2010, 56). Likewise, the 2010 Eurobarometer revealed that 58% of the respondents agreed with the statement that one "can no longer trust scientists to tell the truth about controversial issues because they depend more and more on money from industry." 47% of Europeans attributed a tunnel vision to scientists: They look at issues in a very narrow science-and-technology sense and fail to integrate a wider human or social perspective (European Commission 2010, 19-23). Moreover, dependence of science on private research money is believed to produce unreliable and one-sided results (European Commission 2010, 23-27). The conclusion is that public trust in the appropriateness of scientific judgment at the interface with society is seriously sapped.

Two pathways for developing a possibly more successful mode of science education will be explored in the work package. The first one is emphasizing interaction and is intended to explore the impact of admitting the public to the process of knowledge production. The mentioned polls suggest that the credibility of science has suffered from its one-sided implication with the rich and powerful. This suggests the remedy of democratizing science, an option that needs to be worked out carefully in order to avoid what Philip Kitcher calls the "tyranny of the ignorant" (Kitcher 2001, 118, 129-130). This idea points in the same direction as section 1.4, i.e., public engagement and participation.

Second, a promising strategy for enhancing science education might proceed by including insights from philosophy of science. A relevant item is the appreciation of controversies as a chief instrument of knowledge production. The epistemic rationale underlying controversies is attacking a problem from different angles and thereby increasing the odds of success. However, the general public is disenchanted by controversies in science and tends to lose trust in the reliability of scientific knowledge. Another problem is a mistaken view about what kind of knowledge science is able to gain. The public often holds a digitalized attitude according to which a claim is either one hundred per cent secure or untenable and void. A methodological education of the public could spread the truth that scientific claims can be well confirmed and viable, but still remain uncertain. Earlier hopes have dashed that the public could be won for science by teaching discoveries and theories. It might be time to try a different path and to create a new form of scientific literacy by appeal to methodological education.

The empirical survey will explore views about the interaction between scientists and lay people in scientific questions of social relevance and about key features of scientific method. This is admittedly not the same thing as interacting with a wider lay audience directly. Accordingly, the survey will rather gather views of scientifically educated people. Still, the prospects of science education, as perceived in the scientific community, and the characterization of relevant elements of the scientific method, as seen by scientists, represent worthwhile data as well. The subsequent step is to proceed from such opinions and to conceive a more effective policy for science education.

3. The Pursuit of the Project

3.1 The Design of the Study

In the empirical step of the project, members of the project team organize and conduct interviews in which representatives of the scientific community are asked about what they think of science engaged in society, science education, and ethical values in science. This survey is supposed to address leading researchers and top administrative officers of universities (such as Presidents, Vice-Presidents and Deans). Interviews are intended to be conducted with key figures from these fields regarding their views of RRI and the obstacles they perceive to giving additional weight to it. Interviews will be performed via Skype or on a face-to-face basis. The oral setting, characterized by the immediate presence of the persons involved, increases the commitment on the part of the interviewees and makes it possible, in addition, to sensibly pose open questions. The overall goal is to get an experience-based picture of how leading actors in the field think about RRI and how they view the odds and impediments of implementing its key features.

Another set of material to be analysed concerns written documents issued by universities, their sponsors, and professional associations. A good way to appreciate how relevant RRI commitments are is to examine their impact on the distribution of financial resources. Do factors claimed to be important (such as gender and diversity, open access, social needs) become manifest in the pertinent funding structure? This question is tackled by analysing documents supplied by the relevant universities. Budget figures provide a revealing basis for comparing declared commitments with the actual practice.

3.2 Pursuit of the Study

The interviews and analyses will be performed at various universities of the consortium in order to facilitate access to the decision-makers and top researchers and to get hold of the relevant documents. That is, the consortium partners are supposed to act as door-openers. Prospective participants, mostly from the consortium partner universities, are contacted in advance and informed about the nature of the project. Participants will be provided with an "informed consent form" and an "information sheet." The interviews will be conducted via Skype by scientists and scholars employed in the Nucleus-project in order to secure that the same procedure is followed in each case. Face-to-face interviews have the advantage of being more flexible and offering room for clarificatory follow-up questions. The interviews are recorded, transcribed and analysed by using atlas.ti. The questions and the protocol will be tried out in a test run at Twente University with 6 to 8 scientists and 1 to 2 administrative officers.

The interview will start with biographical questions (such as position, age, and disciplinary background). We will begin with the open question what interviewees think of RRI. Subsequently, we go through the six items listed in section 1. The questions will be concrete and tangible and use scenarios whenever possible. Interview questions may include asking whether people think they could benefit from an RRI framework or what they think of tying RRI achievements to an incentive system (What if this activity increased/decreased your salary?). More open questions are supposed to offer the opportunity of bringing in additional topical elements of RRI. The survey should not be restricted to understanding of RRI by the European commission. Additional considerations are: Do higher administrative officers and principal researchers take RRI concepts into account in drafting their research agenda? In particular, do RRI considerations affect the choice between competing research options? Do universities and researchers attempt to get a clearer understanding of the social compatibility or robustness of certain research endeavours? Do universities and researchers respond to changing social demands and ethical constraints? How are gender and diversity issues and open-access strategies taken into account? Does a feared loss of autonomy make actors hesitant to care more about RRI?

The second source of data to be taken into consideration is university documents. Development plans and incentive schemes might provide more tangible and effective indicators for the importance attached to RRI considerations in the pertinent university. Relevant questions are whether RRI issues and ideals are part of development plans, research quality guidelines, and incentive schemes of the corresponding university. What relevance do such documents assign to key features of RRI? In the affirmative case, does RRI play any role in allocating resources among the Departments or the Chairs? Do universities pursue open access strategies?

As to the time schedule, the test run in Twente University should be made in February 2016, the main survey, comprising in total some 30 interviews with higher administrative officers and some 120 interviews with scientists, should take place from May to September 2016. One more year until September 2017 should be devoted to the analysis and evaluation of the survey.

3.3 Analysis and Evaluation

Analysis and evaluation of the interviews and documents are supposed to be accomplished by using qualitative techniques of interpretation (content analysis). This material is intended to be analysed by applying current methods of descriptive and inferential statistics. Such procedures are routinely applied in quantitative surveys; we extend their application to qualitative methods. A quantitative approach is supposed to explore the impact of the ideas and preferences as expressed in the interviews and identified in the documents.

In particular, the interviews will be analysed and evaluated by using quantitative techniques, such as frequency analysis as well as valence and intensity analysis, and qualitative-interpretative techniques, such as content analysis. In pursuing the analysis, it will be checked via method review whether all relevant observations have been taken into consideration appropriately. The methods used for analysis and evaluation include the quantitative methods of descriptive statistics (summary statistics, histograms) and deductive statistics (estimation and hypothesis testing). The analysis of financial figures requires a quantitative methodology.

The first results will be generalized gradually by identifying contrasting cases and constructing ideal types. Another important step will be to connect the outcome of this quantitative analysis with the mentioned qualitative findings. The goal is to uncover and reconstruct the web of individual and group-related factors that contribute to shaping research decisions.

3.4 Further procedure

Through a conjunction of philosophical analysis and empirical survey we will attempt to produce a coherent and experience-based assessment of the nature of RRI and its understanding among the relevant actors. Building on this information, the conceptual part of the project will adjust and improve the account of RRI. As a result, we expect to gain a clearer view of possible obstacles to realizing a responsible research and innovation policy. This will allow us to identify critical obstacles to implementing RRI and devise pathways to overcoming these obstacles.

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5. Abbreviations

6. ANNEXES: Responsible research & innovation: EU documents

6.1 Science for Society (general characteristic)

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

Responsible research and innovation is an approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation, with the aim to foster the design of inclusive and sustainable research and innovation."

Responsible Research and Innovation (RRI) implies that societal actors (researchers, citizens, policy makers, business, third sector organisations, etc.) work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of society.

In practice, RRI is implemented as a package that includes multi-actor and public engagement in research and innovation, enabling easier access to scientific results, the take up of gender and ethics in the research and innovation content and process, and formal and informal science education."

"Responsible research and innovation is key action of the 'Science with and for Society' objective. RRI actions will be promoted via 'Science with and for Society' objective via:

- actions on thematic elements of RRI (public engagement, open access, gender, ethics, science education), and
- via integrated actions that for example promote institutional change, to foster the uptake of the RRI approach by stakeholders and institutions.

6.2 Open Science (Open Access)

http://ec.europa.eu/programmes/horizon2020/en/h2020-section/open-science-open-access

The global shift towards making research findings available free of charge for readers, so-called 'Open access', has been a core strategy in the European Commission to improve knowledge circulation and thus innovation. It is illustrated in particular by the general principle for open access to scientific publications in Horizon 2020 and the pilot for research data.

Nowadays, it is widely recognised that making research results more accessible contributes to better and more efficient science, and to innovation in the public and private sectors.

In 2012, the European Commission encouraged all EU Member States to put public-funded research results in the public sphere in order to make science better and strengthen their knowledge-based economy, via a Recommendation.

Science has always been open, unlike the processes for producing research and diffusing its results.

As other challenges need to be addressed such as infrastructure, intellectual property rights, content-mining and alternative metrics, but also inter-institutional, inter-disciplinary and international collaboration among all actors in research and innovation, the European Commission is now moving decisively from 'Open access' into the broader picture of 'Open science'.

This is reflected in the Science with and for Society work programme of Horizon 2020 with calls addressing text and data mining, and innovative approach to release and disseminate research results and measure their impact.

Elements of 'Open science' will also gradually feed into the shaping of a policy for Responsible Research and Innovation and contribute to the realisation of the European Research Area and the Innovation Union, the two main flagship initiatives for research and innovation.

6.3 Ethics

http://ec.europa.eu/programmes/horizon2020/en/h2020-section/ethics

For all activities funded by the European Union, ethics is an integral part of research from beginning to end, and ethical compliance is seen as pivotal to achieve real research excellence.

Ethics is an integral part of research from the beginning to the end. It is only by getting the ethics right that research excellence can be achieved. Ethical research conduct implies the application of fundamental ethical principles and legislation to scientific research in all possible domains of research – for example biomedical research, nature sciences, social sciences and humanities.

The most common ethical issues include:

- the involvement of children, patients, vulnerable populations,
- the use of human embryonic stem cells,
- privacy and data protection issues,
- research on animals and non-human primates.

It also includes the avoidance of any breach of research integrity, which means, in particular, avoiding fabrication, falsification, plagiarism or other research misconduct.

Ethics is given the highest priority in EU funded research: all the activities carried out under Horizon 2020 must comply with ethical principles and relevant national, EU and international legislation, for example the Charter of Fundamental Rights of the European Union and the European Convention on Human Rights.

In the work programme 2014-2015 'Science with and for Society', one of the ethics topics, aims at promoting research integrity. The research misconduct cases in the 1980s in the United States have led to the adoption of guidelines and codes of conduct, however, the cases are very complex and diverse. As there is no single approach to research misconduct, the pros and cons of different methods should be assessed. The cases where suspicion was confirmed and lead to sanctions are indispensable.

The other topic focusses on ethics dumping. Due to the progressive globalisation of research activities, the risk is higher that research with sensitive ethical issues is conducted by European organisations outside the EU in a way that would not be accepted in Europe from an ethical point of view. This exportation of these non-compliant research practices is called ethics dumping.

In order to mitigate and reduce the risk, European, national and international ethics bodies should collaborate actively and at multiple levels: within the EU, between the EU and other high-income countries, and between high-income and low-income countries, where the risks of dumping is higher. Good practices shall be identified with the aim of elaborating a code of conduct for all actors.

6.4 Public Engagement in Responsible Research and Innovation

http://ec.europa.eu/programmes/horizon2020/en/h2020-section/public-engagement-responsible-research-and-innovation

Public engagement (PE) in Responsible Research and Innovation (RRI) is about co-creating the future with citizens and civil society organisations, and also bringing on board the widest possible diversity of actors that would not normally interact with each other, on matters of science and technology.

Public engagement (PE) leads to multiple benefits:

- it contributes to building a more scientifically literate society able to actively participate in and support democratic processes, and science and technology developments,
- it injects differing perspectives and creativity in research design and results, and
- it contributes to fostering more societally relevant and desirable research and innovation outcomes to help us tackle societal challenges.

PE implies:

- the establishment of iterative and inclusive participatory multi-actor dialogues between researchers, policy makers, industry and civil society organisations, NGOs, and citizens;
- to foster mutual understanding and co-create research and innovation outcomes and policy agendas effective in tackling societal challenges, and
- fostering wider acceptability of results.

Implementing public engagement in Horizon 2020

1. Build participatory Research & Innovation (R&I) actions

PE can be specifically called for or voluntarily built-in to projects to promote more societally relevant outcomes. Ideally this engagement would be embedded in the research design and process from an early stage, and in an iterative fashion, so that the learnings can contribute to enriching the process and outcomes (citizen science actions could also fall under this category).

2. Provide inputs to influence EU R&I policy agenda

Launch more widespread initiatives (similar to VOICES) involving citizens' engagement that employs face-to-face as well as online participatory methods to provide input to policy and participatory foresight for selected themes. Such initiatives would require high-level commitment, transparency and traceability of outcomes, timely and legitimized integration into our existing Horizon2020 institutional mechanisms and strategy.

3. Support the development and implementation of thematic policies

A major aim of R&I policy is to provide knowledge and evidence to support the design and implementation of thematic policies (e.g. environmental, health, transport) at national to local level, in particular in relation to societal challenges. Public engagement has its rightful place in science/policy/society interfaces supporting both thematic policy development and implementation.

6.5 Promoting Gender Equality in Research and Innovation

http://ec.europa.eu/programmes/horizon2020/en/h2020-section/promoting-gender-equality-research-and-innovation

In Horizon 2020 Gender is a cross-cutting issue and is mainstreamed in each of the different parts of the Work Programme, ensuring a more integrated approach to research and innovation.

Three objectives underpin the strategy on gender equality in Horizon 2020:

- Fostering gender balance in research teams, in order to close the gaps in the participation of women.
- Ensuring gender balance in decision-making, in order to reach the target of 40% of the under-represented sex in panels and groups and of 50% in advisory groups.
- Integrating the gender dimension in research and innovation (R&I) content, helps improve the scientific quality and societal relevance of the produced knowledge, technology and/or innovation.

In many topics across the work programme, it is explicitly requested that applicants take into account women as well as men's needs and behaviours. In addition grant beneficiaries commit to promoting equal opportunities and a balanced participation of women and men at all levels in research and innovation teams and in management structures.

The 'Science with and for Society' Work Programme funds specific initiatives in support of the gender equality strategy. Support is given to Research Performing Organisations (RPO) and Research Funding Organisations (RFO) in order to:

- remove barriers that generate discrimination against women in scientific careers and decision-making (supporting research organisations to implement gender equality plans), and
- integrate a gender dimension in research content.

Funding is also provided to the development of a common framework to evaluate national initiatives promoting gender equality in research policy. A dedicated campaign aims at encouraging girls to study science and female students to further embrace a career in research. Research will be funded to analyse the impact of gender diversity in research teams on research and innovation performance.

These activities are targeted to researchers and innovators, research organisations, primary, secondary and higher education establishments, science museums, citizens and their associations or groupings, media, policy makers at national, regional and local levels, etc.

Expected impact

- Reach a critical mass of universities and research institutions in Europe which implement long-term institutional change through gender equality plans,
- Increase the participation of women in research, improve their careers and achieve gender balance in decision making,
- Increase the scientific quality and societal relevance of produced knowledge, technologies and innovations by integrating an in-depth understanding of both

genders' needs, behaviours and attitudes. It also contributes to the production of goods and services better suited to potential markets.

6.6 Science Education

http://ec.europa.eu/programmes/horizon2020/en/h2020-section/science-education

Building capacities and developing innovative ways of connecting science to society is a priority under Horizon 2020. This will help to make science more attractive to young people, increase society's appetite for innovation, and open up further research and innovation activities.

Making science education and careers attractive for young people is an ambitious goal, since it targets to drastically improve science and technology-literacy in our society.

Innovative formal and informal science education teaching and learning is important in order to raise both young boys' and girls' awareness of the different aspects encompassing science and technology in today's society and to address the challenges faced by young people when pursuing careers in Science, Technology, Engineering and Mathematics (STEM).

Therefore, a sustainable and cross-cutting interaction between the relevant actors in the field is crucial:

- different levels of the education system,
- universities and other higher education establishments,
- research and innovation funding and performing organizations,
- civil society organizations and NGO's,
- industry, policy-makers,
- professors,
- teachers,
- students and pupils,
- Science museums and science centres.

Within the programme, a call was launched with the aim of making science education and careers attractive for young people.

Expected impact:

- Develop scientific citizenship by promoting innovative pedagogies in science education, attracting more young people towards science, with a special emphasis on girls, and addressing the challenges faced by young people, in pursuing careers in science, technology, engineering and innovation,

- Develop responsible research and innovation in higher education curricula,
- Ease the access to scientific careers by increasing the service level of the EURAXESS Services Network.