Case Study

Responsibility and reflexivity in engineering: professional societies and codes of ethics

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Introduction

Problem definition: professions and professional societies in engineering

Following the "Preliminary lessons from the Case Study Programme", this Case Study focuses on engineering professional associations as meso-level actor organizations (Edler et al. 2014) able to affect the scope and characteristics of responsible governance arrangements. From this perspective, professional associations can be players in the building of "capacities and capabilities to 'do' responsible research and innovation" (Edler et al 2014, 30). On the one hand, they exert an influence on the allocation of financial, organisational, social, and intellectual *resources for and to the profession*, as well as on the use these resources have *by the professional collectives* (capacity-building). On the other hand, they *contribute decisively to the reflexive understanding of the profession*, thus potentially affecting attitudes to and practices of

responsibility in everyday work (capabilities-building). This case study focuses on the latter aspect (capabilities-building) by observing how the responsibility of the engineer is constructed in the ethical statements and codes of ethics of several national engineering societies and professional bodies (e.g. national academies of engineering).
This presumed role of professional associations as intermediation organizations in RRI is rooted in the characteristics of professionalism and in the actual intermediary role professional associations play in two major directions. No matter if considered positively as contributors to the normative integration of a differentiating social order or negatively as a form of ideology and of the associated social control of markets and practices (Evetts 2011), our understanding of professionalism is centred on the individual and collective possession of and capacity to leverage specific (expert) knowledge and resources to define determinate sets of skills, activities, criteria and methods of performance, as well as a range of pertinent practical situations to which these diverse repertoires can, and should, be applied. Therefore, professionalization "represents one of the several ways to give order, structure, and meaning to a distinctive area of social and economic life" and, accordingly, it can be considered as an aspect of institutionalization (Muzio et al. 2013, 705).

The intermediation role of professional societies or associations is deployed at the intersection of the two processes of professionalization and institutionalization, i.e. respectively the building, perpetuation and development of a professional identity, and the change and reproduction of broader cognitive, normative and regulatory domains (Abbott 1988, Evetts 2011, Muzio et al. 2013)[1], be professionalization either a driver of or a response to this external change (Evetts 2011). As such, professional societies are at the crossroads of two types of "fiduciary delegations" to the professions. From society, as a profession "is organized about the mastery of and fiduciary responsibility for any important segment of a society's cultural tradition, including responsibility for its perpetuation and for its further development", as well as the "responsibility for the application of its knowledge in practical situations" (Parsons 1959, 547). From the State, as professional bodies are delegated "to police the [...] relationship" between the individual professional and the customer, thus ensuring the correct application of the expert knowledge on which a profession is based upon (cf. Tuhoy 2013 for the medical profession)[2]. In so doing, professional organizations intermediate the individual professional performance and the "corporate demands" from society to the professional community itself (Abbott 1983).

[1] For this sketchy characterizations of institutions as cognitive, normative and regulatory constructs, see Pellizzoni 2005, Pellizzoni and Ylonen 2004.

[2] Licensure is surely the most important *ex ante* instrument that professional societies have to perform this role. Yet, the development of curricula, the direct provision of training, the elaboration of guidelines and standards, the elucidation of the skills, competences and expertises that are part of the professional identities are fundamental activities of professional societies as well. Similarly, professional societies can administer also systems of rewards and sanctions.

Short description and research questions

For the reasons we have briefly illustrated above, the activity of professional associations is inextricably linked to the shaping of professional identity. Though this identity is primarily centred on the knowledge-based expertise that characterises a profession (Abbott 1988), questions about what this expertise is for has accompanied the research on professions, no matter any optimistic or pessimistic view of professions themselves (for a summary, Evetts 2011). In different terms, engineering ethics is part of the debate on the engineering profession. It does not seem a too long stretch to affirm that what engineers are responsible for can be seen as a legitimate part of this discussion.

Code of ethics and ethical statements are a prominent place where these aspects of the profession are defined. They offer a general yet unitary view of an important aspect of the professional identity and, as such, they distill diverse and perhaps contrasting attitudes to and conceptions of ethics in general and responsibility in particular, belonging to different groups, bodies and collectives *within* the profession. While they may not be decisive in capacity-building for responsibility, they are nevertheless central in capability-building, as they prompt reflection on the scope and types of responsibility.

Our short analysis will focus particularly on two related aspects. Firstly, we are interested to distinguish to what extent these relate to 'microethics' "concerned with individuals and the internal relations of the engineering profession" and to 'macroethics' "referring to the collective social responsibility of the engineering profession and to societal decisions about technology" (Heckert 2001). Following Abbott (1983), we can refer these two different layers of ethics respectively to "two levels of societal demands on the profession": the individual relationships of the professional (especially with clients and colleagues) and the "corporate obligations for service to society" (Abbott 1983, 855)[3]. Secondly, we will observe in which way Codes of Ethics establish a connection between these two 'ethical layers', including the mutual influence between the patterns of these links and the identity of the professional engineering and the place that expert knowledge has in it.

Methodology

This Case Study presents a simple content analysis of six different national and international codes of ethics and ethical statements for the engineering profession (see Table 1 for a list). According to the research questions described above, the documents were searched to identify text passages referring to (1) the relation between the engineering profession and the wider society; (2) the duties and responsibilities of individual engineers. Considering the centrality of

[3] This latter dimension has gained prominence, for instance, in the US context, where the National Academy of Engineering (2004, 2008) has issued two reports linking explicitly the responsibility of the engineering profession to its capacity to answering broad societal challenges. From the point of view of RRI, this latter dimension is indicative of the degree significance that the thematic orientation towards societal preferences/grand challenges (Edler et al. 2014, 5) has in the broader context of the ethics of the engineering profession.

technical expertise in professional identity, the search included passages informing about (3) the characterization of "expertise" in the engineering profession as per the Ethics Codes.

Table 1. List of the Ethics Codes and Ethical Statements considered in the analysis[4]

Acronym	Organization	Title	Country	Year
CNI	National Engineering Council	Code of Ethics of Italian Engineers	Italy	2014
CCE	Canadian Council of Enginering, Canadian Engineering Qualifications Board	Guideline on the Code of Ethics	Canada	2012
NSPE	National Society of Professional Engineers	Code of Ethics for Engineers	US	2007
RA/ECUK	Royal Academy of Engineering and Enginnering Council UK	Statement of Ethical Principles	UK	2014
ISF	Ingénieurs et Scientifiques de France	Charte d'Ethique de l'Ingénieu	FR	2001
WFEO	World Federation of Engineering Organizations	Model Code of Ethics	International	n.d.

Note: The latest available version of the Codes was examined.

Results and discussion

This section briefly highlights the major findings of the case study and discusses some lessons that might be useful for the further development of a governance framework for RRI in Reg-AgorA.

1. Macro and micro-ethical dimensions of engineering responsibility

The contents of the Ethics Codes clearly reflects the "corporate nature" of the services the engineering profession is entitled and demanded to provide. Though they are variously formulated, the "welfare of the public" or the "quality of life for all people" are seen as paramount. This commitment is not framed exclusively in terms of "safety", but it is defined in a broader and more proactive way, including often a direct reference to sustainable development. As the WFEO Model Code of Ethics preamble reads:

[4] Translations from French and Italian are made by the Author of the report.

> As engineering professionals, we use our knowledge and skills for the for the benefit of world, in order to create engineering solutions for a sustainable future (WFEO n.d.; cf. also CNI 2014, RA/ECUK 2014, NSPE 2007, ISF 2001).

In the Codes there is the obvious acknowledgement that technology is central to the engineering profession and the assessment of technology's impacts on society are central to the responsibility of engineering:

> Engineers are aware and make people aware of the impact of technological artifacts and systems on the environment (ISF 2001)

> They should: be aware of the issues that engineering and technology raise for society, and listen to the aspirations and concerns of others (Royal Academy/ECUK 2014)

> [Engineers shall] be mindful of the economic, societal and environmental consequ-ences of actions or projects (WFEO n.d.)

These macro-ethical aspects, which we have related to the "corporate service" of the engineering profession, are complemented with the other aspects that refer to the individual performance of engineers:

> In line with our obligations as professionals, we wish to ensure that the choices that we make as engineers enable us to do things which are 'good'. In addition, we wish to ensure that we do these 'good things' in a manner which is 'right'. (WFEO n.d.)

Integrity, leadership, competence, trustworthiness, honesty are all values which engineers are called to comply to and are expected to guide their decisions and actions:

> Professional engineers shall conduct themselves in an honourable and ethical manner. Professional engineers shall uphold the values of truth, honesty and trustworthiness (CCE 2012)

The values of the professional engineer should be reflected in her relationships with the clients and employers, for which she must be a "faithful agent" (CCE 2012, NSPE 2007) and is called to uphold the "quality of services" as part of this duty (CNI 2014). The engineer responsibility is not only to the clients, but also to the engineering community itself:

> [Engineers] Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession (CCE 2012).

> Engineers shall not promote their own interest at the expense of the dignity and

integrity of the profession (NSPE 2007).

Engineers support and defend the honour and reputation of the profession (CNI, 2014)

With regard to this aspect, codes can be seen as a coordination tool (Davis 1991) of the intraprofessional and extraprofessional relations of the engineer. They constitute a formal, conventional mean of control (Abbott 1983, Davis 1991) of the members of the profession, of their interactions, and their relations with outer social actors.

Engineers shall not complete, sign, or seal plans and/or specifications that are not in conformity with applicable engineering standards. (NSPE 2007)

L'ingénieur se comporte vis-à-vis de ses collaborateurs avec loyauté et équité sans aucune discrimination. Il les encourage à développer leurs compétences et les aide à s'épanouir dans leur métier.

Procedures for sanctioning violation, which for instance represent the largest part of the Italian Code of Ethics (CNI 2014), are part of these mechanisms.

2. Linking macro- and micro-ethics: the individual ethics of the professional codes

In exploring the link between the macro and micro-dimension of engineering ethics, it might be useful to resort to Abbott's analysis of the "ethical individualism" of the codes:

Professional ethics codes deal with individuals and individual behaviors. […] Another corollary of ethical individualism is the one-case-at-a-time approach to control and discipline. Since the violation of ethical rules occurs only by individual instances of offense rather than by group failure on some aggregate measure (Abbott 1983, 859-861).

Ethical individualism implies that also the corporate obligations are translated into individual actions and that individual judgments in concrete situations have paramount importance in defining the extend and the boundaries of responsibility:

[A] code of professional ethics is more than a minimum standard of conduct; rather, it is a set of principles which should guide professionals in their daily work. (CCE 2012)

It is interesting to notice that this individualistic stance that is reflected in the Codes occasionally creates tensions between the macro- and micro-ethical aspects of the profession or, in different terms, between individual responsibilities and corporate services. Conflict of interest and their management are the typical forms that these conflicts assume and are widely considered in the

Codes. A long quote from the WFEO Model Code of Ethics can aptly illustrate this point:

> Laudable though the aim of acting in the interests of the community above all else might be, there is a danger in making simplistic statements that say categorically that our duties and responsibilities lie in only one direction, implying by such statements that we have a duty to override (and not balance) legal, fiduciary and contractual responsibilities if they conflict with that 'grand' duty. In practical terms, those legal duties and obligations will arise principally in two specific contexts. First, there will be duties and obligations of engineers to their clients. Second, there will be duties and obligations of those engineers who are employees to their employers. *In some cases there may be a conflict/tension between legal duties and ethical obligations* (WFEO n.d.)[5].

3. Expertise and the engineering profession

As professions are based on the mastery of a certain expertise, such an expertise is part of the ethics codes that have been analyzed. On this regard, we can distinguish two different ways in which this issue of expertise is considered in the ethical documents we analyzed.
On the one hand, as expertise is crucial to engineer's profession, the members of the engineering community share the responsibility of engineers towards the maintenance and increase of this knowledge, which is seen as the condition to successfully perform the profession's services.

> [Engineers shall] maintain and strive to enhance the body of knowledge in which they practise [and] strive to contribute to the advancement of the body of knowledge within which they practise, and to the profession in general (WFEO n.d.).

> Professional engineers have the responsibility to remain abreast of developments and knowledge in their area of expertise, that is, to maintain their own competence (CCE 2012)

> Engineers update regularly their knowledge and skills to follow the evolution of sciences and technologies (ISF 2001)

On the other hand, the possession of a scientific and technical expertise assigns to engineers a responsibility to foster the public understanding of scientific and technical issues, as a condition of public trust in and support to the engineering profession.

> [Engineers shall] [f]oster the public's understanding of technical issues and the role of engineering (WFEO n.d.)

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5 Italics added.

> [M]isinformation can make public opinion shift from excessively confident attitudes to unjustified anxieties (*psychoses*) and unreasonable fears. As a consequence, engineers shall assume a crucial twofold role in society, firstly in governing these technologies to the benefit of the human community and also in the diffusion of information about their actual possibilities and limits. (ISF 2001)
>
> [Engineers shall] actively promote public awareness and understanding of the impact and benefits of engineering achievements (RA/ECUK 2014).

Lessons for Res-AGorA

Firstly, we are interested to distinguish to what extent these relate to 'microethics' "concerned with individuals and the internal relations of the engineering profession" and to 'macroethics' "referring to the collective social responsibility of the engineering profession and to societal decisions about technology" (Heckert 2001). Following Abbott (1983), we can refer these two different layers of ethics respectively to "two levels of societal demands on the profession": the individual relationships of the professional (especially with clients and colleagues) and the "corporate obligations for service to society" (Abbott 1983, 855)[6]. Secondly, we will observe in which way Codes of Ethics establish a connection between these two 'ethical layers', including the mutual influence between the patterns of these links and the identity of the professional engineering and the place that expert knowledge has in it.

Codes of Ethics play a significant role in shaping the identity of professions and are indicative of the professions' self-understanding. They are therefore useful sources for examining the idea of responsibility that characterizes professions, which, as Davis says, "are organized to help members serve others" (1991, 154), and which enters professional identities.
In particular, we used the distinction between macro- and micro-ethics to explore whether Codes had something significant to say for RRI, its design and implementation. With regard to this, we have seen how codes widely refer to the responsibility to identify, assess and take account (anticipatorily) of the social impact of engineering projects and, in a broader sense, of science and technology to advance public welfare. These "macro-ethical elements" of the Codes reflect the engineering's efforts to translate the profession's understanding of societal needs and to orient professional behaviour so that these needs can be responded. In this context, sustainable development is often mentioned as a need for engineers to respond and complement the traditional "paramount" importance of safety in the engineering ethos.

[6] This latter dimension has gained prominence, for instance, in the US context, where the National Academy of Engineering (2004, 2008) has issued two reports linking explicitly the responsibility of the engineering profession to its capacity to answering broad societal challenges. From the point of view of RRI, this latter dimension is indicative of the degree significance that the thematic orientation towards societal preferences/grand challenges (Edler et al. 2014, 5) has in the broader context of the ethics of the engineering profession.

While these considerations are indicative of the space societal demands have in the Codes and of the role these macro-aspects of engineering ethics have in shaping the 'official' professional identity, they say little about the effective influence of the codes on the (ethical) behaviour of professionals. As "formal means" of social control, Codes have been seen as instruments to augment conformity to the collective self-understanding of the profession by way of consensual adhesion rather than on bureaucratic surveillance (Abbott 1983). Yet, their effectiveness is all but uncontested. By considering some basic references to the literature, we introduce some notes on why and to what extent codes perform their orienting functions for and in the professions.

(1) **Status as an incentive inside and outside of the profession**: As to why members of a professional community generally agree to a Codes of Ethics, Abbott affirms that members of the professional community have incentives to believe in and comply to Codes of Ethics as this behaviour is positively correlated to their intra-professional and extra-professional status, respectively the status of an individual professional or professional subgroup in the eyes of other members of the same profession and the status of particular professions in the eyes of the general public. As Abbott explains, ethics and status correlate insofar the profession demonstrates its ability to cope with the ethical challenges raised by new skills and capacities.

> By conferring further means of effective contact with the problems of order, the new skills directly confer new grounds for extraprofessional status claims. At the same time, the new skills present a problem of professional control, to be handled […] by renewed ethical analysis and commitment. When accomplished, such commitment reinforces the professions' claims to disinterested service and to the extraprofessional status such service commands. Thus an ethics revival that derived originally from the emergence of new skills results, by virtue of the linkages of the various functional loops, in a further elevation of extraprofessional status (Abbott 1983, 878).

It is important to notice that this relation between Codes, status and professional is neutral with regard to the positive or negative view of the professions, as the creation of Codes finds a justification both from a view of professions and professional identities as a "benign response to social needs" or as an attempt to build "an exclusive jurisdiction" over some portion of knowledge and the related social domains of application (Starr 2009).

(2) **Cultural and institutional diversity as a determinant of the significance of professional ethics**: it is important to consider that the significance of ethics in the engineering profession and the scope of the Codes' influence on the engineering community varies greatly in time and space and it is affected in a decisive way by national histories and professional traditions. Comparing the French and the German experience, Downey et al. (2007) notice that most engineers in France have never heard of CNISF (the engineering association issuing the *Charte d'éthique*) and that most French engineers know the Code at all. The Authors link this disregard to the training of the French state engineers as performed in the *grandes ecole*s: "For French engineers, demonstrating the ability, commitment, and discipline to become proficient in the mathematical foundations of engineering is to demonstrate that one has the moral disposition to warrant the Republic's trust and lead it in pursuit of an ideal future" (Downey et al. 2007). In Germany, on the contrary, the

engineering profession is characterized by a longtime commitment to social responsibility through technology evaluation and assessment. According to Downey et al., this significance has recently revamped as a response to "a new international context emphasizing low-cost production for mass use. For German engineers, engineering ethics amounts to a unique tool for the defense of the German nation" (2007).

(3) **Sanctions**: while Codes do not usually include references to sanctions and, among the cases we have examined, only the Italian code includes a mention to sanctions and to the disciplinary role of professional associations (interestingly, the Code is ten-pages long, while 27 pages are dedicated to the "general guidelines for disciplinary trials" and the related administrative forms), the formal enforcement of professional rules, including those listed in the Codes, can be implemented also through sanctioning mechanisms. Yet, the literature we have examined suggests that not all the rules (and their breaches) are object of sanctions in the same way. In particular, two aspects are worth of mention: (1) "formal prosecution under professional ethics rules is a function largely of the public visibility of the offense to punish breaches of professional/client obligations more severely than intraprofessional violations"; (2) "[g]eneral public service obligations are extremely important as claims but extremely vague as rules. Obligations to clients are few and relatively specific, and their direct violation leads to the most radical sanctions" (Abbott 1983, 858).

The paragraphs above illustrate three mechanisms that can foster the compliance to the Codes of Ethics. We have emphasized status, culture and sanctions as factors affecting compliance, but, in the two latter cases, we have noticed how their influence on the effectiveness of the Codes is ambivalent. We now focus on four characteristics of the Codes that seem significant for commenting the second question this case study tries to address: the connection between macro- and micro-ethics. By referring to this link, we will make then some tentative considerations on what lessons from professional codes can be relevant for the broader discussion on RRI.
Firstly, although Codes include broad statements about the profession's corporate duties and responsibilities, they deal mostly with individual behaviour, i.e. with the relationships of individual professionals with employers, clients and colleagues. This **individual responsibility** can conflict with the corporate responsibility and represents a sort of "limit" to the latter. The balance between these two potentially contrasting elements is left to individuals in concrete situations. In this sense, the Ethics of the Codes are a sort of "ethics of proximity", where immediate ties (to clients, colleagues, employers) seem to prevail on more distant and diffuse bonds with the wider society. This is reflected by the nature of sanctions, which focus on breaches of client-professional relationships and in the relationships among colleagues.

> Exactly who the 'others are', and what the 'right thing' is, will be a matter of continual balance. We are expected to get the balance right. We also know that each situation may be different, requiring specific choices depending on the circumstances (WFEO n.d.)

Secondly, "ethics of distance", as opposed to this ethic of proximity, seem to enter the Codes as a **"tool for resistance"** rather than for "programming". With this formula, we emphasize that one of the functions of the Codes themselves is indeed to "insulate" or protect professionals from ex-

ternal pressures, including organizational conditionings. "The key point is that individual engineers are not left alone to evaluate the situation on the basis of personal conscience but can find support in a guideline that has been authorized by the engineering community as a whole" (Downey et al. 2007, 475; cf. also Davis 1991, 167-168). The "interpretation of the Code of Ethics" by the Canadian Engineering Qualifications Board clearly exemplifies provides different examples on this matter.

> [T]he engineer must report unethical engineering activity undertaken by other engineers or by non-engineers. This extends to include, for example, situations in which senior officials of a firm make "executive" decisions which clearly and substantively alter the engineering aspects of the work, or protection of the public welfare or the environment arising from the work. (CCE 2012)

Thirdly, engineering codes of ethics are professional codes and differ from "standards governing the development, use, and disposal of technology" (Davis 1996, 99). In so doing, they do not consider only the possession of specific knowledge, but also **the commitment to use such knowledge in certain ways for public service in order to be part of a (professional) group**. This emphasis on public service describes a specificity of the professional codes, which does not occur in generic codes of conducts regarding research and technology development[7].

> [Engineers] have made personal and professional commitments to enhance the wellbeing of society through the exploitation of knowledge and the management of creative teams. (Royal Academy/ECUK 2014)

Fourthly, in the case of engineering, their professional service is unsurprisingly characterised by the centrality of technical expertise. Expertise is crucial in the engineering professional identity and, accordingly, the responsibility of engineers is exercised through their expertise itself, which they must to uphold and expand insofar they are members of a professional community. The space of reflexivity the Codes open is, therefore, limited and resolves within **an expert-centric definition** of interaction between science, technology and society. This can be, of course, a consequence of the Codes being a guide for "professional ethics", but the extension of the responsibility of the engineers to foster the correct reception of techno-scientific knowledge by the lay public that is advocated in some codes resembles closely the logic of the public understanding of science and apparently supports our view.

The considerations above tried to identify some conditions for Codes of Ethics to perform their orientation function (the symbolic incentives of status, cultural contexts, sanctions), with their ambivalent effects. We then listed four aspects (individualism, resistance, disinterested service, expert-centredness) that, in our view, delimit the scope of Codes' role of orientation and the possibility of their extension to RRI beyond professional boundaries. Drawing on this analysis and having sounded this overall note of caution, three elements seem fruitful to support the role of the Codes in RRI.

[7] Additionally, one might consider to what extent the ideal of disinterested service to others characterizes the identity of the other occupational groups involved in the innovation process, like scientists.

Firstly, extraprofessional status can act as an incentive not only for engineering, but also for other occupational groups involved in the innovation process. The more publicly visible are the results of scientific and technology professions and the greater is the capacity to successfully control the ethical problems raised by new skills and knowledge, the stronger are the professions' claims for extra-professional status. In terms of policy, this relation might be supported through implementing specific programmes for monitoring and communication scientific research and innovation activities. However, the increased public scrutiny on R&D activities creates a *de facto* incentivising mechanism.

Secondly, and beyond the symbolic rewards of status, a formal system of incentives may be implemented to positively sanction behaviour that is compliant with the "macro-ethical" imperatives identified in the Codes (in more general terms and in the RRI parlance, behaviour responding to societal demands). These incentives may be even more important for the professional groups other than engineers that are involved in technological innovation (first and foremost, scientists) and that have not the ideal of "public service" as one of their founding characteristic. A formal system of incentives can complement and direct the more general social processes that relate (professional) status to resources and legitimacy (acquisition), thus "qualifying" this relation in terms of responsibility.

Thirdly, though professions may resist external interventions to regulate, supervise or assess the performance of the professional community as such, they probably won't object if they are asked to do what they do all the time, i.e. to serve via their expertise. Therefore, insofar they describe a general orientation framework towards RRI goals, regulatory initiatives and instruments like technical standards (e.g. ISO) can represent an apt terrain to facilitate the encounter of engineering with other social actors in research and innovation and can outline a collaborative context for fostering reflexivity about and commitment to "macro-ethical concerns".

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Towards Anticipatory Governance of Responsible Research and Innovation

The objective of the Res-AGorA project is to develop a comprehensive governance framework for responsible research and innovation (RRI). This will be a contribution to the EU ambition of becoming a genuine Innovation Union by 2020 striving for excellent science, a competitive industry and a better society without compromising on sustainability goals as well as ethically acceptable and socially desirable conditions.

The goal of the Rea-AGorA project will be achieved through extensive case study research about existing RRI governance across different scientific technological areas, continuous monitoring of RRI trends in 16 European countries, and constructive negotiations and deliberation between key stakeholders. This comprehensive empirical work will be the building blocks of the creation of a governance framework for RRI.

The case study summarised in this document is output of Res-AGorA's extensive empirical programme (Work Package 3).

More information at www.res-agora.eu

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