Grounding RRI Actions to Achieve Institutional Change in European Research Funding and Performing Organisations

Grant Agreement n. 824521

STATE-OF-THE-ART REVIEW OF DOCUMENTED EXPERIENCES

Document 6 – Approaches to RRI

Prepared by

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Introduction

In the framework of the Grounding RRI Actions to Achieve Institutional Change in European Research Funding and Performing Organisations (GRACE) project, under WP3 (Governance and Mutual Learning), a specific task (T3.1) is focused on "the collection of experiences documenting RRI-documented institutional changes" and on "the elaboration of these experiences into a set of short guidance documents".

The overall aim of the Task is that of **assisting the GRACE partners** engaged in embedding RRI in their own institute to design and implement a set of RRI-oriented Grounding Actions (GAs), to integrate these GAs with each other (developing a unitary governance system for them), to ensure their sustainability and to use them as a platform for developing a Roadmap towards RRI going beyond the GRACE project lifespan (overall 8 years).

In order to pursue this objective, a state-of-the-art of documented experiences on RRI has been developed, the results of which are presented in **seven autonomous documents**, although connected to each other, i.e.:

- Document 1 - Collection of experiences on gender equality
- Document 2 - Collection of experiences on citizen engagement
- Document 3 - Collection of experiences in science education
- Document 4 - Collection of experiences on research ethics and integrity
- Document 5 - Collection of experiences on open access
- Document 6 - Approaches to RRI implementation
- Document 7 - Basic scheme for self-assessment

All the documents have been developed by **Knowledge & Innovation** (K&I), which is the leader of WP3. They are not formal deliverables and their circulation is restricted to the GRACE project consortium members.

This document

This is the 6th document of the series, devoted to the **approaches to RRI implementation**. Its aim is that of providing GRACE partners with some basic theoretical and methodological orientations for implementing the GAs and developing the 8–year Roadmap.

The document includes three sections.

- In the **first section**, a **theoretical interpretation** of RRI is provided, taking advantage of the existing literature and EU-funded projects.

- The **second section** focuses on the different **options** related to the RRI implementation process.

- The **third section** provides a short **reflection on possible approaches to RRI**.

The document has been developed by Luciano d'Andrea and Giovanna Declich (K&I).

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Section One –
Interpreting RRI

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This section provides a short reflection on RRI so as to help GRACE implementing partners to better grasp what is actually at stake with it and with the Grounding Actions aimed at embedding RRI in their own organisations.

The section will start from the definitions given to RRI in the literature and the dimensions of RRI (paragraphs 1 and 2). Then, an enlargement in scope is done, in order to contextualise RRI in the broader changes occurring in science and innovations (paragraphs 3, 4, and 5). Finally, an interpretation of RRI is provided which could usefully be taken into consideration while designing and developing the RRI-oriented Grounding Actions (paragraph 6).

1. RRI definitions

Responsible Research and Innovation (RRI) can be generally understood as a specific policy approach aimed at managing science and science-society relations. However, exactly defining what RRI is and which are its contents and dimensions is not actually simple. In the box below, a set of definitions of RRI are provided.

SOME DEFINITIONS OF RRI

The process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (R. Von Schomberg)[1].

A collective commitment of care for the future through responsive stewardship of science and innovation in the present (R. Owen et al.)[2].

An alignment to R&I process and its outcomes to values, needs and expectations of European society (M. Georhean-Quinn)[3].

Ways of proceeding in Research and Innovation that allow those who initiate and are involved in the processes of research and innovation at an early stage (A) to obtain relevant knowledge on the consequences of the outcomes of their actions and on the range of options open to them and (B) to effectively evaluate both outcomes and options in terms of moral values (including, but not limited to wellbeing, justice, equality, privacy, autonomy, safety, security, sustainability, accountability, democracy and efficiency) and (C) to use these considerations (under A and B) as functional requirements for design and development of new research, products and services (Expert Group on the State of Art in Europe on RRI)[4].

Reflection, analysis and (public) debate concerning the moral acceptability of new technology and innovation (J. Van den Hoven)[5].

[1] Von Schomberg, R. (2012). Prospects for technology assessment in a framework of responsible research and innovation. In *Technikfolgen abschätzen lehren* (pp. 39-61). VS Verlag für Sozialwissenschaften.
[2] Owen, R., Stilgoe, J., Macnaghten, P., Gorman, M., Fisher, E., & Guston, D.H. (2013). Framework for Responsible Innovation. In R.Owen, Heintz, M. & Bessant, J. (eds.) *Responsible Innovation*. Wiley.
[3] Geoghean-Quinn, M. (2012). *Science in Dialogue. Towards a European Model for Responsible Research and Innovation*. Odense, Denmark.
[4] Expert Group on the State of Art in Europe on RRI (2013). Options for strengthening responsible research and innovation. Luxembourg: Publications Office of the European Union.
[5] van den Hoven, J. (2014) *Responsible Innovation in brief*. The Delft University of Technology.

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A higher-level responsibility or meta-responsibility that aims to shape, maintain, develop, coordinate and align existing and novel research and innovation-related processes, actors and responsibilities with a view to ensuring desirable and acceptable research outcomes (B.C. Stahl)[6].

As highlighted by Job Timmermans and Bernd Stahl[7], RRI is alternatively interpreted as:

- Something which is **external to the research and innovation process** (in particular a governance process) (this is, for example, the definition proposed by Von Schomberg or by Owen et al.)

- A **requirement to be embodied in the research and innovation process** (the definition given by Geoghean-Quinn, which reflects the official position of EU)

- A **part of the research and innovation process** and even, we could add, a different way to make research and innovation (the definition provided by the Expert Group on the State of Art in Europe on RRI or that of Stahl seem to fall into this group).

Timmermans and Stahl also notice that, in many cases, **not a real definition of RRI** is given but a procedural approach to RRI, explaining, not what RRI is, but simply how to do it.

2. RRI keys and dimensions

The **ambiguity** about the nature of RRI can be observed also when the **contents of RRI** are concerned.

In this regard, the EC approach is quite simple (and perhaps simplistic), i.e., using RRI as an **umbrella concept** encompassing already existing issues dealt with in the context of research and innovation policies, i.e., gender equality in science, open access to research data and publications, research ethics and integrity, citizen engagement, and governance (intended as a means for integrating the other five dimensions)[8].

However, the majority of the authors prefer to approach RRI, not in terms of specific contents, but in terms of specific **conceptual dimensions of RRI** which, separately or in combination with each other, are supposed to induce changes in research practices, science policies or scientific culture.

As highlighted by Burget, Bardone and Pedaste[9], there is a convergence among authors on four main dimensions of RRI.

- **Inclusion.** It mainly refers to the engagement of different stakeholders from the early stages of research and innovation onward so as to give voice to all the concerned interests, values, needs, and beliefs.

[6] Stahl, B. C. (2013). Responsible research and innovation: The role of privacy in an emerging framework. *Science and Public Policy*, *40*(6), 708-716.
[7] Timmermans, J., & Stahl, B. (2013). Annual Report on the main trends of SiS, in particular, the trends related to RRI. *GREAT (Governance of Responsible Innovation)*.
[8] European Commission (2012). *Responsible Research and Innovation. Europe's Ability to Respond to Societal Challenges*. Publication Offices of the European Union.
[9] Burget, M., Bardone, E., & Pedaste, M. (2017). Definitions and Conceptual Dimensions of Responsible Research and Innovation: A Literature Review. *Science and engineering ethics*, *23*(1), 1-19.

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- **Anticipation**. It refers to the capacity of envisioning the future of R&I and understanding how current dynamics help design the future in order to prevent risks and to lead research to desirable impacts.

- **Responsiveness.** It concerns the capacity to develop proactive management of new technologies so as to identify risks and develop an ethically adequate response. According to Burget, Bardone and Pedaste, responsiveness also relates to transparency (responses should be open to the public debate) and accessibility (scientific results about risks and responses should be openly accessible to everyone). As it is easy to notice, responsiveness is partially overlapped with the dimension of anticipation.

- **Reflexivity**. It is mainly seen as the capacity of the research system to keep control of its own activities and assumptions, to be aware of the limits of the knowledge produced and of the framing processes connected to the identification of the issues to be addressed as well as to reflect on values and beliefs connected with R&I. Reflexivity is linked to public dialogue and collaborative approaches in science.

3. A new social model for science

The points discussed so far allow perceiving the major expectation underpinning RRI, i.e., **modifying the consolidated social model** – often expressed with the image of the "Ivory Tower" – of producing and reproducing science. Such a model sees science as:

- Separated and autonomous from society
- Also separated from the facts, worries and practicalities of society and, in general, of the real world
- Based on forms of self-direction (it advances on the basis of scientists' interests)
- Not involved in the actual implications and use of its outputs (in terms of knowledge, discoveries, technologies, but also impacts and risks).

All in all, RRI suggests a model for science **going to the opposite direction**, i.e. a social institution:

- Fully embedded in society and strongly connected with political, economic, and societal dynamics (*de facto* limiting its autonomy)
- Open to the external lay actors and sensitive towards expectations, needs, worries and problems of society
- Based on forms of co-direction and co-production with stakeholders and the public at large
- Directly concerned with the actual implications and use of its outputs.

Following this logic, the still dominant social model of science, from the RRI perspective, is thought as leading to an "**irresponsible" research and innovation**, i.e. a social institution potentially dangerous in its process and products, ethically questionable in its orientations and socially undesirable in its impacts. In the texts dealing with RRI, a sense of guilt can be sometimes perceived about the errors made by science and scientists in social, ethical and environmental terms.

In this perspective, RRI, as it is usually presented, is largely understood as a **prescriptive approach**, that is an approach mainly based on ethical arguments (pertaining to what is right and what is wrong); and these arguments are supposed to be able, as such, to mobilise scientists, science leadership and other stakeholders.

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4. Why RRI just now?

These considerations lead us to a question: why have the concept and the debate on RRI been developing just now, i.e., in the last decade?

Before answering, it could be useful to shortly recall the **origin of RRI**.

As Stahl[10] pointed out, in Europe the term "responsible innovation" was introduced, in its current usage, in 2009. However, the European Research Advisory Board had already published in 2005 a document in preparation of the EU FP7 for Research and innovation, titled "Science and Society"[11], in which the notion of a "responsive and responsible European Science" was proposed.

Going back in time, we can also notice **some antecedents of RRI** such as, in 2001, the establishment in USA of the NSF-ADVANCE Programme, i.e., the first national funding scheme aimed at activating institutional change processes in research organisations to favour gender equality in science and innovation, or the development, in the 1990s, of the so-called ELSA (ethical, legal, and social aspects of research) programmes, aimed at including these aspects in the research process.

Not by chance, in the same period, different scholars were developing a series of **interpretive models** focusing on the deep and broad changes which were and still are occurring in science and innovation. Among these models, we can mention here the Mode 1/Mode 2 model[12], the Post-academic science[13], the Triple Helix approach[14], the Post-normal science[15] or the Innovation systems[16].

To a different extent, all these models capture **important aspects of the evolution of science and innovation**, including:

- The transformation of science as a **multi-actor process**, involving a wide range of actors different from scientists up to encompass the public at large
- The increasing tendency toward **political steering** of scientific research, especially through the mechanism of competitive access to public funds
- The increasing accent to the **social and economic benefits** of scientific research, which is now favouring investments in applied research rather than in fundamental research
- The increasing tendency toward **trans-disciplinary research** also accompanied with a growing specialisation within the different scientific disciplines

[10] Stahl, B. C. (2013). Responsible research and innovation: The role of privacy in an emerging framework. *Op. Cit.*
[11] European Commission (2006), EURAB Activities Report 2005, *European Communities.*
[12] Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). The new production of knowledge: the dynamics of science and research in contemporary societies. Sage; Nowotny, H., Scott, P. & Gibbons, M. (2001). *Re-thinking Science: Knowledge and the Public in the Age of Uncertainty*. Polity.
[13] Ziman, J. (2000): *Real Science. What it is, and what it means*. Cambridge University Press.
[14] Leydesdorff, L., & Etzkowitz, H. (1998). The triple helix as a model for innovation studies. *Science and public policy*, *25*(3), 195-203.; Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university-industry-government relations. *Research policy*, *29*(2), 109-123.
[15] Funtowicz, S.O., & Ravetz, R.J. (1993). Science for the post-normal age. *Futures,* September.
[16] Lundvall, B. Å. (ed.) (1992). National Innovation Systems: Towards a Theory of Innovation and Interactive Learning. Pinter.

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– The **decreasing authority** of and the increasing people's **distrust** in science and scientific institutions, which is leading to a growing demand for **accountability and public scrutiny** of research process and products, also in view of preventing risks and undesirable impacts.

All the interpretive models, with a different accent, show both the opportunities and risks connected to these changes, all seen as capable to profoundly modifying the social position and status of science in society and making all dominant strategies (those based on a one-way scientific communication) as increasingly ineffective.

However, it could be naïf to consider science as the only institution in which these changes are occurring. On the contrary, **all the other social institutions of modernity**, including politics, public administrations, or economic institutions, **are strongly involved by similar processes**. For example, all these institutions are suffering from a diminishing authority and public confidence, are no longer restricted to "experts" and are open to and often challenged by "lay people", are affected by forms of de-standardisation, fragmentation and variability of their internal mechanisms, and are exposed to a social pressure pushing them to become more useful, effective, productive, and sensitive to societal needs and expectations.

These general trends overall reflect a **modifying balance between social structures** (embodied in, e.g., social norms, shared believes, dominant behavioural patterns, social configurations, and cultural views) **and agency** (i.e. the capacity of individuals to more freely think and act as well as to "build up" their own life, projects, and identity, ignoring or even challenging the social structures). While in **modern mass society** social structures were remarkably stronger than individuals' agency (thus, the individuals had to adapt to social structures), in the so-called **late modernity**, individuals' agency is lesser and lesser limited by social structures, with the effect of producing a highly diversified social life (in terms of, e.g., lifestyles, social demands, interests, expectations, solutions, and social configurations) and further weakening social structures and the social institutions which embody them[17].

Thus we could say that RRI emerged as an issue in the last decade (with some antecedents tracking back to the last decades of the last century) just because of the **development and consolidation of these new interpretive frames** which provided RRI with a solid theoretical background, in turn reflecting broader transformations affecting contemporary societies as a whole.

5. Critical changes

The models mentioned above, as well as the literature around RRI, tend to focus on some specific aspects of the evolution of science and innovation, mostly pertaining to science-society relations or, better, the relations between scientific actors and other concerned stakeholders.

However, there is a wide and fragmented scientific literature – often ignored or overlooked by these models and in the RRI debate – which highlights the spreading of a range of **critical changes** which do not concern the relations between scientific actors and other concerned stakeholders, but which involve the **most intimate mechanisms and organisational structures** on which the production of scientific knowledge is based.

The following tendencies can be mentioned here.

[17] See, for example: Beck, U. (1992). *Risk society: Towards a new modernity* (Vol. 17). Sage; Giddens, A. (1991). *Modernity and Self-Identity: Self and Society in the Late Modern Age*. Stanford University Press; Bauman, Z. (2000). *Liquid society*. Polity; Archer, M. S. (2007). *Making our way through the world: Human reflexivity and social mobility*. Cambridge University Press;

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- **Increasing competition** among research institutions and research systems on a global scale[18].

- **Acceleration of all research and innovation processes**, with impacts on the organisation of the academic life, the researchers' life conditions, research quality, and research integrity[19].

- A **shrinking of research funds**, combined with an increase in the research costs, producing an extremely competitive access to funds and publishing, a decline in the success rate for grant applicants, the activation of new forms of "delocalisation" of the research work (laboratory activities are moved in emerging countries where costs are lower) and an increase in the time researchers devote to look for new research fund[20].

- A **diversification of tasks** within research organisations, also due to an increased market-oriented organisations, leading researchers to devote time to a wide range of different types of activities (participation in extended research networks, direct involvement in innovation and technology transfer, activities related to accountability, transparency and public scrutiny, administrative work, etc.), with an inevitable decrease in the time devoted to scientific work[21].

- An **increased staffing** of research organisations, especially conducted by heightening the number of contingent staff (PhD students and postdocs) prevalently paid through soft money (i.e., money related to specific projects) in order to contain personnel costs; this is also determining an increasing pressure on young researchers to make more in less time with the aim of accessing permanent positions which are reducing in number[22].

- A consequent **segmentation of staff** by age, sex, nationality, and contractual status, leading to, e.g., overtraining (tendency to retain PhD students and Postdocs longer than necessary), decrease in teaching quality (increasingly done by ever cheaper teaching staff), changes in internal labour relationships (research organisations are no longer a "community of peers" but a sort of "industry"

[18] See, for example Alberts, B., Kirschner, M. W., Tilghman, S., & Varmus, H. (2014). Rescuing US biomedical research from its systemic flaws. *Proceedings of the National Academy of Sciences*, *111*(16), 5773-5777; Fochler, M., Felt, U., & Müller, R. (2016). Unsustainable growth, hyper-competition, and worth in life science research: Narrowing evaluative repertoires in doctoral and postdoctoral scientists' work and lives. *Minerva*, *54*(2), 175-200; Schatz, G. (2014). The faces of big science. *Nature Reviews Molecular Cell Biology*, *15*(6), 423-426

[19] See, for example, Pels, D. (2003). *Unhastening Science: Autonomy and reflexivity in the social theory of knowledge*. Liverpool University Press; Garforth, L. & Cervinková, A. (2009). Times and trajectories in academic knowledge production. In U. Felt (Ed.), *Knowing and living in academic research. Convergence and heterogeneity in research cultures in the European Context*. Institute of Sociology of the Academy of Sciences of the Czech Republic; Müller, R. (2014, September). Racing for what? Anticipation and acceleration in the work and career practices of academic life science postdocs. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research* (Vol. 15, No. 3); Vostal, F. (2016). *Accelerating Academia: The Changing Structure of Academic Time*. Palgrave MacMillan; Bianchetti, L., & Quartiero, E. M. (2010). Researchers under Pressure: a comparative study of new forms of producing, advising and transmitting knowledge in Brazil and the European Union. *European Educational Research Journal*, *9*(4), 498-509.

[20] See, for example: OECD (2016). *Science, Technology and Innovation Outlook 2016*. OECD Publishing; Alberts, B., Kirschner, M. W., Tilghman, S., & Varmus, H. (2014). Rescuing US biomedical research from its systemic flaws. *Op. cit*.; Stephan, P. (2012). *How economics shapes science*. Harvard University Press; Ehrenberg, R. G., Rizzo, M. J., & Jakubson, G. H. (2003). *Who bears the growing cost of science at universities?* (No. w9627). National Bureau of Economic Research.

[21] See, for example: Kogan, M., Moses, I., & El Khawas, E. (1994). *Staffing Higher Education*. Jessica Kingsley; Musselin, C. (2007). The transformation of academic work: Facts and analysis. *HAL Archives Ouvertes* <hal-01066077>; Bozeman, B. (2015). Bureaucratization in academic research policy: perspectives from red tape theory. In *20th International Conference on Science and Technology Indicators, Lugano, Switzerland;* FASEB (2013). *Findings of the FASEB Survey on Administrative Burden* (https://www.faseb.org/Portals/2/PDFs/opa/2014/6.7.13%20FASEB%20NSB%20Survey%20findings.pdf).

[22] See, for example: Dijstelbloem, H., Huisman, F., Miedema, F., & Mijnhardt, W. (2014). Why science does not work as it should. And what to do about it. *Science in Transition, Position Paper*; Alberts, B., Kirschner, M. W., Tilghman, S., & Varmus, H. (2014). Rescuing US biomedical research from its systemic flaws. *Op. cit*.; Stephan, P. (2012). *How economics shapes science, Op.cit.;* Ravetz, J. (2016). How should we treat science's growing pains? *The Guardian*, 8 June 2016.

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employing high-qualified human resources), individualisation (researchers increasingly act as individual professionals and not as part of a staff), and attitude of self-promotion among scientists[23].

- An increase in the **mobility of researchers**, entailing, e.g., difficulties in returning to one's home country, or problems in managing family life, especially for women scientists[24].

- A growing **pressure on research assessment systems**, due to the hyper-production of scientific knowledge and the increased competition among researchers and research organisations, which emerge in phenomena like systematic problems and errors in peer review or increased use of quantitative indicators to assess researchers, research institutions and scientific journals, with distorting or at least questionable effects on science quality[25].

- A set of **critical dynamics affecting the quality of research**, such as decreasing reproducibility of scientific data, tendency of researchers to adopt safe and low-risk research strategies, to produce irrelevant science (for career advancement rather than producing advances in science) and redundant papers (publishing the same data or papers more than once), increasing malpractice or undesirable impacts of commercial interests on research quality[26].

While, in many cases, these trends are offering new and unexpected opportunities for research and innovation, it is however evident the pervasiveness and depth of the changes researchers and research institutions are facing and the many risks of different nature they are exposed to.

[23] See, for example: Musselin, C. (2005). European academic labour markets in transition. *Higher Education*, *49*(1), 135-154; Musselin, C. (2007). The transformation of academic work: Facts and analysis. *Op. Cit.*; Dijstelbloem, H., Huisman, F., Miedema, F., & Mijnhardt, W. (2014). Why science does not work as it should. And what to do about it. *Op. Cit;* Slaughter, S., & Leslie, L. L. (1997). *Academic capitalism: Politics, policies, and the entrepreneurial university*. The Johns Hopkins University Press, 2715 North Charles Street, Baltimore, MD 21218-4319.; Ylijoki, O., & Ursin, J. (2015). High-flyers and underdogs: The polarisation of Finnish academic identities. In L. Evans, & Nixon, J. (Eds.), *Academic Identities in Higher Education: The Changing European Landscape*. Bloomsbury Academic.

[24] See, for example, Dubois, P., Rochet, J. C., & Schlenker, J. M. (2014). Productivity and mobility in academic research: Evidence from mathematicians. *Scientometrics*, *98*(3), 1669-1701; Franzoni, C., Scellato, G., & Stephan, P. (2014). The mover's advantage: The superior performance of migrant scientists. *Economics Letters*, *122*(1), 89-93; Halevi, G., Moed, H. F., & Bar-Ilan, J. (2016). Does Research Mobility Have an Effect on Productivity and Impact?. *International Higher Education*, (86), 5-6; Marinelli, E., Pérez. S.E. & Fernandez-Zubieta, A. (2013). *Research-Mobility and Job-Stability: Is There a Trade-Off?.* Paper presented at the 35th DRUID Celebration Conference 2013, Barcelona, Spain, June 17-19; Børing, P., Flanagan, K., Gagliardi, D., Kaloudis, A., & Karakasidou, A. (2015). International mobility: Findings from a survey of researchers in the EU. *Science and Public Policy*, *42*(6), 811-826.

[25] See, for example: Guthrie, S., Lichten, C., Corbett, J. & and Wooding, S. (2017). *International mobility of researchers. A review of the literature.* RAND Corporation; Young, N. S., Ioannidis, J. P., & Al-Ubaydli, O. (2008). Why current publication practices may distort science. *PLoS medicine*, *5*(10), e201; Osterloh, M., & Frey, B. S. (2015). Ranking games. *Evaluation Review*, *39*(1), 102-129; Hicks, D., Wouters, P., Waltman, L., De Rijcke, S., & Rafols, I. (2015). The Leiden Manifesto for research metrics. *Nature*, *520*(7548), 429; Rothwell, P. M., & Martyn, C. N. (2000). Reproducibility of peer review in clinical neuroscience: Is agreement between reviewers any greater than would be expected by chance alone?. *Brain*, *123*(9), 1964-1969; Gunsteren (van) W. (2015) (2015). On the pitfalls of peer review. *F1000Research*, *4*

[26] See, for example: Vermeulen, N., (2010). *The projectification of science: the case of virology*. Paper presented at the annual meeting of the 4S Annual Meeting – Abstract and Session Submissions, Crowne Plaza Cleveland City Center Hotel, Cleveland, OH; Stephan, P. (2012). *How economics shapes science, Op.cit.*; Brochard, L. (2004). Redundant publications, or piling up the medals. Getting published is not the Olympic Games. *Intensive care medicine*, *30*(10), 1857-1858; Irzik, G. (2013). Introduction: Commercialization of academic science and a new agenda for science education. *Science & Education*, *22*(10), 2375-2384; Kaiser, M. (2014). The integrity of science–Lost in translation?. *Best Practice & Research Clinical Gastroenterology*, *28*(2), 339-347; Baker, M. (2016). Is there a reproducibility crisis? A Nature survey lifts the lid on how researchers view the 'crisis rocking science and what they think will help. *Nature*, *533*(7604), 452-455; Dijstelbloem, H., Huisman, F., Miedema, F., & Mijnhardt, W. (2014). Why science does not work as it should. And what to do about it. *Op. cit*.; Alberts, B., Kirschner, M. W., Tilghman, S., & Varmus, H. (2014). Rescuing US biomedical research from its systemic flaws. *Op. cit*.

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6. A view of RRI

The issues discussed so far, although in a short and schematic way, help develop some considerations for building up an interpretation of RRI on which GRACE could be based.

a. RRI as a policy reaction to change

In the picture which has been drawn above, RRI should be viewed as a **policy reaction to the changes already occurring in science and innovation** or, better, an attempt to drive these changes towards desirable or at least manageable outputs.

As a matter of fact, RRI is more or less based on the double perception that one the one side, science is changing because of the broader changing affecting society and, on the other side, this process is making more intense, ambiguous, and problematic the relations between science and society.

It is also to notice that RRI is **only one** of the possible policy reactions to the transition of science and innovation. For example, the many models developed for modifying the way in which research organisations are structured and managed (for example, that of the Entrepreneurial university[27]) or the way in which innovation is done (for example, the so-called Smart Specialisation strategy[28]) are equally forms of reaction to the changes affecting science.

b. Usefulness as the main motivation for getting involved with RRI

As we said above, RRI is mainly intended as a prescriptive concept, based on ethical arguments. For such a reason, the main message is that RRI is to be implemented because it is right to do it, regardless of the features of the context of application.

However, the picture described above suggests that a simply prescriptive approach to RRI is feeble, although ethical motivations may play a role. As a matter of fact, if RRI aims to manage the changes (with their risks and opportunities) which are already occurring in science and innovation, the motivations to take action should have mainly to do with the actual **capacity of RRI to solve the problems** researchers and research organisations are already facing and worried about.

Researchers, officers or leaders of research organisations should, therefore, see RRI as something help them save time and resources and not (as it often happens), a bureaucratic obligation, a "tick box operation" or a "superstructure" which does not modify research organisations at all.

c. RRI as a "stock" of knowledge and practices

[27] See, for example, Slaughter, S., & Leslie, L. L. (1997). *Academic capitalism: Politics, policies, and the entrepreneurial university*. *Op. cit.*.; Clark, B. R. (1998). *Creating Entrepreneurial Universities: Organizational Pathways of Transformation. Issues in Higher Education*. Elsevier Science Regional Sales, 665 Avenue of the Americas, New York, NY; Nwaogu, E. E. (2014). A Guiding Framework for Entrepreneurial Universities., OECD Publications; Etzkowitz, H. (2017). The entrepreneurial university. *Encyclopedia of International Higher Education Systems and Institutions*, 1-5.

[28] See, for example, Foray, D. (2014). *Smart specialisation: Opportunities and challenges for regional innovation policy*. Routledge; Carayannis, E. G., & Rakhmatullin, R. (2014). The quadruple/quintuple innovation helixes and smart specialisation strategies for sustainable and inclusive growth in Europe and beyond. *Journal of the Knowledge Economy*, *5*(2), 212-239; McCann, P. (2015). *The regional and urban policy of the European Union: Cohesion, results-orientation and smart specialisation*. Edward Elgar Publishing.

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This leads to a third consideration.

RRI does not exist in itself. As we already observed, its definition, contents, and boundaries are not univocally interpreted and sometimes are even ambiguous.

We could say, therefore, that **RRI only exists when it is contextualised and actually implemented** in a given research organisation and research system, turning an abstract view of RRI into a self-tailored "**RRI profile**", i.e. a set of actions, measures and ideas pertaining to RRI.

In this sense, RRI can be understood as a **stock of theoretical and practical knowledge**, or, broadly speaking, as a set of resources, a cultural background and a source of inspiration for those who want to face the key transformations of science and innovation, as they manifest themselves in their own organisation.

This obviously implies the **presence of a group of people** – we could say a "transformational agent" – motivated to activate a process of change, able to appropriately mobilise the internal or external actors and capable to access the necessary skills, capacities and resources to develop impact-making actions so as to modify the existing structures (practices, views, languages, culture, perceptions, objectives, etc.) and to face the many resistances and barriers to change.

d. Implementing RRI through institutional change

Governing and driving the transformations affecting science and innovation as well their positive and negative implications require, to a variable extent, the implementation of **institutional changes in research organisations**.

Institutional change can be operationally defined as a type of change triggered in a given organisation which is characterised by **four specific dimensions**, i.e.:

- Irreversibility
- Comprehensiveness
- Inclusiveness
- Contextualisation.

These four dimensions are described in the table below.

Dimension	Description
Irreversibility	Institutional changes should be visibly rooted in the organisations so that they can evolve over time but cannot be reversed, e.g., by a simple leadership turn-over or budget cuts. In the perspective of GRACE, this means that the Grounding Actions should generate an institutional arrangement (i.e., any explicit, recognised and binding measure) thought to last over time.
Comprehensiveness	Institutional changes, to be real and irreversible, cannot be understood as a mere change of the organisation rules and procedures. Even the most well-defined rules and procedures can be circumvented when they are not supported by those who should apply them. Therefore, institutional change, to some extent, should affect other "layers" of the organisation life, e.g., cultural and cognitive attitudes of staff and

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Dimension	Description
	leaders, daily behaviours and practices, communication patterns and, obviously, procedures, rules, standards and organisational structure
Inclusiveness	Institutional changes, to be comprehensive, have to involve, sooner or later and to a variable extent, all the players and stakeholders within the concerned organisation, from the leadership to the students. In other words, institutional changes cannot be but a collective effort. Therefore, both top-down and bottom-up processes are to be activated and coordinated.
Contextualisation	Finally, as already said, institutional changes cannot be the same everywhere. Each organization has its features, past experience, specific problems, cultural background, mission and objectives. Also, the national culture and policies have their weight in making research organisations different from each other. Therefore, even though problems and solutions can be highly recursive and assume recurrent patterns, their mix is quite unique. Hence the need to contextualise institutional changes, e.g., devising strategies and selecting tools which are specifically tailored on the concerned institution or unit.

e. The role of Grounding Actions

Finally, to complete the picture and going more into the structure and features of the GRACE project, it is also necessary to dwell upon the **role of Grounding Actions**.

Quite simply, the Grounding Actions (GAs) can be understood as **any action aimed at implementing or favouring institutional change**. We could derive some **key features** of the GAs from what we said about the institutional change in general.

- In order to favour the **irreversibility** of change, GAs should be aimed at generating one or more **institutional arrangements**, i.e., explicit, recognised and binding measures (e.g., new funds, units, officers, regulations, decisions, plans, guidelines, etc.) ensuring continuation and long-term sustainability to the actions carried out under GRACE.

- In order to favour the **comprehensiveness** of change, GAs should be viewed, not as single actions or events, but as a **coordinated set of activities triggering a process of change**, characterised by its own dynamics (e.g., activating resistances and reactions and entailing negotiations). This also means that GAs should be as far as possible **integrated** with each other.

- In order to favour the **inclusiveness** of change, GAs should be able to **mobilise the key concerned actors** and to develop with them a wide range of **negotiations** of different type (interpretive, symbolic, institutional, etc,).

- Finally, in order to favour the **contextualisation** of the change, GAs should be based on a **diagnosis** of the impacts that the transformations affecting science and innovation are having or are expected to have on the research organisation, an **analysis** of the initiatives and measures already in place oriented to RRI and the **development of an RRI profile** tailored on the needs, features and expectation of the concerned organisation.

The features of the Grounding Actions in relation to the dimension of institutional change are summarised in the table below.

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Dimension of the institutional change	Features of the Grounding Actions
Irreversibility	GAs should result in a set of institutional arrangements ensuring continuation and long-term sustainability to the actions initiate under GRACE
Comprehensiveness	GAs should include a coordinated set of activities triggering a process of change and should integrate with each other
Inclusiveness	GAs should mobilise the key concerned actors and activate negotiations processes about problems and solutions to take
Contextualisation	GAs should be based on a diagnosis of the transformations affecting the concerned research organisations and on an analysis of the initiatives and measures towards RRI already in place and should lead to the development of an RRI profile tailored on the concerned organisation

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Section Two –
Implementing RRI

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After a reflection on nature and contents of RRI, we can start reasoning on which are the most appropriate approaches to RRI to adopt.

According to the Oxford Dictionary, an **approach** can be defined as "a way of dealing with a situation or problem". In our case, the situation to be dealt with is the presence of six research organisations little involved with RRI and the problem to be solved is how institutionally embedding RRI in them.

In practical terms, an approach can be understood as the result of a **combination of choices**, in principle interrelated in a way to develop something consistent (precisely, an approach).

What do these choices refer to? In other words, which are the different **options** in principle available in implementing RRI?

On the basis of previous of an analysis of the many EU-funded projects dealing with RRI or the single RRI keys, we can identify, in this regard, **four main areas** in which some choices have to be made, respectively pertaining to:

- The promoting entity
- The stakeholders' involvement
- The development of the process of change
- The institutional arrangements.

For each of them, some "**critical steps**" of the RRI design and implementation process will be highlighted, showing, for each of them, the main options available.

1. Promoting entity

a. The structure and composition of the core and the extended team

The first critical step to deal with concerns the entity who promotes RRI. This is a key variable which can be of pivotal importance in defining how the institutional change will develop. For example, Caprile et al.[29] distinguish four kinds of programmes for promoting institutional change, just based on who drives the process, i.e., top-down programmes (with the leaders as initiators), bottom-up programmes (with single researchers as initiators), idiosyncratic programmes (with a single person who tries to introduce specific changes) and departmental programmes (with a departmental manager as initiators).

In the case of GRACE, understanding who promotes and manages the process of change is also relevant. In this regard, it could be useful distinguishing between the "**core team**" (the group of people directly supported by GRACE and in charge of carrying out the GAs and designing the Roadmap) and the "**extended team**" (including other individuals of the organisation working on GAs without formal responsibility about their implementation and engaged with the GAs irregularly, occasionally or only performing specific tasks).

The composition of the team plays a crucial role for different reasons:

[29] Caprile, M., Addis, E., Castaño, C., Klinge, I., Larios, M., & Meulders, D. (2012). Meta-analysis of gender and science research. *Luxembourg: Publications Office of the European Union.*

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- Team composition influences the capacity of the Team to mobilise other actors, to coordinate their activities and to lead them to modify the existing "structures" (rules, cultural approaches, behavioural patterns, procedures, etc.)

- Team composition influences the overall approach adopted in the design and implementation of GAs and the Roadmaps

- Team composition influences the quality of the action, being this latter largely depends on the expertise, knowledge and experience of team members on institutional change and on RRI keys (gender equality issues, open access, ethical issues, etc.).

Many different solutions can be envisaged: for example, involving in the extended team relevant leaders, representatives of key administrative office (Human Resources Department, Communication Department, offices in charge of Research or Teaching, etc.), single researchers or staff members particularly motivated or interested in RRI, or representatives of internal groups or networks. Thus, a wide range of possible configurations of the promoting entity, mixing core and extended team, can be envisaged.

Roughly speaking, three main (not alternative) **options** can be identified:

- Involving relevant **leaders** so as to enhance the political support for implementing the GAs;
- Involving **management** so as to enhance the technical support for implementing the GAs;
- Involving single **individuals**, **networks** or specific **stakeholders** who are directly interested in or already active on RRI-related issues (for example, informal women's network on gender equality or researchers particularly active in science communication on public engagement).

b. The weight of volunteering

Another aspect to be considered is the **weight of volunteering**, i.e., if and to what extent the promoting entity also encompasses people who participate on a voluntary basis in addition to those participating because of institutional duties. In this regard, it is to highlight that often also leaders or administrative staff members participate in institutional change programmes on a voluntary basis.

It is quite evident that the involvement of volunteers could be positive since they are surely highly motivated people, could infuse passion into the GAs and could make some actions more effective and impactful. At the same time, largely Involving volunteers may make the core team or the extended team more unstable because of their usually irregular or limited involvement.

2. Stakeholders' involvement

The second key component which comes into play in developing an RRI-oriented institutional change concerns who are the key actors to be involved in the GAs and more in general in the RRI process. It is quite evident that who are these actors largely will depend on the kind of Grounding Action. For example, a GA pertaining to gender equality in science may involve individuals and groups of people different from those who could be involved in case of GAs on, e.g., open access or public engagement. It is equally clear that some kinds of actors (for example, the key leaders of the organisation or some central units or officers) could or should be involved anyway.

In this area, some **critical steps** also deserve to be analysed.

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a. Participatory levels

GAs can be different according to the tendency to involve **many or few actors**.

This aspect partially depends upon the type of action to be developed. However, levels of participation it is mainly the output of specific choice done the promoting team.

One can decide to implement a given action investing on participation or not (for example, activating participatory tools and consultation processes), looking for high or low level of internal or external visibility (for example, adopting communication tools, organising conferences, or using the web) or enlarging or restricting the target or the scope of the actions (e.g. involving all researchers in developing GAs focused on open access or gender equality, involving students in developing GAs focused on education, etc.).

So, while the two options can be roughly defined as "high" or "low" participatory level, the key question is should be to what extent, why and how promoting participation.

b. External ties

Another variable is the tendency to develop relationships with **external actors**.

Different reasons can be found in the establishment of external ties. They may be aimed at, e.g.:

- Learning from others' experience (for example, involving organisations which already developed a given type of GA)
- Accessing external expertise which is not available inside the organisation
- Establishing relations with specialised networks focused on RRI-related issues (for example, national associations on ethical issues in science, national networks of women's researchers, etc.) which could support the team in developing the GAs
- Involving external key actors in the GAs design and implementation process (for example, civil society organisations, governmental bodies, etc)
- Looking for resources and support for establishing long-term institutional arrangements for the actions initiated under GRACE (relations with foundations or funding organisations, for example, or other actors providing services and expertise relevant to the GA)
- Increasing the visibility of GAs also internally the organisation by involving external supporters or testimonials.

Again, while the options can be roughly defined as "**high**" or "**low**" level of external ties, the key question concerns why, with whom and to what extent establishing these ties.

c. Political backing

Grounding Actions can be also differentiated according to the **role played by top management** in promoting and implementing the action.

There are different examples of RRI-oriented initiatives which have been promoted and implemented, at least to a certain development stage, with a limited involvement of leaders (for example, adopting a bottom-up approach or limiting the action to a very specific unit or part of the organisation). On the

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other hand, many experts in an institutional change in research organisations highlight the importance of involving top leadership from the beginning in order to facilitate the development of the action and its embedment in the organisation and to make the action visible (using leaders, for example, as testimonials).

At the same time, trying to involve leaders who do not want to get involved may be risky and counterproductive. Moreover, a large involvement of leaders may limit the capacity of the team to choose the most effective or the most feasible solutions.

The question is, therefore, finding the level of political backing which is the most appropriate or the highest as possible, taking into consideration features of the organisation and orientations of leaders.

d. Managerial support

Another variable is the level of **involvement of middle management** in designing and implementing GAs. Administrative offices (including, e.g., Human Resources department, Communication department, Research department, or Teaching department) may be to the different extent involved with the design and implementation of GAs.

Their direct participation could facilitate the implementation and long-term sustainability of GAs, the involvement of other actors, or the access to resources, but could also have negative impacts, such as slowing down the implementation process, producing views of the GAs in conflict with those of the Team, or making the process more bureaucratic.

Hence the need to look for the highest level of managerial support as possible, understanding when, how and to what extent involving the concerned management structures.

3. Process of change

The third key component concerns the strategies to adopt in the GAs implementation process. Quite obviously, they largely depend upon the kind of GAs and the RRI key the GAs refer to. However, observing past experiences related to institutional change, four main **critical steps** deserve to be highlighted.

a. Focus

Organisations are complex entities and their changes imply to intervene on different factors of the life of the organisation. The question evoked here is then: which factors have the GAs primarily to start from?

Three main cases can be identified.

The first case is that of inducing institutional changes by directly modifying the **existing norms** (procedures, guidelines, protocols, rules or organisational charts, etc.), i.e. the "rules of the game" on which the life of the organisation is based[30].

[30] This reflects an organisational view of institution; see, for example, Coriat B., Weinstein O. (2002), Organizations, firms and institutions in the generation of innovation Research Policy 31273–290; North D.C. (1990) *Institutions, Institutional Change and Economic Performance*, Cambridge University Press, 1990.

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The second case is that of starting from a modification of the **social patterns** (cognitive, emotional, relational, behavioural, etc.) which are shared by the majority of people inside the organisation[31].

Finally, it can be also possible to indirectly induce institutional changes by primarily modifying the way in which **scientific knowledge is produced,** i.e. producing scientific knowledge adopting RRI principles and tools.

Obviously, many intermediated situations can be identified.

To make an example, for supporting gender equality, one can start:

- Modifying the **norms** pertaining to recruitment, promotion, or the language used in advertising the vacancies
- Modifying the **social patterns** through courses against gender bias addressed to recruitment and promotion committees or establishing mentoring schemes which take into account gender diversity issues
- Modifying the **research process** introducing a consultation process involving women and women's groups, imposing a gender perspective in the definition of the research questions or favouring a research team which is balanced in term of gender.

Although the third option does not directly act on the organisation, it is supposed to change the research practices enough to induce also changes in the way in which the research organisation is culturally and institutionally structured.

b. Negotiations

The process leading towards institutional change is primarily made up of **negotiations**. Indeed, changing an institution means bringing a set of key actors to agree upon new solutions, arrangements or mental approaches.

At least, **four different kinds of negotiation** can be identified, probably all necessary, but to a variable extent, according to the nature of GAs or their development stage, i.e.:

- The interpretive negotiation
- The symbolic negotiation
- The institutional negotiation
- The operational negotiation.

Interpretive negotiation concerns the interpretation of the situation. For example, people (men but also many women) tend to overlook or to deny the presence of forms of gender inequality in one's own organisation; research leaders think useful the one-way scientific communication but dangerous or useless the two-way public engagement in research processes; researchers, especially those working with industry, could see the open access to publications and data as risky for their own research and career; etc. Interpretive negotiations can be then necessary for raising awareness and

[31] This reflects a sociological view of institution; see, for example, Berger, P. L., Luckmann T. (1966) *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*, Garden City, NY, Anchor Books; North, D. C. (1990) *Institutions, Institutional Change and Economic Performance*, Cambridge University Press, Cambridge.

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making it possible for the different actors to agree about what are the problems to deal with and how to do it.

Symbolic negotiation concerns the visibility of the problems to face with and the solutions to be adopted. For example, for favouring gender equality in science it is necessary to support women scientists' visibility, removing or belittling stereotyped images of women scientists in institutional websites or promoting women's qualified presence in scientific communication events; for supporting open access, it is probably necessary to support the visibility of open journals, informing researchers about the benefits of procedures making data immediately accessible, or awarding scientists promoting open access; for promoting ethical issues, initiatives could be probably necessary for giving an internal visibility to ethical-related issues; and so forth. Symbolic negotiations can be necessary, for example, to put the issue in agenda, to start modifying personal attitudes and behaviours, to create pressure for pushing the organisation to change,

Institutional negotiation mainly concerns the definition of the new arrangements, be they aimed at modifying norms, social patterns, or the research process. Institutional negotiation, therefore, includes, for example, the screening of the most appropriate arrangements, the design of the new arrangements, and the actual establishment of them (through a decision, a norm, an agreement, the allocation of specific funds, etc.).

Operational dimension concerns the actual implementation of decisions in a reasonable time. This implies the power of translating goodwill and declarations into reality, activating monitoring and assessment mechanisms, providing for problem-solving, speaking out when commitments are not respected. It is not rare, for example, that decisions taken are not implemented, are implemented only partially, are implemented in a way which makes the decision taken less effective, because of bureaucratic or administrative reasons, passive or active resistance by someone, lack of time, or simply for a low level of efficiency.

c. RRI range

The term "range" refers here to the areas of RRI considered, including both the RRI keys (gender equality, citizen engagement, ethical issues, open access, and education) and the RRI dimensions (for example, anticipation, reflexivity, etc.).

Different options are available, including:

- **A narrow range**: the action is focusing only on the two or three RRI keys which are less developed in the organisation also in a long-term perspective
- **An expanding range**: the action starts from few RRI keys to enlarge the action to the other keys over time
- **A wide range:** the action, since from the beginning, tries to consider RRI in general, even though starting from some specific keys.

Choices related to the critical step could be in principle based on an appraisal, even rough, of the situation of RRI in the organisation and the definition of priority actions and keys. Consultations with relevant leaders and stakeholders could be effective in this regard.

d. Action scope

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A similar reflection can be done about the RRI scope, whereas the scope refers to the institutional domain in which an action is made (one department, more departments, the entire organisation).

Again, we could distinguish at least among:

- **A narrow scope**, focusing on a specific part of the organisation
- **An expanding scope**, i.e., starting from a part of the organisation to enlarge the RRI scope to other parts or to the organisation as a whole
- **A wide scope**, focusing on the entire organisation.

These options are largely dependent upon the size and features of the organisation.

4. Institutional arrangements

The fourth and last area in which a set of choices should be taken concerns the **institutional arrangements**. As said above (see section One, point 6), this term is used here to refer to any explicit, recognised and binding measure thought to last over time (or a reasonable lapse of time). Thus, what is at stake with the institutional arrangements is the **long-term sustainability** of GAs initiated under GRACE and ultimately the same possibility to activate a Roadmap towards RRI.

Institutional arrangements largely vary according to the nature of the GAs. However, some general critical steps can be highlighted.

a. Formalisation

The first critical step concerns the level of formalisation of the arrangements, i.e. to what extent the arrangements are formally and fully defined. Usually, formalisation implies, e.g., the definition of explicit and shared norms, code of conducts, standards, solutions, or procedures to be followed and often a set of measures to be activated in case they are not observed. To avoid misunderstanding, also low formalised arrangements often imply the establishment of norms, a code of conduct or a set of standards, with the difference that they are indicative and loosely applied.

Highly formalised arrangements are usually more binding for both the staff members and leaders than less formalised ones. Therefore, at least in principle, they are more likely to last over time. However, they sometimes are less adaptive to change, are more likely to be implemented in a bureaucratic way, can be perceived by the staff as an external and time-wasting obligation to be accomplished and are more difficult to be modified when needed.

Low formalised arrangements are more uncertain in their contents and implementing procedures and can be even variably interpreted. However, they are more flexible, can be more able to arouse the interest of staff members (since, in principle, anyone can contribute more in developing them) and can be more easily changed if the context changes.

b. Responsibility

A second critical step concerns **who is responsible for the arrangements** which have been established.

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It is to keep in mind that ensuring long-term sustainability to a GA not necessarily implies an institutionalisation of the GAs, i.e., the fact that the responsibility to implement the GAs shifts to the institution, becoming a task of a given officer, office or department. For example, an action can be developed and implemented by single researchers and volunteers or autonomously by single units without a formal involvement of the management or leaders of the organisation.

In many cases, mixed solutions can be found: volunteers or individuals implementing the action with the support of the organisation even with the support of external entities (for example, a governmental agency, a foundation, an NGO, or a local authority). The funds necessary to continue the action over time not necessarily come, entirely or partially, from the budget of the organisation.

c. Monitoring mechanisms

Another aspect to be considered is **how the implementation of the GAs and the Roadmap can be monitored**. The presence of monitoring mechanisms is necessary to assess the actual implementation, the effectiveness and the impacts of the arrangements which have been developed.

Undoubtedly, the choices related to monitoring mechanisms are strongly linked to the kind of institutional arrangement (highly formalised or not) and the actor(s) who are responsible for the implementation of the action. However, to main tendencies can be highlighted here.

On the one side, there could be a tendency to **integrate the monitoring process into the general assessment mechanisms** adopted in the organisation as a whole. In this sense, monitoring (and evaluation) is viewed as an organisational function to be implemented.

On the other side, there could be the tendency to **separate the monitoring process from those used for monitoring the other aspects of the life of the organisation**, recognising – so to say – a special status to RRI. In this case, the monitoring process tends to be more participatory in nature, open to the contribution of other actors and often based on tools like consultations, surveys, or internal debates.

Different intermediate situations can be observed (for example, only some specific keys are the subject of specific monitoring procedures).

d. RRI governance structure

Finally, institutional arrangements can be different in terms of the **governance structures** which are adapted for managing RRI issues in the organisation.

MOrri indicators seem to suggest a preference towards an **integrated approach** towards the governance of RRI in general, by establishing a specific governance structure (a unit, an officer, a member of the board of directors, etc.) in charge of all the RRI keys, thus considering the different keys as deeply interconnected.

However, there is also an opposite tendency, i.e., keeping the governance of the different RRI keys **separated** with each other and embedding them into already existing structures (for example, open access policies in charge of the Library Department, public engagement policies in charge of the Communication department, gender equality in charge of the Human Resources department, and so forth).

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The main advantage of a highly integrated approach is that of keeping RRI visible and to open to the possibility to develop comprehensive RRI policies. The main disadvantage is the risk of creating conflicts among those who are engaged with specific keys or establishing connections among the keys when this is not functionally or organisationally necessary.

The main advantage of a low integrated approach is that of facilitating the embedment of the different keys into the existing governance mechanisms (while this is more difficult in the case of a highly integrated approach). Moreover, in this way, the different keys can be managed in a different way, without the need of creating a bridge among them. Obviously, in this way the overall cultural and policy impact of the GAs can be remarkably lower.

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Section Three – Approaches to RRI

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In the previous section, an attempt was made to identify some "**critical steps**" in the pathway toward the design and implementation of GAs and the Roadmap, identifying each time the main available options.

In this third section, a reflection is made on the possibility to identify **practical approaches** to RRI.

As we said above, an approach can be considered as the result of a combination of choices. In our case, we have identified **14 basic critical steps** that require team choices (and therefore require analysis and a decision or set of decisions to be made). Therefore, to start with, it is useful to reconsider these critical steps as it has been presented above, organised in the four main areas: promoting entity, stakeholders' involvement, the process of change, and institutional arrangements.

CRITICAL STEPS	CHOICES TO TAKE	OPTIONS
PROMOTING ENTITY		
a. Source of action	– Who promotes the GAs – Who promotes the Roadmap – Which actors should be primarily involved	Top management Administration network/single individuals/specific stakeholders
b. Volunteering	– To what extent, why and how promoting volunteering	High Low
STAKEHOLDERS' INVOLVEMENT		
c. Participatory level	– To what extent, why and how promoting participation	High Low
d. External ties	– To what extent why and with whom developing external ties	Strong Weak
e. Political backing	– When, how and to what extent involving leaders	Strong Weak
f. Managerial support	– When, how and to what extent involving management structures	Strong Weak
PROCESS OF CHANGE		
g. Focus	– What aspect of the organisation focusing to start the change – How to do that and why	Social patterns Norms Research practices
h. Negotiations	– Which negotiations are primarily necessary to promote the GAs – Why and how	Interpretive Symbolic Institutional Operational
i. RRI range	– Which RRI keys and dimensions primarily to focus on – If and how enlarging the RRI range	Narrow Expanding Wide
j. Action scope	– Which part of the organisation primarily to involve – If and how enlarging the action scope	Narrow Expanding Wide
INSTITUTIONAL ARRANGEMENTS		
k. Formalisation	– Which level of formalisation of institutional arrangement to look for	Highly formalised arrangements Lowly formalised arrangements
l. Responsibility	– Who will be responsible for GAs and the Roadmap after the end of GRACE	Institutional actors Non-institutional actors
m. Monitoring mechanisms		Embedded in the general procedures

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CRITICAL STEPS	CHOICES TO TAKE	OPTIONS
	– To what extent, why and how monitoring GAs and Roadmap – Who will be responsible for that	Separated from the general procedures
n. Governance structure	– To what extent GAs should be integrated with each other and why	Highly integrated with each other Lowly integrated with each other

Certainly, **other critical steps**, as well as other options, can be identified and or may emerge during the implementation of GAs and the Roadmap. Therefore, GRACE implementing partners should, so to say, "customise" the list, adding new critical steps or options when appropriate.

Theoretically speaking, choices are unrelated to each other. In practical terms, there is always, some sort of **consistency** among the choices taken, due to both objective conditions in the organisation (for example, attitudes of the leaders; the presence of an external support, like in this case; the availability of funds; etc.)and subjective views and expectations of the promoters about RRI and how it should be implemented.

Simplifying a lot, **two ideal-typical approaches** to RRI can be identified, which can be referred to them respectively as a "**social approach**" and an "**organisational approach**" to RRI.

1. A social approach to RRI

The social approach to RRI tends to induce institutional changes starting from the modification of the **social patterns** (cognitive, emotional, relational, behavioural, etc.) which are dominant or largely shared by the majority of people inside the organisation[32]. The underlying assumption is that producing changes in the culture and behaviours of staff members will result, sooner or later, in a parallel change of norms, procedures, and organisational structures.

The social approach primarily sees RRI as something requiring a **large mobilisation of the concerned actors** and soliciting their **personal commitment** to change their own behaviours, views and mindset. In this sense, RRI is not simply viewed as an organisational reform mainly involving leaders and managers, but as a deeper process of cultural and social change involving everyone, also emotionally.

More in details, considering the 14 critical steps, the following general tendencies can be highlighted.

– **PROMOTING ENTITY.** In the social approach, as just said, the **source of action** is mainly placed in staff members, e.g., individual researchers, networks of people, single units, single leaders or specific groups or stakeholders. The involvement of management can be variable (also depending upon the attitudes of administrative offices). The involvement of leaders is expected not to be a priority. The level of **volunteering** is supposed to be high.

– **STAKEHOLDERS INVOLVEMENT**. Under a social approach, **participatory levels** are likely to be high. As for the **external ties**, when they exist, they are expected not to be of an institutional nature (e.g., formal agreements). The **political backing** is variable but generally low or uncertain. Also, **managerial support** can be variable. It is to notice that often administrative staff is more inclined to adhere to a social approach than to an organisational approach.

[32] This reflects a sociological view of institution; see, for example, Berger, P. L., Luckmann T. (1966) *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*, Garden City, NY, Anchor Books; North, D. C. (1990) *Institutions, Institutional Change and Economic Performance*, Cambridge University Press, Cambridge.

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- **PROCESS OF CHANGE.** In the social approach, the **focus** is put on social patterns, even when the attention is turned on research practices. Symbolic and interpretive **negotiations** may have a major role, even though both institutional and operational negotiations are inevitably practised. The **RRI range** and the **action scope** may be largely variable.

- **INSTITUTIONAL ARRANGEMENTS. Lowly formalised** institutional arrangements are expected to be prevalent, while diffusion of **responsibilities** on the implementation of RRI, especially among non-institutional actors, is supposed to be practised. As for **monitoring mechanisms** and **governance structure,** they largely vary according to the organisational context. Participatory monitoring methodology is likely to be adopted.

2. An organisational approach to RRI

The organisational approach to RRI tends to induce institutional changes by trying to modify the organisational structures first, starting from the existing **norms** (procedures, guidelines, protocols, procedures or organisational charts, etc.), i.e. the "rules of the game" on which the life of the organisation is based[33]. The underlying assumption is that, modifying the "rules", also behavioural patterns and beliefs, sooner or later, will change accordingly.

The organisational approach primarily sees RRI as the output of an organisational effort built upon the primary involvement of **leaders** and **managers** at a different level using the established organisational procedures, structures and hierarchical relations. In this framework, RRI is supposed to be managed as an internal reform to be introduced and implemented, prevalently adopting a top-down perspective.

Considering the 14 critical steps mentioned above, the following general trends can be observed.

- **PROMOTING ENTITY.** In the organisational approach, top management is supposed to play a major role as a **source of action**, even though not necessarily is the initiator of the process. Administrative offices and middle management are expected to be institutionally concerned. The level of **volunteering** is expected to be low, at least in the first phases of the process.

- **STAKEHOLDERS INVOLVEMENT.** In an "ideal-typical" organisational approach, **participatory levels** tend to be low, while the intensity of **external ties** can be variable, even though they are expected to be of an institutional nature. The **political backing** is obviously high, while the **managerial support** can be variable, also depending upon the autonomy and culture of middle managers.

- **PROCESS OF CHANGE.** The **focus** of the organisational approach should mainly be the normative dimensions (regulations, rules, procedures, etc.), also when an effort is made for modifying research practices. As far as **negotiations** are concerned, institutional negotiations are expected to be dominant, even though also the symbolic negotiation can play a major role (for example, in the institutional communication and in the mission statements). The **RRI range** of the action tends to be wide, covering all the RRI keys, even though different situations can be also found. The **action scope** tends to be also wide, covering the entire organisation.

[33] This reflects an organisational view of the institution; see, for example, Coriat B., Weinstein O. (2002), Organizations, firms and institutions in the generation of innovation Research Policy 31273–290; North D.C. (1990) *Institutions, Institutional Change and Economic Performance*, Cambridge University Press, 1990.

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- **INSTITUTIONAL ARRANGEMENTS.** The organisational approach is expected to privilege a high level of **formalisation** in developing the institutional arrangements and to entrust to institutional actors the **responsibility** on RRI. The adoption of **monitoring mechanisms** can be variable (even though their integration in the general procedures is more likely to occur), while the level of integration of the **governance structure** largely depends on the specific institutional strategy adopted.

3. From ideal-types to the real world

As said above, the organisational and the social approaches are "ideal-typical" in nature. Therefore they are **conceptual constructions which do not exist at all** in the real world.

As a matter of fact, especially in the context of late modernity, adopting a **purely organisational approach**, totally based on norms, organisational mechanisms, top-down decisions and established procedures, is practically impossible. A certain level of consensus and involvement of staff members and internal stakeholders is in any case necessary. Hence the need to adopt traits of the "social approach", such as forms of dialogue, consensus building, and participation, also in the framework of an organisational approach.

Similarly, adopting a **purely social approach** is unrealistic. Institutional change requires some sort of "stabilisation" of the new arrangements, which must be explicit, public, legally legitimated, internally recognised, supported with specific funds, and based on a distribution of tasks and responsibilities. This necessarily means that norms, organisational procedures, and structures should be sooner or later modified.

The rough distinction between the organisation and the social approach is anyhow useful for designing and implementing GAs and the Roadmap.

Firstly, it helps GRACE implementing partners better understand and make explicit **their own view of RRI and institutional change** and to assess it against the actual features, needs and expectations of their organisation.

Secondly, it helps them also **devise their own strategies** for implementing the GAs and, in the future, the Roadmap, developing a self-tailored mix of both the approaches.

Finally, keeping in mind this distinction, it is also easier for them to **manage the critical steps** of the GAs and the Roadmap and to timely identify new ones, thus increasing as far as possible the possibility to better drive the process of change.

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