Universität für Bodenkultur Wien
University of Natural Resources and Life Sciences, Vienna

Department für Wirtschafts- und Sozialwissenschaften (WiSo)
Department of Economics and Social Sciences

Institut für Wald-, Umwelt- und Ressourcenpolitik
Institute of Forest, Environmental and Natural Resource Policy

Responsible Research and Innovation (RRI) and its Potential for Knowledge Processes and Sustainable Environmental Development

–

A Case Study Review of COLUMBUS and MARINA

Master thesis at the University of Natural Resources and Life Sciences, Vienna
Master programme: Environment and Bio-Resources Management

By Viktoria Brunner, BSc.
01140214
viktoria.brunner@students.boku.ac.at

Assisted by
Assoz. Prof. Mag. Dr. Reinhard Steurer
Mag. Dr.phil. Patrick Scherhaufer

Vienna, February 2018

Universität für Bodenkultur Wien

Gregor Mendel Straße 33

A-1180 Wien, Österreich

Department:

Department of Economics and Social Sciences (WiSo)

Head of the Department:

Univ.Prof. Dipl.-Ing. Dr. Erwin Schmid

Institute:

Institute of Forest, Environmental and Natural Resource Policy

Head of the Institute:

Univ.Prof. Dipl.-Ing. Dr.nat.techn. Karl Hogl

Supervisor:

Assoz. Prof. Mag. Dr. Reinhard Steurer

Institute of Forest, Environmental and Natural Resource Policy

Feistmantelstraße 4

1180 Vienna

Second Supervisor:

Mag. Dr.phil. Patrick Scherhaufer

Institute of Forest, Environmental and Natural Resource Policy

Feistmantelstraße 4

1180 Vienna

Acknowledgements

I would like to thank my supervisor Patrick Scherhaufer, who helped me to structure my research work, who always took time for me, and who gave me helpful and considerate advice when I encountered difficulties.

I would like to thank my co-supervisor Reinhard Steurer, who helped me to focus my work in the first place and who engaged Patrick Scherhaufer in this project.

I would like to thank my internship supervisor Florence Huron thanks to whom I was able to write this thesis. Thank you for your guidance and for your trust in my work at NAUSICAA.

I also want to thank Iwona Gin for her support, for all her constructive advice and for her trust in me. I really learned a lot from you.

A big thank you also to my other colleagues at Nausicaa. You were the nicest and funniest colleagues and you made my stay at NAUSICAA special.
I also want to thank Philippe Vallette for giving young, foreign students like myself the opportunity to work at NAUSICAA. My stay at NAUSICAA was a unique experience. Not only did I learn a lot about the work in European projects, I also discovered my love for the oceans.

A great thank you also to all the interviewees for their time and motivation for doing the interviews. Thank you for your trust. Without you, this research work would not have been possible.

I also want to thank my university, BOKU, for offering me interesting, comprehensive courses and programmes, and for giving me the possibility to work and learn in a familial and friendly atmosphere.

Thank you also to my friends who supported me along the way and who were always there for me.

Last but not least, I would like to thank my parents for their support and never-ending patience and for giving me the possibility to finish my studies.

Thank you!

Merci beaucoup à vous tous !

Eidesstattliche Erklärungen

Ich erkläre eidesstattlich, dass ich die Arbeit selbstständig angefertigt habe. Es wurden keine anderen als die angegebenen Hilfsmittel benutzt. Die aus fremden Quellen direkt oder indirekt übernommenen Formulierungen und Gedanken sind als solche kenntlich gemacht. Diese schriftliche Arbeit wurde noch an keiner Stelle vorgelegt.

Ort, Datum *Unterschrift*

Abstract

Responsible Research and Innovation (RRI) is a concept formulated by the European Commission with the objective of making research more responsible resulting in more beneficial outcomes for society. RRI particularly aims at tackling the Societal Challenges of our time. It consists of six dimensions that ought to be integrated during the work process and in its results; Public Engagement, Science Education, Open Access, Ethics and Gender Equality, and the overarching dimension of Governance. The approach of RRI is relatively new but intentions to integrate a responsibility perspective into research have existed for a long time and could also contribute to sustainability efforts.

This master thesis investigates the EC-funded projects COLUMBUS and MARINA which carry out different knowledge activities in order to tackle marine and maritime issues and to contribute to Blue Growth and the Blue Society. COLUMBUS implicitly integrates RRI elements whereas MARINA explicitly follows the RRI approach. This thesis' objective is to investigate both projects for RRI characteristics in knowledge processes and, furthermore, aims at eliciting the projects' possible implications for sustainable environmental development with regard to RRI and knowledge processes. Therefore, the thesis employs three methods. Semi-structured expert interviews are conducted with COLUMBUS and MARINA project partners to investigate both projects regarding RRI elements, knowledge processes and environmental and sustainable outcomes. The experts' statements give insights on how RRI is implemented, how RRI works in knowledge processes, how it affects sustainability and the environment, and how the approach could be improved. Furthermore, an online survey assesses internal and external stakeholder opinions regarding stakeholder satisfaction about project processes and RRI dimensions. Moreover, a Thematical Analysis of COLUMBUS and MARINA project documents searches for RRI elements in both projects and describes detected RRI-relevant activities and objectives.

The main findings show that the RRI dimensions Public Engagement and Science Education are visibly intertwined in both projects, that personal value gain for stakeholders is important in knowledge processes, that RRI relates to well-known knowledge processes, and that COLUMBUS and MARINA both have ambitions and the potential to contribute to sustainability by enhancing chances of knowledge reuse, and by creating social connections. It is furthermore argued that an explicit environmental dimension should be integrated in RRI.

Zusammenfassung

Das von der Europäischen Kommission forcierte Konzept Responsible Research and Innovation (RRI) stellt eine neue Herangehensweise dar, um die Forschung und Innovationen nach Ansprüchen sozialer Relevanz und Verantwortung auszurichten. RRI umfasst fünf Dimensionen: Beteiligung der Öffentlichkeit, Wissenschaftliche Bildung, Offener Zugang, Ethik, Geschlechtergleichstellung und die allumfassende Dimension Governance. Die Definition RRI besteht erst seit Kurzem, jedoch gab es schon seit jeher Intentionen die Forschung und Innovation verantwortungsbewusster zu gestalten. RRI könnte heute zu Nachhaltigkeitsentwicklungen beitragen.

Diese Masterarbeit untersucht zwei von der Europäischen Kommission geförderte Projekte: COLUMBUS und MARINA. Beide Projekte widmen sich Anliegen aus dem marinen und maritimen Bereich, der Förderung von Blue Growth und Blue Society und dem Finden von nachhaltigen Innovationen und Lösungen. COLUMBUS behandelt RRI Elemente implizit in seinen Vorhaben, während MARINA explizit versucht, RRI in der Praxis umzusetzen. Das Ziel dieser Masterarbeit ist es, beide Projekte auf RRI Elemente in Wissensprozessen zu analysieren und des Weiteren, die Auswirkungen beider Projekte auf nachhaltige ökologische Entwicklungen (im Hinblick auf RRI und Wissensprozesse) zu eruieren.

Hierzu bedient sich die Arbeit dreier Methoden. Teilstrukturierte Expertengespräche werden mit Projektpartnern von COLUMBUS und MARINA durchgeführt um beide Projekte bezüglich RRI, Wissensprozesse und nachhaltiger und ökologischer Ergebnisse zu untersuchen. Die Stellungnahmen der Experten geben Aufschlüsse darüber, wie RRI realisiert wurde, wie es in den Wissensprozessen wirkt, wie es Nachhaltigkeit und die Umwelt potentiell beeinflusst und wie es verbessert werden könnte. Darüber hinaus erfasst eine Online-Umfrage die Meinungen interner und externer am Projekt Beteiligter im Hinblick auf Projektprozesse und RRI Dimensionen. Außerdem wurde eine thematische Analyse (Thematic Analysis) der Projektdokumente von COLUMBUS and MARINA durchgeführt, welche es ermöglicht RRI Elemente zu erkennen und ihre Relevanz für die Projektaktivitäten und Zielsetzungen zu beschreiben.

Die Ergebnisse zeigen, dass Public Engagement und Science Education Überschneidungen aufweisen, dass persönlicher Wertgewinn für Stakeholder in Wissensprozessen besonders wichtig ist und, dass die in RRI vorkommenden Wissensprozesse nicht neu sind. Außerdem haben beide Projekte das Potential zu nachhaltiger Entwicklung beizutragen, indem sie die Wahrscheinlichkeit von Wissensanwendung erhöhen und die Zusammenarbeit zwischen unterschiedlichen Stakeholdern und RRI-Praktikern fördern. Des Weiteren plädiert diese Arbeit für die Aufnahme einer Umwelt-Dimension in das RRI-Konzept.

Table of contents

1 Introduction

The European Union has been called upon to foster initiatives and innovations to solve key global health and development problems, the so-called Grand Challenges of our time (LUND DECLARATION, 2009; LUND DECLARATION, 2015). These challenges are said to have a significant impact on our societies and research and innovation are likely to find solutions to defeat them (STAHL, 2013, 709). For this, the EU depends on the involvement of relevant stakeholders, in EU member states or associated countries, who will not only help to identify challenges, but also participate in countering the societal, economic and environmental problems that the EU and its citizens are facing (LUND DECLARATION, 2009; LUND DECLARATION, 2015). Throughout history, governance often failed to meet people's expectations and to foresee unintended side effects of innovations and inventions (STILGOE et al., 2013, 1569), which is why the demand for responsible and transparent research has grown over time.

Within the European Horizon 2020 programme, the concept of Responsible Research and Innovation (RRI) sets out to tackle the more narrowly defined Societal Challenges[1] specified by the EU and underpins the work programme of the EU-funded programme "Science with and for Society" (SwafS) (EUROPEAN COMMISSION, 2016a, 6). As characterised by the EC, RRI implies "that societal actors (researchers, citizens, policy makers, business, third sector organisations, etc.) work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of society" (EUROPEAN COMMISSION, 2017d). The RRI concept consists of integrating five thematical key dimensions in its processes and outcomes (Science Education, Open Access, Public Engagement, Gender Equality and Ethics) and it aims at promoting its vision in policies and institutions which constitutes a sixth dimension: Governance (ibid.).

The concept of RRI as such does not correspond to one fixed definition; it is a term used in the legal text of the Horizon2020 programme and is said to have been explicitly pinned down the first time in 2011 (SUTCLIFFE, 2011). Hence, RRI is relatively new and, so far, hardly applied in the practical field, but it can yet be expected to bring about beneficial changes for research and innovation processes. How can these benefits be relevant for the EU and its citizens? The

[1] 1. Health, demographic change and wellbeing;
2. Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bio-economy;
3. Secure, clean and efficient energy;
4. Smart, green and integrated transport;
5. Climate action, environment, resource efficiency and raw materials;
6. Europe in a changing world - inclusive, innovative and reflective societies;
7. Secure societies - protecting freedom and security of Europe and its citizens. (EUROPEAN COMMISSION, 2017e).

possible advantages brought on by RRI are manifold; establishing new networks and partnerships (SMALLMAN et al., 2015, 14), preventing significant waste of financial resources (SCHROEDER and LADIKAS, 2015, 9), enabling the anticipation of positive and negative impacts of innovations (VON SCHOMBERG, 2013, 22) – to only name a few. RRI activities are often anticipatory as they demand an "understanding of the future" (STAHL, 2013, 709). Furthermore, VON SCHOMBERG (2011, 9) proposes that RRI be an "interactive 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 (in order to allow a proper embedding of scientific and technological advances in our society)." The EUROPEAN COMMISSION (2017d) also mentions that RRI aims at strengthening sustainable research and innovation. Sustainable development targets the economy, society and the environment and aims at meeting "the needs of current generations without compromising the ability of future generations to meet their own needs" (Brundtland Report; WCED, 1987). It was the Brundtland Report that first defined the concept of sustainable development, and since then, subsequent international documents and agreements have supported this concept (e.g. 2030 Agenda for Sustainable Development, EU 20/20/20 targets, Kyoto Protocol, etc.). In order to reach sustainability through sustainable development, the participation of all sectors of society is needed, with SDG16 calling for the promotion of peaceful and inclusive societies for sustainable development and building effective, accountable and inclusive institutions (UNITED NATIONS, 2015). Moreover, sustainability has the premise that "human and natural systems are dynamically interdependent and cannot be considered in isolation in order to resolve critical issues" (DALE and NEWMAN, 2005, 352). RRI could therefore play an important role in aligning people's needs and expectations regarding environmental issues, and finding inclusive and sustainable solutions for all stakeholders.

Aligning research processes and its outcomes with the needs and expectations of stakeholders also means assembling knowledge from different backgrounds and belief-systems. Existing knowledge transfer models, such as linear processes (unidirectional or bidirectional), cyclical processes, dynamic multidirectional processes (WARD et al., 2009, 6) and other knowledge types and processes could be incorporated or complemented by RRI approaches. Understanding the role of RRI for knowledge processes is therefore crucial for understanding RRI's potential impact on stakeholders and society.

The RRI concept has been addressed in projects throughout the EU's FP7 and H2020 programmes, mostly focusing on the establishment of indicators for monitoring and evaluating RRI. Although the cross-cutting issue of RRI can be applied to any domain, literature shows that, so far, the concept has mostly been applied in fields such as nano-sciences and nano-

technologies, medicine, engineering, and physics (SUTCLIFF, 2011). Consequently, RRI has rarely been implemented in environmental domains, and no explicit recommendations have been given for environmental sectors implementing this concept. However, looking at the Societal Challenges, the environment is at the core of complex problems (e.g. food, sustainability in agriculture and forestry, marine and maritime and inland water research, climate action, environment, resource efficiency, smart and green energy, etc.) and touches on a broad range of stakeholders who might eventually profit from an approach such as RRI.
Thus, the core of this master thesis is the investigation of RRI in two EC-funded projects (COLUMBUS and MARINA) dealing with knowledge activities in the marine and maritime domain. COLUMBUS[2] exploits project results from the marine and maritime domain by engaging with knowledge owners and linking them to knowledge users (COLUMBUS, 2017), while MARINA[3] promotes RRI through a knowledge sharing online platform and throughout a series of participatory workshops for interested stakeholders (MARINA, 2017). The author of this thesis became acquainted with the concept of RRI while working on these two EU-projects during an internship at the aquarium NAUSICAA – Centre National de la mer. These case studies serve as a basis for extracting relevant practical information about how RRI is being implemented in projects and how this implementation affects knowledge processes. Finally, the objective of this master thesis is to find out how RRI can affect knowledge processes in general and how, in return, these modified knowledge processes/activities can be expected to affect the execution of sustainable development.
This thesis contains a theoretical excursus explaining the emergence of RRI, the RRI dimensions, frequently mentioned advantages and challenges regarding RRI, as well as knowledge activities that are considered important for the case studies and RRI. The methodologies used in this thesis are outlined (Meuser/Nagel analysis of semi-structured expert interviews, descriptive statistics of an online survey, and Thematic Analysis of project documents). All results gained are presented and critically discussed, including strengths and pitfalls concerning the methodology used.

1.1 Research questions

The overall objective of this thesis is to facilitate the understanding of how RRI can affect working on sustainable solutions for environmental issues because literature on this topic is

[2] Full title: COLUMBUS - Monitoring, Managing and Transferring Marine and Maritime Knowledge for Sustainable Blue Growth
[3] Full title: MARINA - Marine Knowledge Sharing Platform for Federating Responsible Research and Innovation Communities

still scarce. RRI's potential to affect sustainable environmental development is analysed by investigating how knowledge processes are and can be modified due to RRI.

Therefore, the research questions that this master thesis responds to are the following:

1. How are the six RRI dimensions (Public Engagement, Science Education, Open Access, Gender Equality, Ethics, and Governance) realised/integrated in the projects COLUMBUS and MARINA?
2. How are knowledge processes changed through RRI?
    - And what changes can the projects bring to the environmental domain regarding sustainable development?

1.2 Data and methods

The primary data was collected in semi-structured expert interviews in order to extract relevant qualitative information regarding the research questions. The objective was to set a focus on the research questions and, at the same time, give the interviewees sufficient opportunities and impetus to reveal underlying theoretical or practical constructs that might not yet have been considered – an important factor for exploring unknown RRI related issues. Semi-structured interviewing also allowed the interviewer to come up with spontaneous questions relevant for understanding the interviewee or encouraging the latter to elaborate their answers but, at the same time, the structured guideline ensured comparability between the different interviews. The recorded interviews were transcribed and analysed using the Meuser/Nagel qualitative analysis approach (MEUSER and NAGEL, 1991).

Additional data was collected in an online survey targeting COLUMBUS and MARINA external stakeholders as well as project partners. The goal was to investigate how stakeholders perceived the work within the projects on an individual level and to assess their perceptions regarding RRI dimensions and knowledge processes. 24 survey responses were collected.

Furthermore, public deliverable documents of COLUMBUS and MARINA were analysed using the Thematic Analysis approach as described by BRAUN and CLARKE (2006) in order to detect RRI-relevant dimensions within the project documents.

1.3 Case Studies

The author of this thesis did a six-month long (February 2017 – August 2017) internship at the aquarium NAUSICAA and worked on the projects COLUMBUS and MARINA. The internship was a pivotal factor in deciding to base the master thesis on RRI, as RRI is mentioned throughout both projects and turned out to be a rather unexplored topic for the environmental domain. COLUMBUS implicitly engages with RRI, while MARINA is built upon this concept.

Both projects aim at successfully collaborating with stakeholders and implementing knowledge activities for the benefit of the environment, contributing to Blue Growth and the Blue Society. COLUMBUS (COLUMBUS – Monitoring, Managing and Transferring Marine and Maritime Knowledge for Sustainable Blue Growth) is a project running from March 2015 to February 2018. It is integrated in the H2020 section of Societal Challenges (Food security, sustainable agriculture and forestry, marine, maritime and inland water research, and the bioeconomy) and wants to ensure accessibility and uptake of research knowledge outputs by end-users (policy, industry, science and wider society) (COMMUNITY RESEARCH AND DEVELOPMENT INFORMATION SERVICE, 2017). COLUMBUS addresses the main problem that important research results are not always exploited, even though they could be of use to marine and maritime stakeholders (COLUMBUS, 2017). Hence, it explores urgent challenges and knowledge needs in the marine and maritime sectors. Subsequently, it examines results of past and current marine and maritime projects which could provide solutions to these challenges/knowledge needs, and the project then ensures that this knowledge is transferred (via the COLUMBUS knowledge transfer methodology) to users that can make use of it (COLUMBUS, 2017). COLUMBUS aims at raising awareness among citizens, so they will realise what an impact marine and maritime research has on their lives (COLUMBUS, 2017). NAUSICAA is mainly responsible for the work package “Promoting marine research towards a blue society” by means of creating value for society, as well as supporting the Responsible Research and Innovation principles and illustrating the impact of research use (COLUMBUS, Coordination and Support Action, 2015). MARINA (MARINA – Marine Knowledge Sharing Platform for Federating Responsible Research and Innovation Communities) is a project running from May 2016 to April 2019. Its focus lies on bridging the gap between scientists and society through multi-stakeholder activities (workshops, online platform). MARINA is funded under the “Science With And For Society” (SWAFS) sub-programme of H2020 (“Integrate society in science and innovation issues, policies and activities in order to integrate citizens' interests and values and to increase the quality, relevance, social acceptability and sustainability of research and innovation outcomes in various fields of activity from social innovation to areas such as biotechnology and nanotechnology”) (COMMUNITY RESEARCH AND DEVELOPMENT INFORMATION SERVICE, 2017a). MARINA’s objective is to engage different societal actors in a knowledge sharing process. Hence, MARINA carries out various participatory activities, inter alia; Mobilisation and Mutual Learning (MML) workshops, a Web Knowledge Sharing Platform (WKSP) and exhibitions (MARINA, 2017) and, eventually, transfers outcomes and experiences from participatory activities to policy-makers in order to foster the RRI approach. The workshops apply different kinds of methodologies, e.g. focus Group, World Café, Science Café, Delphi, Future Search,

Structured Democratic Dialogue Process (SDDP)[4]. The project should serve as an example for developing RRI roadmaps with the goal of aligning R&I and societal needs. In MARINA, NAUSICAA holds the work package "Stakeholder Dialogue and Citizen Awareness in Societal Challenges" (MARINA, Coordination and Support Action, 2016). The aim of this WP is to start the process of creating marine and RRI situational awareness among existing RRI communities and societal forums for knowledge exchange and issue understanding (ibid.). Table 1 represents the relation of COLUMBUS and MARINA, enabling a better understanding of how the projects are linked to each another.

Table 1 extracted from the table "Past projects relevant for MARINA" (project document MARINA, Coordination and Support Action, EUROPEAN COMMISSION, 2016d).

The COLUMBUS project capitalises on EC's significant research by ensuring accessibility and uptake of research Knowledge Outputs by end-users (policy, industry, science and wider society) for contributing to sustainable Blue Growth.	Collected data about EC's research will be used to create the taxonomy for the KSP [online platform]. Moreover, the transferable knowledge for marine projects, identified by COLUMBUS, will be used to expand the MARINA KSP.

NAUSICAA (NAUSICAA - Société d'Exploitation du Centre National de la Mer) is a marine science centre and aquarium in Boulogne-sur-mer, in the North of France. The aquarium aims at raising awareness of the importance of the world's oceans and at educating the general public about how to better manage marine resources and protect the marine environment. Moreover, it disseminates scientific information, develops outreach activities and events and works on projects. NAUSICAA was recognized as the world's first Centre of Excellence for ocean education by the UNESCO Intergovernmental Oceanographic Commission in 1999 (NAUSICAA, 2017). By 2018, NAUSICAA will be Europe's largest aquarium (LANCIAL, 2017).

1.4 Master thesis roadmap and delimitations

In order to facilitate the understanding of this master thesis, the research methods employed are visualised in Figure 1. Figure 1 was created by the author of this thesis and inspired by the schematic diagram used in the paper of REED et al. (2014, 339). The figure can be described as follows; in a first step, a literature review and a review of the projects COLUMBUS and MARINA provided impetus and allowed for the elaboration of the research questions. This phase was followed by different steps using three different research methods;

[4] Structured Democratic Dialogue: An Application of a Mathematical Problem Structuring Method to Facilitate Reforms with Local Authorities in Cyprus (LAOURIS and MICHAELIDES, 2017).

- semi-structured interviews were prepared, a pretest was conducted, interview partners were identified and then interviewed. The interviews were transcribed and then analysed using the Meuser/Nagel method (MEUSER and NAGEL, 1991);
- an online survey about RRI in COLUMBUS and MARINA was prepared, pretested, published (online), and subsequently coded, described and analysed;
- a Thematic Analysis (BRAUN and CLARKE, 2006) was employed to analyse the project documents (public deliverables).

Detailed descriptions of each method follow in chapter **3**. The results of the different methods and a consequent analysis of the latter allow for a discussion and final conclusion in order to answer the research questions of this master thesis.

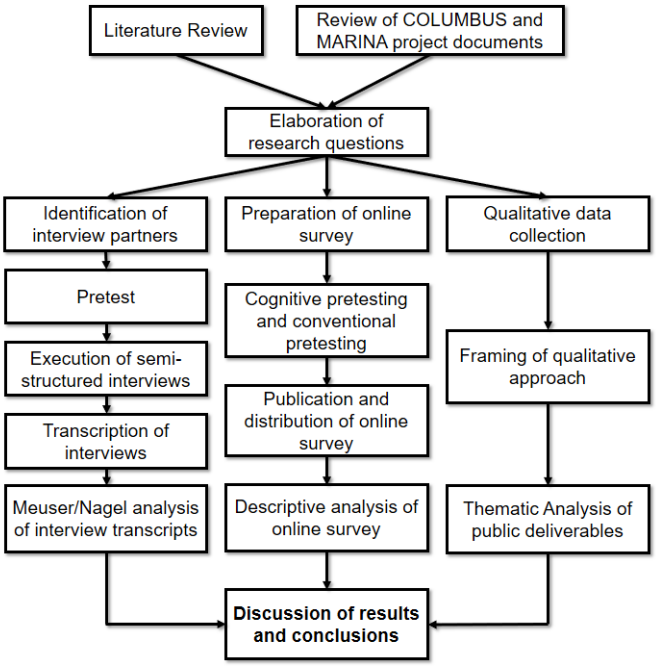


Figure 1 Master thesis roadmap: schematic diagram of the research methodology (own image)

Delimitation of the study

This research work will be of assistance for future research in this field, helping to better anticipate RRI's potential influences and more efficiently exploit its benefits for the environmental domain. The questions of how RRI has been experienced to affect knowledge processes and how this experience could be of use for future RRI applications are answered. The assessment of actual environmental outcomes related to RRI is not an objective of this study, neither is the assessment of how RRI has actually affected stakeholder behaviour towards the environment. Interviews with stakeholders other than project partners have not

been carried out in this research work, as the projects under investigation do not necessarily build on participants' continuing engagement, e.g. some participants take part once, others multiple times. The effects of RRI on the environment and on people's behaviour are estimated to occur after regular engagement in the long term and could be subject to investigation in future studies concerning the impacts of RRI. Such investigations are judged too resource-intensive (time, finances, participants) for this research work.

This thesis focuses on how RRI works for project partners, i.e. those who implement RRI for their purposes. Not interviewing external project stakeholders might limit the understanding of how project processes were perceived by those involved. The participants views are considered in the online survey and could be explored in more detail in further research.

2 Theoretical background

This chapter investigates state of the art literature regarding the main topics of this master thesis: the Responsible Research and Innovation (RRI) approach, sustainable environmental development and knowledge activities. The role of RRI in the EU as well as its emergence, its key dimensions, proposals for other dimensions, challenges and advantages are examined. Moreover, the importance of the concept of sustainable development in the environmental domain is highlighted and sustainable development aspects that link to the RRI approach are accentuated. Furthermore, the definition of knowledge and knowledge processes as well as existing prominent knowledge principles in environmental sciences are investigated.

2.1 The Responsible Research and Innovation approach

Responsible Research and Innovation (RRI) is a term and concept used within the EU's Research and Innovation funding programme H2020, which runs during the period of 2014-2020, and will therefore be promoted as an emphasised key action and as a cross-cutting issue throughout the whole programme (EUROPEAN COMMISSION, 2017d). The H2020 Work Programme of SwafS from 2016-2017 describes the RRI approach as follows: "Responsible research and innovation is a process for better aligning research and innovation with the values, needs and expectations of society. It implies close cooperation between all stakeholders in various strands comprising: science education, definition of research agendas, access to research results and the application of new knowledge in full compliance with gender and ethics considerations" (EUROPEAN COMMISSION, 2016a, 6). The RRI approach aims at integrating specific actions in R&I processes that are based on the following five thematic dimensions: Science Education, Open Access, Public Engagement, Gender Equality, Ethics; in addition to that, RRI also aims at establishing an organisation among stakeholders and within institutions that allows RRI integration in policy-making and institutional structures (Governance) (EUROPEAN COMMISSION, 2017d) (see Chapter **2.1.2**).

One of the priorities of the H2020 programme is the pillar of Societal Challenges. The definition of these Societal Challenges reflects the "policy priorities of the Europe 2020 strategy and addresses major concerns shared by citizens in Europe and elsewhere" (EUROPEAN COMMISSION, 2017e). The European Commission consulted stakeholders and interested parties after the EU's Seventh Framework Programme (FP7) and pinned down these seven

Societal Challenges[5] that Europe will tackle within the new H2020 programme (EUROPEAN COMMISSION, 2013).

In H2020, RRI is seen as a crucial instrument for finding sustainable and systematic solutions with the engagement and collaboration of citizens (EUROPEAN COMMISSION, 2016a, 6). RRI considers scientific enquiry also from the natural environment's viewpoint but, "fundamentally, it is about creating high quality science that is more in the public interest" (GARCIA et al., 2016, 8). Thus, environmental aspects are mainly considered in R&I outcomes and impacts as RRI's focus mainly lies on societal desirability.

RRI shall not only tackle research outcomes but shall be embedded as a "systematic procedure" throughout the whole R&I process (GARCIA et al., 2016, 13). Individual actors will not deliver RRI on their own; instead RRI will be established as a "collective, inclusive and system-wide approach" (VAN DEN HOVEN et al. 2013, 58). VON SCHOMBERG characterises the RRI approach as a "transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)" (VON SCHOMBERG, 2013, 19). Stakeholder dialogue and transdisciplinary approaches are relevant elements employed within RRI and shall help identify and tackle Societal Challenges as well as foster early approval of research and innovation (VAN DEN HOVEN et al., 2013, 11f).

Furthermore, H2020 wants to ensure that the EU produces science and technology that drives economic growth (EUROPEAN COMMISSION, 2014, 5). The EU strongly builds on innovations in order to maintain competitiveness of European businesses and to enhance environmental and economic sustainability on the microlevel as well as on the macro-level (ZWART et al., 2014, 13f). RRI can be seen as a process innovation as it proposes "different ways of organising, funding, undertaking and engaging with innovation and research" (OWEN, 2015, s.p.). RRI does not follow any fixed definitions and demands but describes a flexible and practicable approach. The concept is not mandatory but some of its policy agendas already constitute normative requests in project calls, and scientists are already keen on using RRI in funding proposals to follow the wishes and requests of policy makers (RIP, 2014, 8). RR is also described as "an

[5] 1. Health, demographic change and wellbeing;
2. Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bio-economy;
3. Secure, clean and efficient energy;
4. Smart, green and integrated transport;
5. Climate action, environment, resource efficiency and raw materials;
6. Europe in a changing world - inclusive, innovative and reflective societies;
7. Secure societies - protecting freedom and security of Europe and its citizens (EUROPEAN COMMISSION, 2017e).

attempt at social innovation" (ibid.); an innovation that can only be taken up through institutional changes and sub-cultural changes that could be "stimulated by soft command and control".
Although RRI is primarily promoted in European funding schemes, similar initiatives are said to be taking place worldwide (in 2017 RRI workshops were held e.g. in Brazil and the USA[6]). Under FP7 less than 10 RRI projects were funded, whereas a web search on CORDIS revealed that H2020 funds more than 20 projects that explicitly tackle RRI in their objective description (COMMUNITY RESEARCH AND DEVELOPMENT INFORMATION SERVICE, 2017), though the number of grant agreements that stipulate an implementation of implicit RRI activities is estimated to be much higher.
In this chapter, the official concept of RRI, its roles and ambitions in the EU were considered. As can be seen, RRI builds on known elements (such as participatory processes) and thus does not represent a novelty. RRI-related approaches have evolved and changed over time, responding to emerging technological and ethical needs. The evolution of RRI is discussed in the following chapter.

2.1.1 The emergence of Responsible Research and Innovation

Even though the approach of RRI in the EU is said to be a "recent phenomenon" (OWEN et al., 2012, 752), the idea of integrating this concept of responsibility in Research and Innovation is not a new discipline but "it is a basic strategy to change the way in which research and innovation is usually done" (ZWART et al., 2014,12). The emergence of RRI shall not mean that R&I have been carried out irresponsibly up to now (RRI TOOLS, s.a.). Responsibility in governance has historically been concerned with the outcomes of science and innovation that were later found to be "unacceptable or harmful to society or the environment" (STILGOE et al., 2013, 1569). In the centuries before, it was the scientists who took responsibility for their inventions and possible impacts, while in the 21st century decisions are made within institutional working frameworks (RIP, 2014, 3). STAHL (2013, 5) argues that RRI's novelty "lies in the fact that it coordinates existing responsibilities." Today, there are networks of various stakeholders that "may produce innovations by diffusing accountability (responsible or otherwise), while the consequences can be far more substantial and far-reaching" (ZWART et al., 2014, 14). However, researchers themselves are often well-aware of societal concerns and react accordingly, for instance in the 1970s researchers met to tackle concerns in the field of recombinant DNA research and produced a memorandum relating to this (STILGOE et al., 2013, 1568). Before the emergence of RRI, philosophy, bioethics and technology assessments were

[6] RESPONSIBLE RESEARCH AND INNOVATION IN PRACTICE (2017): at: https://www.rri-practice.eu/news-events/ [Accessed 01.12.2017].

the primary forms of integrating ethics into research works (ZWART et al., 2014, 4f; BURGET et al., 2017, 2f). Moreover, the field of technology assessment is especially known for evaluation of intended and non-intended impacts of new technologies (KHODZHAEVA et al., 2014, 111). Consideration of social and ethical aspects of scientific and engineering research can be found as early as FP2 (1987–1991), and a "Targeted Socio-Economic Research" programme was promoted throughout the FP4 (1994–1998) (RODRIGUEZ et al., 2013, 1127). Socio-technical integration gained relevance in terms of legitimacy because increasing trust issues had emerged among European citizens, which can partly be attributed to multiple food scandals in the 1990s (ibid.). In 1990 the concept of ELSI (Ethical, Legal, and Societal Implications) emerged in the USA mainly in the field of genetic and genomic research and was followed by the concept of ELSA (Ethical, Legal and Social Aspects) in the EU in 1994 (FP4), which was concerned with critically assessing on-going research and facilitating the future embedding of science (ZWART et al., 2014, 7ff). ELSA focused on proximity (embeddedness in scientific programmes), early anticipation of social issues, interactivity with stakeholders in order to co-create research, and interdisciplinarity between research communities (ZWART and NELIS, 2009, 543). ZWART et al. do not see "a radical departure from ELSA" in RRI, but emphasize that, other than ELSA, RRI's focus lies on collaborations with private and industrial partners and strives for socio-economic benefits of scientific and technological change (ZWART et al., 2014, 12). Figure 2 visualises the evolution of RRI from its predecessors.

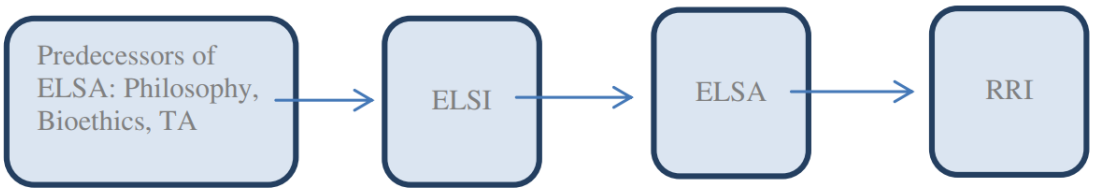


Figure 2 The predecessors of RRI (ZWART et al., 2014, 4)

Authors detect the beginnings of RRI mainly in the domains of nanotechnology in the mid-2000s (RIP, 2014, 1), as well as in disciplines such as science and technology studies and humanities, notably within the Science and Society domain at the EC (OWEN, 2015, s.p.). The term "Responsible Research" was first mentioned in the FP6 (2002-2006) in association with actions that should enhance dialogue in research on ethics of science and technology, and in the FP7 the term of "Responsible Research and Innovation" emerged (BURGET et al., 2017, 2). RRI's significance was raised in May 2011 due to a workshop held at the Directorate-General Research in Brussels, which was attended by several experts drawn from academia and politics (OWEN et al., 2012, 752; SUTCLIFF, 2011). The purpose of the event was to reflect on RRI and to develop a shared understanding of the meaning of RRI, the overall objective being

the formulation of policy recommendations that would support the development and implementation of a policy underpinned by the concept across the European Research Area (OWEN et al., 2012, 752). Then, in 2014, the conference "Science, Innovation and Society: achieving Responsible Research and Innovation" in Rome produced the Rome Declaration which promotes Responsible Research and Innovation in an integrated way (ITALIAN PRESIDENCY OF THE COUNCIL OF THE EUROPEAN UNION, 2014). The participants of this conference called on stakeholders to collaborate and find sustainable solutions to our Societal Challenges, as stating that “conditions are now right for responsible research and innovation to underpin European research and innovation endeavour” (ibid.).

From 2014-2016 the EU project “RRI TOOLS, a project to foster Responsible Research and Innovation for society, with society” was carried out and developed a Training and Dissemination Toolkit (RRI TOOLS, s.a.). The project provides those who are interested in RRI with useful tools, explications and examples that demonstrate implementation possibilities the concept. This toolkit is mentioned as a lot of recommendations given by the project were of use for this master thesis.

RRI evolved out of other ethical approaches and its definition and design are still a work in progress; workshops and conferences are still taking place, in Europe or elsewhere, and implementation activities are widely discussed (see Chapter **2.1.2.1**). The current dimensions, forming the RRI approach, are discussed in detail in the next chapter.

2.1.2 Responsible Research and Innovation dimensions

According to the EC, RRI has six dimensions, five of which constitute thematic elements of RRI: Science Education, Open Access, Public Engagement, Gender Equality and Ethics. RRI also strives to be a central objective across relevant policies and activities, including in shaping the European Research Area and the Innovation Union (OWEN et al., 2012, 752), and therefore the 6th dimension ascribed to RRI is “Governance”. Figure 3 visualizes the ensemble of theoretically and practically overlapping RRI dimensions which all together form the RRI concept (RRI TOOLS, s.a.).

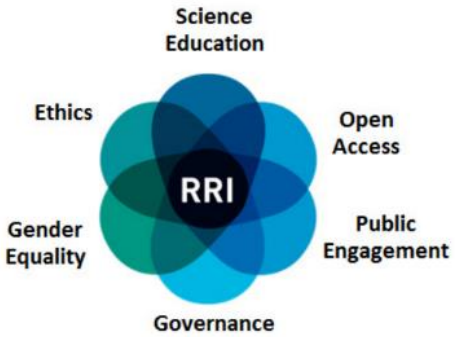


Figure 3 RRI dimensions as described by the EC (RRI TOOLS, s.a.)

Public Engagement

Public Engagement aims at enabling an active and transdisciplinary collaboration between usually disconnected societal actors (e.g. researchers, policy makers, industry and civil society organisations, NGOs, and citizens) and engages them in participatory R&I processes on science and technology development issues (EUROPEAN COMMISSION, 2017c). Engaging societal actors in direct participation actions and including them in upstream R&I processes contributes to identifying their values, needs and expectations - therefore societally relevant, accepted and desired R&I outcomes can be fostered, and possible public value failures of future innovation can be pre-empted (EUROPEAN COMMISSION, 2012a, s.p.). The methods used to make Public Engagement possible and to facilitate stakeholder exchange are manifold. The International Association for Public Participation lists various engagement actions based on the level of participation: inform (provide accurate information to make sure stakeholders understand the problem, alternatives, solutions, etc.); consultation (obtaining feedback on analysis, outcomes, etc.); involvement (working with stakeholders and considering their input); collaboration (partnering with stakeholders in each aspect of decision making); delegated power/empowerment (letting the stakeholders decide) (THE INTERNATIONAL ASSOCIATION FOR PUBLIC PARTICIPATION, s.a.). Public Engagement can be defined as "societal commitment" which encourages citizens as well as end-users of R&I to get engaged in discussions and debates around R&I and to produce or co-create knowledge (in terms of their needs and expectations) while holding "different degrees of agency" such as "citizen science, science in transition, do-it-yourself, fablabs, hacker spaces, maker spaces, etc." which often deal with the use of digital tools (STRAND et al., 2015, 21f).

Gender Equality

The dimension of Gender Equality aims at banning discriminating conditions against women in research and education, it promotes equal opportunities and participation for both sexes in R&I and shall help R&I to produce socially relevant knowledge by taking into account women's needs and behaviours as well as men's (EUROPEAN COMMISSION, 2012a). The gender equality dimension in RRI aims at promoting gender balanced research teams, breaking down gender stereotypes, raising awareness towards gender-sensitive funding, and considering the gender dimension in R&I and in decision making (EUROPEAN COMMISSION, 2017b). The EC cites the objective of reaching a target of 40% of the under-represented sex in research panels and groups and 50% in advisory groups (EUROPEAN COMMISSION, 2014a, 1; EUROPEAN COMMISSION, 2016, 3). Furthermore, promoting equality between women and men in decision-making, equal economic independence for women and men, equal pay for equal work, ending gender-based violence and strengthening women's rights across the world are the priorities

and key actions of the EU Strategic Engagement for Gender Equality from 2016-2019 (EUROPEAN COMMISSION, 2016c, 9).

Science Education

Science Education aims at implementing pedagogies in order to attract young people towards science, enhance the current education process, and provide societal actors with scientific knowledge (EUROPEAN COMMISSION, 2012a). The main objectives regarding Science Education on the EU-level are: the enhancement of education to equip future researchers and other societal with knowledge/tools to become good RRI actors; fostering interest in science among children and young people with the aim of encouraging research careers or enabling them to contribute to a science-literate society (STRAND et al., 2015, 6). Improved scientific knowledge provides citizens with the ability to partake in discussions and decisions on research, innovation, science and technology (GARCIA, et al., 2016, 11). Science Education should be integrated in the education programme from pre-school to engaged citizenship; the quality of teaching should be enhanced to improve the quality of learning outcomes; collaborations between formal, non-formal and informal educational providers, enterprises and civil society should be strengthened to ensure the engagement of all stakeholders; and the public's understanding of scientific findings and their capability to discuss them should be improved (HAZELKORN et al., 2015). Science Education can happen through various activities and can be categorised as informal (unintentional learning resulting from daily activities), formal (e.g. in educational and training institutions, following a curriculum) and non-formal (e.g. science camps, clubs), and further differentiates between professional and personal learning (CEDEFOP, 2009). Some organisations propose science-based activities (re-cycling initiatives, community activities, environmental groups, clubs, etc.) with a focus on "self-discovery, curiosity and fun" or engagement in research projects (e.g. monitoring environmental phenomena) (HAZELKORN et al., 2015, 24). All citizens, no matter what age, should be engaged in educational science processes throughout their whole lives in order to mainstream Science Education and to build a "more balanced science-informed society" (ibid.).

Open Access

Projects funded or co-funded by H2020 have to make sure that scientific information which they publish is openly accessible and free of charge (EUROPEAN COMMISSION, 2017a, 3). Scientific information refers to peer-reviewed scientific research articles (publications in scholarly journals) or research data (data underlying publications, curated data, raw data) (ibid.). In the context of RRI, Open Access is not an objective but rather "a means to achieve the goal of better alignment of R&I with societal values, needs and concerns" (STRAND et al.,

2015, 32). Open Access policies are expected to improve research conditions by reducing duplication of efforts, by minimising the time spent searching for and accessing information, and by consequently speeding up scientific progress (EUROPEAN COMMISSION, 2012, 3; EUROPEAN COMMISSION, 2017a, 5). Open Access includes the rights to read, download, print, copy, distribute, search, link, crawl and mine, and, in the context of research funding, Open Access requirements only become an issue "if publication is chosen as a means of dissemination" (EUROPEAN COMMISSION, 2017a, 4). Furthermore, Open Access considers the challenge of intellectual property rights and is seen as a key feature for RRI by making the results of research available to businesses and to societal actors (ibid.). The two main routes to Open Access are; "green" Open Access (beneficiaries deposit their work in an online repository, institutional or subject-based, at the same time as, or after publication and the article is freely accessible for everyone); and "gold" Open Access (an article is immediately published and free of charge at the site of publication) (EUROPEAN COMMISSION, 2017a, 3). The different levels of Open Science, representing the bigger picture of open sharing (EUROPEAN COMMISSION (2016b) consist of different levels: Level 0 (maintenance and updates of project websites, green and gold Open Access); Level 1 (Level 0 incl. project blogs, responses to comments/feedback, publication of project movie clips); Level 2 (Level 1 incl. upload of experimental datasets to project websites, publication of laboratory notebooks, regular dialogue between stakeholders, rich virtual environments for processes of learning) (STRAND et al., 2015, 32).

Ethics

In the EU, Ethics is seen as an integral part of research and shall help achieve real research excellence; Ethics in research must comply with fundamental ethical principles in national and international contracts and agreements, e.g. the European treaties on Human Rights and the EU Charter of Fundamental Rights (VAN DEN HOVEN et al., 2013, 23). Moreover, honesty, accountability, fairness and good stewardship should be core principles of research and innovation (GARCIA, 2016,11). Beyond the mandatory legal aspects, the Ethics dimension aims at ensuring increased societal relevance and acceptability of research and innovation outcomes in order to produce high quality results (EUROPEAN UNION, 2014, s.p.). The three main topics of Ethics in RRI can be categorised as follows; Research integrity and good research practice (e.g. plagiarism, fabrication, fraud, scientific neutrality, etc.), including the issues of codified rules and actual values, measures to improve accountability with respect to research integrity; research ethics for the protection of the objects of research (e.g. human beings, animals, etc.); and societal relevance and ethical acceptability of R&I outcomes (STRAND et al., 2015, 33f).

Governance

The goal of RRI is to foster practices that influence policy and decision-making; therefore, Governance is an important "umbrella" dimension covering the other key dimensions and promoting institutional change to support the implementation of RRI among stakeholders (EUROPEAN COMMISSION, 2012a, s.p.). RRI should be embedded in structures that are in line with existing practices but also flexible and able to adapt to changes (GARCIA et al., 2016, 11). Governance describes the governing of RRI processes, and STRAND et al. (2015, 20) suggest that the main focus lie on "identifying networks of stakeholders and the ways they collectively assume the responsibility of raising awareness regarding RRI and devising policies for the promotion of the key RRI elements". Governance was reportedly deleted as a key dimension, because of applicational difficulties in the work programmes of Horizon 2020 (RIP, 2016, 295). The dimension Governance is nevertheless treated in this master thesis, as it completes the RRI concept as currently described by the EC.

Throughout literature, the often mentioned RRI parties and stakeholders concerned by the approach are:

- Policymakers: e.g. policy officers, legislators, public bodies, research centre directors and funders, decision-makers in Research and Innovation on a local, national or international level, etc.;
- Education community: e.g. teachers, students, families, science centres, museum staff, science communicators etc.;
- Research community: e.g. individual researchers, research managers, research technicians, support staff etc;
- Business and industry: e.g. business building on research and innovation, SMEs, transnational companies, networks, incubator hubs, supporting organisation etc.;
- Civil society organisations: e.g. individuals (citizens), organisations, trade unions, NGOs, media etc.;
- Any user of R&I as well as research ethics committees and their members.
  (GARCIA et al., 2016, 12; STAHL, 2013, 710f).

In this thesis, the term "stakeholder(s)" is used and includes all of the aforementioned heterogenous stakeholder types. This list of stakeholders involved in RRI as well as the descriptions about the RRI dimensions cannot be seen as exhaustive. The RRI approach is not a rigid concept but rather has to be perceived as an evolving and adaptive approach.
The RRI dimensions explained in this chapter are defined by the EC, General-Directives or other official EU-related institutions and projects. As RRI is still evolving, many authors have

addressed the concept's definition and interpretation and come up with proposals for other possible RRI dimensions. These will be discussed in the following chapter.

2.1.2.1 Proposals for other dimensions

Considerable dimensions as well as other non-thematic dimensions have been mentioned by authors other than the EC, as RRI does not impose mandatory and binding requirements concerning the involvement of stakeholders, the consideration of RRI dimensions, as well as their implementation. Regarding process dimensions, VAN DEN HOVEN et al. (2013, 23) describes how the implementation of RRI will have beneficial impacts on the way research and innovation (R&I) is currently carried out in the EU, namely through three non-thematic dimensions: a normative dimension (embedding research and innovation in European values that have been laid down, e.g. The Treaty of the EU, Charter of Fundamental Rights of the EU etc.); a substantive dimension (making decisions substantially better by integrating societal concerns); and an instrumental dimension (improving the situation of administrations and making research funding more effective).

OWEN et al. (2012) and STILGOE et al. (2013) propose important features and dimensions that could be taken into account when discussing RRI. Both papers mention "anticipation", "reflection/reflexivity", as well as "inclusion/inclusive deliberation" and "responsiveness" as essentials for RRI. "Anticipation" involves anticipating possible intended or unintended future impacts of research and innovation while thinking systematically and revealing new opportunities (STILGOE et al., 2013). "Inclusion" means enabling different stakeholders to get engaged in open and transparent research and innovation processes, to let them discuss agenda topics and participation processes (ibid.). "Responsiveness" as described by OWEN et al. (2012) is threefold and includes "anticipation", "reflection" (taking into account underlying purposes, motivations, uncertainties, etc.) and "inclusive deliberation" (opening up reflection to publics and stakeholders through processes of dialogue and engagement). STILGOE et al. (2013) define "responsiveness" as the aim to respond to new knowledge and to emerging perspectives, views and norms. Furthermore, STILGOE et al. (2013, 1571) do not employ the term "reflection" but "reflexivity" as an RRI dimension, meaning the activity of questioning "one's own activities, commitments and assumptions, being aware of the limits of knowledge and being mindful that a particular framing of an issue may not be universally held", i.e. rethinking prevailing conceptions. Thus, RRI should be seen as "an iterative, continuous and flexible process of adaptive learning" (OWEN et al., 2012, 755).

Based on a literature review, BURGET et al. (2017, 10) mention that "anticipation" in RRI stands for visioning the future of research and innovation as well as seeing and "understanding how the current dynamics help design the future". According to them, "Inclusion" refers to public

debates and has a strong political connotation, with the EC focusing on the inclusion of various actors in EC funded projects (ibid. 9f). Moreover, literature revealed that discussions around the dimension "responsiveness" mainly tackle risks, ethics, transparency, as well as accessibility, and "reflexivity" mostly relates to anticipation, public dialogue, and public involvement, as these are said to help researchers reflect on social and ethical dimensions of research (BURGET et al., 2017, 11f).

The RRI Tools project (2014-2016) explicitly makes references to the RRI process dimensions: "diverse and inclusive" (a wide range of actors need to be involved and listened to in the early stages of research and innovation); "open and transparent" (research and innovation should be open to society in a meaningful and honest way); "anticipative and reflective" (research and innovation should take into account how its own dynamic will affect the future); and "responsive and adaptive to change" (research and innovation need values and processes to adapt to emerging knowledge and needs) (RRI TOOLS, s.a.).a

STRAND et al. (2015) focus on the six dimensions (Public Engagement, Science Education, Open Access, Ethics, Gender Equality and Governance) as proposed by the EC, and furthermore suggest the dimensions of "sustainability" and "social justice/inclusion". Here, environmental "sustainability" is proposed to be assessed by means of monitoring renewable, non-renewable resources, consumption and regeneration of stocks, ecosystem services and their effect on human well-being (KETTNER et al., 2014). "Social justice" describes, among others, the access and affordability of products and services developed as a result of research and innovation activities for different social groups, focusing on whether researchers consider the impact of their research on social justice and whether they try to minimise potential negative consequences for larger populations (STRAND et al., 2015, 38f).

In addition to the six RRI dimensions defined by the EC, the project Governance of Responsible Innovation (GREAT) (2013 – 2016) proposed another thematic dimension: "Taking Care of Our Planet" (Environmental Stewardship), justifying this proposal by EC's emphasis on sustainability in the EU and EU's climate policy. "This addition followed the consultation work undertaken during the project, where the absence of the environment in the original list of thematic elements was considered in need of remedy" (WILFORD et al., 2016, 3).

As RRI implies a way of thinking and doing that "guides research and development in ethically appropriate ways" it should also prevent any harm to the physical environment (ibid. 2). Hence, engagement has to correspond with ethics that "seek to ensure informed decision-making and the minimising of harm to society or the environment" (ibid. 11). Moreover, the FP7 project Responsible Industry called for RRI approaches to be alert to "mitigate environmental impacts" and adopt an "environmentally friendly" profile (THE RESPONSIBLE-INDUSTRY PROJECT CONSORTIUM, 2017, 6).

BURGET et al. (2017) who operationalised a literature analysis on the four different conceptual dimensions proposed by STILGOE et al. (2013) (anticipation, reflexivity, responsiveness and deliberation), additionally also selected two emerging conceptual dimensions for RRI: "sustainability" and "care". Here, "Sustainability" tackles sustainable economic growth and sustainable resource use (resource efficiency), whereas "care" stands for a collective idea of responsibility among stakeholders' participation in the research and innovation processes by integrating people's objectives and day-to-day practices (BURGET et al., 2017, 12f).
The Dutch Research Council of the Responsible Innovation Programme (MVI) defined the following dimensions of RRI: "valorisation" (stakeholders are involved in the research and results can be implemented directly); "interdisciplinarity" (researchers from different disciplines work together); "pro-activity" (ethical and societal aspects are integrated into the process); "internationality" (the research takes the global context into consideration); "relevance and knowledge utilization" (research proposals are considered in terms of relevance and the practicality of their results) (OWEN, 2015, s.p.).

Table 2 presents an overview of the dimensions mentioned in this chapter and does not claim to be complete.

Table 2 Exemplary list of proposed RRI dimensions (created by the author) in alphabetical order

In-exhaustive list of proposed RRI dimensions by authors other than the EC
Anticipation
Care
Deliberation
Environment
Inclusiveness/Inclusion
Interdisciplinarity
Internationality
Openness/Transparency
Pro-action
Reflexivity
Relevance and knowledge utilization
Responsiveness
Social justice
Sustainability
Valorisation

BURGET et al. come to the conclusion that RRI is still under development and that its main goal is to include all the stakeholders in the early stages of research and development and to anticipate impacts of research outcomes (BURGET et al., 2017, 15). RRI has caused many to contribute their respective ideas in order to shape RRI's framework and define its interpretations. The contributions try to clarify and further develop the key elements of RRI conceptualisations as formulated by the EC. Moreover, RRI assembles known practices; "many research organisations and funding organisations have long established practices for promoting open access, ethical standards, or gender equality, items that could now be classified under the umbrella of RRI" (FORSBERG et al., 2018, 5).

The vagueness of RRI can be explained by the fact that, in order to work in transdisciplinary fields and communities, the concept had to be "sufficiently vague to allow for broad adherence while remaining concrete enough to utilize it as a reasonably well-functioning device for policymaking and research practice" (FELT, 2017, 3). RIP emphasizes the fact that at present, RRI represents an open-ended idea that can be understood as an occasion "for a number of threads of development and of challenges and debates coming together under what is essentially a blanket term" (2016, 292). RRI therefore offers actors opportunities to give their input on on-going discussions (ibid.). Critical and constructive reviews about the opportunities that RRI has to offer have to be carried out (RIBEIRO et al., 2016, 20). Furthermore, BARDONE and LIND state that responsible research is "a type of engagement to develop in time rather than an outcome to bring about once and for all" (BARDONE and LIND, 2016, 16). Thus, RRI's flexibility regarding its interpretation is mostly seen as an opportunity. Moreover, many of the RRI elements themselves are evolving concepts (e.g. Gender Equality), and if RRI strives to be responsive and anticipative, then the continuous discussion about its conceptualisation as well as implementation will be a necessity. More challenges and advantages relating to RRI are discussed in the next chapter.

2.1.3 Challenges and opportunities for Responsible Research and Innovation

Literature has been preoccupied with the exploration of potentials and weaknesses of RRI or related concepts, as the ideas and the integration of RRI principles are not uncontested. As mentioned in chapter **2.1.2.1**, the RRI approach is not subject to mandatory requirements, and the concept is as yet in its creation phase.

Six years ago, OWEN et al. stated that there was still "a lack of clarity in terms of definition" (OWEN et al, 2012, 752), and discussions about definitions of RRI have not yet come to an end. Some dimensions are better explored and more discussed in literature than others. Most of the stakeholders "do not seem entirely aware of what RRI refers to specifically" (BURGET et al., 2017, 3). Furthermore, VON SCHOMBERG (2013, 1) argues that "there is no agreed definition of

the concept, and approaches [to] how it should be implemented may vary." The RRI approach is said to be "in vogue," and researchers and those whose work is related to research and innovation are encouraged to join the debate concerning the meaning of RRI (ZWART et al., 2014, 11f). RIBEIRO, et al. (2016, 2) also state that "the meaning and application of RRI – as concept, approach or overarching policy – is often loosely articulated". RIP also states in a video interview that RRI can be described as a fashion that might disappear from the agenda of the EC again, but he mentions that vestiges will be left of the concept and will continue to have an impact on R&I (RRI TOOLS, 2016). An internet search revealed that in 2017 many RRI events, meetings and workshops were still held with titles such as "Engaging society for Responsible Research and Innovation (RRI): New options to move forward" (CETAF, 2017), "Responsible Research and Innovation (RRI) - Eine Frage der Verantwortung" (MEDIZINISCHE UNIVERSITÄT WIEN, 2017) and Richard Owen's Oslo Summer School in Comparative Social Science Studies 2017 (UNIVERSITY OF OSLO, 2017). Events like these indicate that the RRI approach is still in the making, and stakeholders constantly elaborate the concept and try to find ways to implement it in different domains and disciplines.

A factor contradicting the promised success of RRI, mentioned by several authors is the fact that innovation prospers in competitive environments. VON SCHOMBERG (2013, 5f) states that, so far, most innovations have taken place in a commercial context and that, contrary to the objective and belief of Open Access and Public Engagement, information asymmetries usually support the emergence of inventions and innovations. This is a hypothesis also supported by BLOK and LEMMENS (2015, 23ff), who further state that innovation is the main source of competitive advantage. Therefore, parties involved in knowledge exchanges might refuse to share knowledge due to "fear of losing competitive edge" (LIYANAGE et al., 2009, 12). Another difficulty regarding RRI is the prediction of R&I consequences. BLOK and LEMMENS (2015, 25) refer to a control dilemma (Collingridge dilemma) which is based on the assumption that consequences of a technical invention can hardly be predicted at the beginning but when the undesirable consequences are discovered, the technology is already anchored in society and the economy, which makes it difficult to control. Due to our epistemological limitations and uncertainty of the future we are limited in foreseeing unintended or intended impacts from R&I (VON SCHOMBERG, 2013, 13f; BLOK and LEMMENS, 2015, 26; STAHL, 2013, 709).

STAHL (2013, 711) states that it is still not clear how participatory activities can be organised and integrated in RRI (in what institutional framework, on what geographical level, with which stakeholders, etc.). Regarding Public Engagement, conflicts of interest among stakeholders make it difficult to align their often contradictory positions and expectations (BLOK and LEMMENS, 2015, 21; KHODZHAEVA, 2014, 112). Furthermore, technology can only be used and exploited if it is accepted but often, there is a gap of acceptance between professionals and

lay people (KHODZHAEVA, 2014, 112f). Moreover, imposing a broad application of RRI in the EU might very likely result in stakeholders offering resistance against this conceptual approach (STAHL, 2013, 713).

As the H2020 strategy in the EU stresses the importance of tackling multiple goals (e.g. building industrial leadership, ensuring competitive industries, boosting job creation, finding solutions for the Societal Challenges), it will be complicated to negotiate which "right impacts" should be given more emphasis than others, because the power of politics plays a crucial role and RRI cannot be decoupled from its political context and the political agenda (OWEN et al., 2012, 753). Regarding politics, another important aspect about RRI is the fact that it was not proposed by researchers in the field, but by policy makers and funding agencies in a top-down manner (ZWART et al., 2014, 2). In addition to the criticism concerning RRI's weaknesses, FELT (2017, 6) states that, in the bio-economy RRI is often used as "a mechanism to grease the wheels of technological progress" and foster advancement instead of really scrutinising the embedded values. In this case, RRI can be used as a deception which employs citizen engagement merely to convince participants of an innovation's alleged benefits.

Possible advantages of RRI for sustainable development and the environment are manifold. Unlike VON SCHOMBERG (2013) and BLOK and LEMMENS (2015), GURZAWSKA et al. (2017, 1) state that the fact that businesses still refuse to adopt the RRI approach is "unfortunate because not adopting RRI could lead to missed competitive opportunities as well as negative economic, societal and environmental impacts." The authors clearly see RRI's potential in the creation of social and environmental innovations which can be beneficial for the economy and its businesses (GURZAWSKA et al., 2017, 2). Furthermore, RRI could help to establish new networks and partnerships (SMALLMAN et al., 2015), to prevent significant waste of financial resources (SCHROEDER and LADIKAS, 2015, 9), and to enable anticipation of positive and negative impacts of innovations (VON SCHOMBERG, 2013). "Moreover, the newness of RRI does not reside in its interactive and anticipatory orientation, as is suggested by authors who introduced the term, but rather in its emphases on socio-economic impacts" (ZWART et al., 2014, 1). Many companies, especially small firms, focus very much on the day-to-day processes of the trade but forget to develop long-term strategies for the future (GHANEMI and YAN, 2017). Long-term perspectives are important to ensure innovative competitiveness and to guarantee long-term success but for this, companies must be "highly ethical and have the sense of responsibility in their work as well as the development process of the products" (ibid.). Thus, RRI could help develop long-term strategies for businesses, fostering sustainability.

Innovations which are imposed by government and contested by societal actors upon their introduction, could also foster people's growing scepticism towards research and innovation

(R&), so RRI could be a necessary tool to legitimise R&I developments and outcomes. By bringing all relevant stakeholders to one table and by examining expectations and values, RRI could raise the acceptance of new innovations coming from research, and in some cases, early societal intervention may enable the anticipation of positive and negative impacts and help gather social support (BLOK AND LEMMENS, 2015, 24). In the past, several undesirable R&I outcomes could have been avoided by considering an RRI approach which would have allowed taking into account societal concerns in the R&I process. Examples for past failing social support of innovations are the investment of the Dutch government in the development of Electronic Patient Record Systems, which the Dutch parliament ultimately abandoned because there had been concerns about whether this system sufficiently took into account privacy control aspects (VAN DEN HOVEN et al., 2013, 63). When Monsanto introduced genetically modified organisms (GMOs) to European markets in the 1990s, European NGOs fiercely rejected these products (VON SCHOMBERG, 2013, 14). An approach such as RRI could have changed the outcomes of negotiations regarding GMO products. Other examples of products or innovations that were heavily contested after their negative effects came to light are asbestos, CFCs, and tobacco (SUTCLIFF, 2017, 5).

RIBEIRO et al. (2016, 8) identified the main objectives of RRI strategies as follows; the development of better or novel practices, the delivery of societal benefits, the anticipation of technology impacts and the promotion of public acceptance. Furthermore, RRI's novelty is said to lie in four main elements: RRI has the ability to emphasise suggestions about ethical considerations in research and innovation; RRI does not invent but focus on existing tools and "examines the value and impact of these tools" (e.g. ethical reflection, stakeholder engagement, etc.); furthermore, RRI wants to "mobilise resources to develop new approaches"; and lastly, it strives for engagement of actors that may be excluded from R&I decision-making processes (ibid. 20).

In conclusion, it can be said that "RRI is no panacea" and that the mere fact of implementing it will not avoid all negative consequences from R&I, but RRI has the potential to allow stakeholders to "improve the quality of debate and thereby contribute to better and more standardised decisions about contested developments" (STAHL, 2013, 713). This chapter discussed implications of RRI in R&I and society. As the next chapter shows, RRI elements are also linked to sustainable development actions.

2.2 Responsible Research and Innovation for sustainability and the environment

This chapter first clarifies how sustainable development is defined, and furthermore presents an abstract of a historical overview of sustainable development in politics and, therein, highlights environmental aspects and aspects that can be linked to RRI (as defined by the EC).

In this master thesis sustainability stands for an established (environmental, societal, economic) system that persists unharmed over time, while sustainable development describes the process towards achieving this sustainability. The three-pillar sustainable development concept was first introduced by René Passet (1979), presenting an integration of the environment in society and the economy. An environmentally sustainable system understands natural processes and puts measures in place to protect them; an economically sustainable system carries out management practices, policies, technologies and lifestyles while protecting natural resources; socially sustainable systems guarantee equality in jobs, education, natural resources, and societal welfare (FLINT, 2013, 34f). The three-overlapping dimensions equally consider all sectoral issues "in a synergy relationship" (ibid.). In Figure 4, the three-overlapping circles model links economic, social, and environmental parts; each decision toward problem-solving has an impact on all three dimensions (=holistic sustainable solutions).

Figure 4 Venn diagram of sustainable development (JHA., 2015, 2)

The expression "sustainable" or "sustainability" originally roots in forestry; back in 1713, the chief mining official Hans Carl von Carlowitz published the forestry treatise "Sylvicultura oeconomica", in which the principle of sustainable use of wood was discussed during a time when many parts of Europe were in need of vast quantities of this natural resource (SCHMITHÜSEN, 2013). Nowadays, the common definition of sustainable development is often cited as "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). Sustainable development will be an overarching objective of H2020 (The Grand Challenge) and at least 60% of the total H2020 budget will be related to sustainable development targeting in particular the climate and environmental objectives (EUROPEAN COMMISSION, 2017). Following the Lisbon strategy, the Europe 2020 strategy was adopted in 2010 and contributes to moving Europe out of its crisis and laying the foundations for a more sustainable future built on smart, sustainable and

inclusive growth (EUROPEAN COMMISSION, 2010). Furthermore, the EC undertakes a bi-annual monitoring report on sustainable development, which, among others, also monitors natural resources (EUROSTAT, 2015). In regard to sustainable development, the natural environment is described as a "prerequisite for socio-economic development", crucial for human health and represents intrinsic values such as educational, cultural, recreational, aesthetic, religious, spiritual and other intrinsic values (UNEP, 2013, 15).

VON SCHOMBERG describes the Responsible Research and Innovation approach as "a transparent, interactive 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 (in order to allow a proper embedding of scientific and technological advances in our society)." In this case, for VON SCHOMBERG, "sustainability" means a contribution to the EU's objective of achieving scientific and technological advances for the benefit of the society. Not only should R&I processes be sustainable, products should also be evaluated "with a view to their normative anchor points: high level of protection to the environment and human health, sustainability, and societal desirability" (VON SCHOMBERG, 2011, 9). The following pages outline the relationship between long-existing RRI elements and their inclusion in international sustainable development agreements and objectives tackeling also environmental issues.

Political concerns about sustainable development and the environment go back more than four decades. It was in 1972, when the United Nations Conference on the Human Environment (Stockholm Conference) was held on international environmental issues. The Declaration of the United Nations Conference on the Human Environment addresses how human activities influence the natural environment and, therefore, proposes management actions to enable a sustainable development of the environment, society, and the economy. For instance, it urges citizens, communities and businesses to accept their responsibility towards the environment, it advocates for policies that eliminate any form of oppression, so that people can take responsibility, and promotes education in environmental matters for all (UNITED NATIONS, 1972). These examples show links to the RRI dimensions of Science Education, Ethics, and Governance.

In 1987, "Our Common Future" (Brundtland Report) was published by the United Nations World Commission on Environment and Development, covering a variety of different issues related to the environment: food security, species, and ecosystems as resources for development, energy as well as land use and the interrelated problems of poverty, injustice, and environmental stress (WCED, 1987). The report also tackles gender equity, ethical problems posed by the development of technologies, as well as the question of how education allows for a better use of resources (ibid.) – all of them issues covered by RRI. Then, in 1992, the

United Nations Earth Summit in Rio de Janeiro, Brazil, produced the Rio Declaration on Environment and Development, as well as the Agenda 21 (UNITED NATIONS, 1992). The Rio Declaration formulates rights and responsibilities of states in regard to natural resources (UNITED NATIONS, 1992a). The Agenda 21 pleads for the integration of environmental and development concerns in order to fulfil "basic needs, improved living standards for all, better protected and managed ecosystems and a safer, more prosperous future" (UNITED NATIONS, 1992, s.p.), also addressing the integration of citizens in decision-making, the promotion of sustainability through education, the development of data bases (open access), the empowerment of women, as well as cultural and ethical considerations. In 1997, a review of the Earth Summit progress was made by the United Nations General Assembly, evaluating how well countries, organisations, and society had responded to the challenges defined at the Earth Summit and adopted the Programme for the Further Implementation of Agenda 21 (UNITED NATIONS, 1997). In 2012 the United Nations Conference on Sustainable Development "RIO +20: The Future We Want" was held, resulting in the document "The Future We Want". At this conference world leaders reaffirmed their commitment to sustainable development, embracing economic progress, social development, and environmental protection for the benefit of all (UNITED NATIONS, 2012). One of the principal outcomes of Rio+20 was the call for the development of a set of universally applicable sustainable development goals (SDGs), later eventually resulting in the adoption of non-binding environmental, societal and economic guidelines. The SDGs ("Transforming our World: the 2030 Agenda for Sustainable Development") are a set of 17 global goals with 169 targets, addressing human well-being, the environment and the sustainable use of our resources, but also go further to include goals such as "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" (Goal 4), "Achieve gender equality and empower all women and girls" (Goal 5) and "Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels" (Goal 16) (UNITED NATIONS, 2015). All of the RRI dimensions are tackled implicitly or explicitly throughout the SDGs, underlining the fact that issues embedded in the RRI approach are considered in actions deemed necessary to foster sustainable development. The SDGs integrate environmental aspects through integrated goals that eventually embody all three aspects of sustainable development, giving the environment "an equal footing" to the social and economic dimensions, showing that environmental sustainability is the basis for socio-economic development, and encouraging "a type of development that minimizes unintended environmental consequences and strengthens adaptation and resilience to environmental and other changes" (UNEP, 2013, 2f).

In the last few years, the EU has set out to promote the Green Growth and Blue Growth concepts. Blue Growth is the long-term strategy to support sustainable growth in the marine and maritime sectors as a whole, but also faces criticism, linking it to what is called “ocean grabbing”: powerful economic actors take control of decision-making and decide about use and management of marine resources, making profit and steadily gaining power (TNI, 2014, 3, in: BARBESGAARD, 2016, 13f). Another concept tackled by both projects is the concept of Blue Society which represents a vision for society in which people can benefit from the ocean’s potential while ensuring the sustainable use of marine resources (VALLETTE, 2017). The concept is funded on the idea that a system of governance can be established between stakeholders, allowing them to recognise the oceans as a common good that must be managed sustainably by means of innovations and exchanges of knowledge and skills (ibid.). Thus, achieving Blue Society is intrinsically linked to political discussions regarding power structures and multi-stakeholder solutions. The concept of Blue Growth and Blue Society are given emphasis because both projects, COLUMBUS and MARINA, address these concepts throughout their project activities.

This historical overview makes clear that, for the past decades, efforts for sustainable development have been made, and the environment as well as ethical issues have long been at the core of sustainable development issues. Today, topics like public engagement, gender equity, environmental education, and good governance support sustainable processes and are key to achieving environmental as well as economic or social sustainability goals (SDGs; UNITED NATIONS, 2015). Nevertheless, authors note that the SDGs are the result of political negotiations and remain subject to political interests and interpretations (WINKLER AND WILLIAMS, 2017). Moreover, sustainable development is a process that has the potential to encourage discussion, involvement and public consultation, potentially fostering partnerships, but it is also said to have a strong political connotation (ROBINSON, 2004). Thus, discussions about sustainability are, not always explicitly, linked to debates about political and power structures. Hence, just like in discussions about RRI, where negotiations concerning the “right impacts” can be complicated (OWEN et al., 2012, 753), sustainable development is confronted with a variety of different challenges and stakeholder interests.

This chapter shows how sustainable development discussions first started and that the concept is still an on-going process, and a playing field of various interests. RRI-related elements can be detected in aspirations for sustainability, and both concepts link to discussions demanding political and structural changes. As this master thesis puts a focus on environmental sustainability, the environmental dimension shall once more be highlighted by

a statement made by Stanley Rowe from the Saskatchewan Environmental Society during a WCED Public Hearing in Ottawa, 26-27 May 1986:

"When, therefore, we optimistically declare that economic development and environmental maintenance can go along hand in hand, this qualifier must immediately be added: only if the maintenance of the ecosphere is made the first priority".

2.3 Knowledge definitions

This chapter highlights definitions for knowledge, and knowledge processes/activities. The definitions are presented and explain how knowledge can be distinguished, framed and looked at from different angles in order to better put it into context with RRI and the discipline of environmental sciences.

Definitions for knowledge vary depending on multiple factors such as the context, period, philosophy, etc. This master thesis puts knowledge in a context applied to the concept of RRI and, therefore, considers that knowledge has to be related to people's values and personal experiences. The goal of this chapter is not to formulate a new definition of knowledge, but to find existing definitions that best describe knowledge for the purposes of this master thesis. An understanding of the concepts of knowledge is important because the distinction among the different types of knowledge plays a role in knowledge management developments and can help recognise different aspects of knowledge (ALAVI and LEIDNER, 2001, 112). This is important as "different perspectives of knowledge lead to different approaches and views of 'knowledge management'" (LIYANAGE et al., 2009, 5).

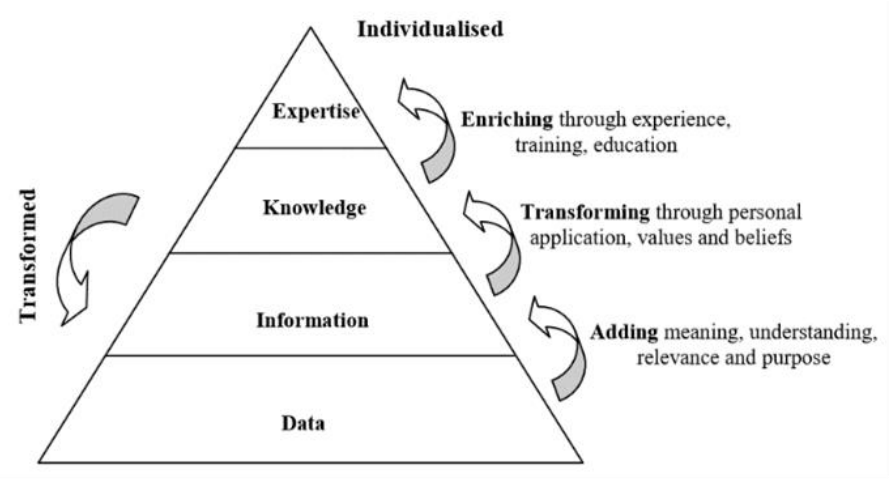


Figure 5 Knowledge hierarchy (BENDER and FISH, 2000, 126)

Figure 5 is derived from BENDER and FISH (2000) and explains how knowledge can be seen in relation with data, information and expertise; by adding meaning, understanding, relevance and purpose to mere quantitative or qualitative data, data are transformed into information; the introduction of personal application, values and beliefs transforms information into knowledge; and knowledge that has been enriched through experience, training and education finally becomes expertise (ibid.). Big quantities of mere information are of little value because, in order to understand and actively build knowledge, information has to be processed "in the mind of individuals through a process of reflection, enlightenment or learning" (ALAVI and LEIDNER, 2001, 110).

Human beings can hold different kinds of knowledge that explain individuals' behaviour and way of thinking; therefore, throughout this research work, the definition of knowledge takes the following into account:

- explicit knowledge: knowledge that is held by the owner, that can be articulated, codified and expressed easily;
- tacit knowledge: unarticulated knowledge rooted in actions, experience, etc. (LIYANAGE et al., 2009, 3f).

Throughout this thesis, knowledge is rather perceived as an entity, than as a process. This is done in order to better frame knowledge and distinguish between knowledge itself and the knowledge activities and processes that can take place. Knowledge activities, such as knowledge transfer, exchange, dissemination, and sharing, have varying definitions. As described in the literature, there is no standardisation of terms which categorizes the actions describing the different forms of management systems of knowledge. GRAHAM et al. (2006, 14) state that "knowledge translation," "knowledge transfer," "knowledge exchange," "research utilization," "implementation," "dissemination," and "diffusion" are the most common terms and are often used interchangeably. This master thesis focuses on the activity of knowledge transfer (KT; term used for COLUMBUS) and knowledge sharing (term used for MARINA), but also addresses knowledge dissemination and knowledge exchange. Table 3 presents the different knowledge definitions relevant for this thesis. SCHWARTZ emphasizes that "a major distinction between knowledge sharing and knowledge transfer (terms that may sometimes be used interchangeably) is that transfer implies focus, a clear objective, and unidirectionality, while knowledge may be shared in unintended ways multiple directionally without a specific objective […]" (SCHWARTZ, 2006, 493). In this thesis, "knowledge exchange" stands for contacts between stakeholders in general, hence representing an umbrella term for the descriptions in Table 3.

Table 3 Definitions of knowledge activities for this master thesis

Term	Definition
Knowledge transfer	"The focused, objective-seeking communication of knowledge between individuals, groups, or organizations such that the recipient of knowledge (a) has a cognitive understanding, (b) has the ability to apply the knowledge, or (c) applies the knowledge" (SCHWARTZ, 2006, 498).
Knowledge dissemination	Knowledge dissemination means "diffusion that is directed and managed" (GREEN et al., 2009, 152).
Knowledge sharing	Knowledge sharing is "the exchange of knowledge between and among individuals, and within and among teams, organizational units, and organizations. This exchange may be focused or unfocused, but it usually does not have a clear a priori objective" (SCHWARTZ, 2006, 498).
Knowledge brokering	Regarding knowledge brokering, SCHWARTZ states; "A broker is someone who holds a position in a network that connects two or more unconnected parts of that network […]. It is closely related to the idea of bridging ties because bridging ties imply brokerage" (SCHWARTZ, 2006, 820).

Additionally, there are not only different kinds of knowledge and knowledge activities, literature has also described different steps in knowledge activities such as; problem identification and communication; knowledge/research development and selection; analysis of context; knowledge transfer activities or interventions; knowledge/research utilization (WARD et al., 2009, 5). Moreover, there are different states in knowledge processing; socialisation (the process of sharing experiences and the creation of tacit knowledge), externalisation (articulation of tacit knowledge into explicit knowledge), combination (systematisation of concepts into a knowledge system, i.e. different kinds of explicit knowledge are combined), internalisation (incorporation of tacit knowledge into the tasks of an individual or organisation) (SECI Model by; NONAKA and TAKEUCHI, 1995). The directions of knowledge processes can further be identified as linear (process between individuals with an identifiable start and end-point), cyclical "where aspects of the research, context, knowledge transfer intervention and evaluation lead to the identification of new problems"; or a dynamic multidirectional process (different degrees of linkages and exchange between researchers and users of research) (WARD et al., 2009, 6).

PAULIN and SUNESON discuss the terms knowledge transfer, knowledge sharing, and respective knowledge barriers (2012). Based on other literature, they identify factors that influence knowledge sharing on an individual level (such as the nature of knowledge, the motivation to share, the opportunities to share, the culture and the work environment), and they detect interpersonal and team characteristics, cultural characteristics, individual characteristics and motivational factors (perceived benefits and costs, interpersonal trust and justice and individual attitudes) in knowledge sharing activities (ibid. 85). Possible knowledge barriers on an individual level are manifold; lack of time to share knowledge; low awareness of

the value and benefit of possessed knowledge to others; strong hierarchy; insufficient capture; lack of contact time and interaction between knowledge sources and recipients; poor communication and interpersonal skills; lack of trust in people or in the knowledge due to the source; as well as differences in national culture (inter alia, language) (RIEGE, 2005, 23f).
This chapter describes general knowledge aspects and activities. Knowledge activities happen in many different domains and environments and show different characteristics depending on the application area. In the next chapter, possible knowledge activities in environmental sciences will be discussed.

2.3.1 Knowledge activities for environmental sciences

As knowledge activities constantly happen in different contexts for different disciplines, the different perspectives of knowledge as well the different environments in which it takes place should be taken into account in order to work with it efficiently. Thus, knowledge activities in the environmental domain are assumed to be crucial in order to achieve environmental change and to tackle the challenges that touch on environmental issues.
Regarding knowledge activities with different stakeholders, REED et al. published a study with the title “Five principles for the practice of knowledge exchange in environmental management” (2014). Therein, REED et al. (2014, 337f) state that “enabling more effective knowledge exchange between research producers and users has the potential to significantly enhance the impact of environmental management research, policy and practice”. They state that there is little knowledge/expertise about what needs to be done to enhance knowledge exchange in the environmental management, and they therefore propose five principles in order to enhance environmental impact; knowledge exchange should be considered as integrated in the whole research process, i.e. stakeholders should be informed about intended inputs and outcomes; stakeholder diversity in knowledge exchange should represent the stakeholder diversity in research; knowledge exchange should be a “safe space” in which those involved can effectively listen to each other, share knowledge and skills and build trusting relationships (ibid. 341); tangible, valuable outputs should be delivered to as many stakeholders as possible in order to gain support of stakeholders; and knowledge exchange activities should be sustained after the project’s lifetime (REED et al., 2014). They also conclude that the quality of relationships between stakeholders can be more important than the quality of the research itself (ibid.). What is also important is to leverage the already existing needs and demands between stakeholders and to make use of their interests: in practice, researchers and practitioners usually contact each other for different reasons as practitioners look for research-based knowledge to help their decision making, and researchers look for practitioners to gain knowledge about new issues (VAN KERKHOFF and LEBEL, 2006, 469f). This relationship can be

leveraged; research-based knowledge can make a unique contribution to sustainability, but in order to link knowledge to sustainable actions, individuals will have to change their behaviour, and this, in return, may require "altering powerful institutions or social relations" (ibid. 470), showing that actions towards sustainability will ultimately be the result of social and political decisions.

Figure 6 The knowledge arena: sustainability science as a collective learning process (CORNELL et al., 2013, 62)

CORNELL et al. (2013, 62) argue that scientists have a crucial role to play in the application of knowledge together with all the other stakeholders involved (civil society, industry, polity). Sustainability can be regarded as an "open-ended process of social learning", and encompasses various social, economic and environmental challenges (ibid.). In order to meet these complex challenges, the authors propose among others: societal agenda setting, collective problem framing, and stakeholder participation (CORNELL, 2013). Figure 6 visualises sustainability science as a collective learning process: different stakeholders develop a common vision, they integrate available knowledge, finally implement actions together and what is learnt from experience is then reintegrated in their knowledge and the process is reiterated. Regarding education, DALE (2005) emphasises that environmental education differs from sustainable development education. Environmental and ecological sciences are described as "fact and tool oriented"; they respond to biological and ecological questions but lack the capacity for inter-/transdisciplinarity and stakeholder engagement, whereas critical sustainability issues (e.g. climate change, poverty, environmental degradation) are not easy to be solved and require an "understanding of complex systems, an interdisciplinary approach to its theory and a transdisciplinary approach to its practical implementation" (ibid. 353). DALE

(2005) recognizes the importance of ecological/environmental education but advocates for sustainable development literacy.

3 Methodology

A literature review on Responsible Research and Innovation was conducted before defining the research questions of this thesis. Literature was searched on Scopus, scholar.google, Boku Lit:Search, researchgate and on the internal server of Nausicaa.

RRI is a much-discussed topic and relevant projects and papers emerge constantly. The choice was made to investigate RRI in both projects COLUMBUS and MARINA because, even though the projects' structures and objectives are different, they tackle the same issues of raising awareness of the importance of the oceans, and both work with different kinds of stakeholders to find more sustainable environmental solutions. Sustainable development and the environment are issues that are more and more raised in the context of RRI but are not well explored yet. Analysing these two projects and finding similar or relevant differing results could be proof that some things regarding RRI elements in project processes would need to be tackled, irrespective of the context and objectives. The research questions were conceptualised to cover RRI in both projects, in knowledge processes and in sustainable environmental development. Knowledge transfer and knowledge sharing play a role in both projects and were a perpetus for basing the research question on knowledge processes. Both projects provided enough material and opportunities to better investigate RRI within them, and so the choice was made to conduct a case study analysis of both projects. In order to understand and, to fully exploit both projects and to eventually answer the research question, three methods were chosen.

The projects provided sufficient material and documents for qualitative analysis and, moreover, it was possible to contact project partners who were familiar with the RRI approach. In order to get quantitative and (presumably) generalisable data out of the projects, a survey was set up for internal and external project stakeholders of COLUMBUS and MARINA. Thus, a triangular methodology was constructed in order to answer the two main research questions. This approach enables the comprehensive investigation of theoretical as well as practical perspectives of the case studies COLUMBUS and MARINA.

The semi-structured expert interviews form the core of this research work and investigate practical project processes as perceived by internal stakeholders (=experts) (practical perspective). The results of the online surveys provide insights into certain project aspects and aspects of RRI as perceived by internal and external stakeholders (practical perspective). The theoretical Thematic Analysis (BRAUN AND CLARKE, 2006) examines inner project workings and detects the RRI dimensions within documents of the projects (theoretical perspective).

3.1 Case study projects: COLUMBUS and MARINA

The author of this thesis worked at NAUSICAA – Centre de la mer during a six-month long internship and came across the concept of Responsible Research and Innovation while working on the two projects COLUMBUS and MARINA. The reason for basing the work on these two EU-projects was that a more targeted and in-depth approach was estimated to yield more comprehensive and coherent information for the understanding of RRI. Investigating more projects would have been too time-consuming and investigating only one project would not have allowed for summarising similarities of different approaches. As a much discussed and widely applicable approach, RRI contains elements that could be of interest for the sustainable development as well as for the environment, and that was the reason for the decision to investigate both projects from an environmental perspective. The internship allowed a thorough examination of project processes and participation observation (in a MARINA Mobilisation and Mutual Learning workshop). The availability of project partners and the support from colleagues at NAUSICAA were factors that facilitated the conduction of this research work.

Case studies are a widely used research method. “The case study is a research strategy which focuses on understanding the dynamics present within single settings” (EISENHARDT, 1989, 534). Case studies typically involve qualitative or quantitative data or both and are said to “benefit from having multiple sources of evidence” (YIN, 2012, 10). On the other hand, weaknesses of theory building from case studies are that intensive use of empirical evidence can produce overly complex theory, the produced theory can be “very rich in detail but lacks the simplicity of overall perspective” and moreover, the theory can fail to detect which relations are important and which ones are idiosyncratic to the case (EISENHARDT, 1989, 547). Thus, the study might be “unable to raise the level of generality” (ibid.). The methodology in this thesis combines qualitative (documents, interviews) with quantitative (survey) evidence. This is an approach that can prove to be “highly synergistic,” as quantitative evidence can indicate relationships which may not be evident to the researcher, it can support findings when it confirms evidence found in qualitative data, and it can stop the researcher from “being carried away” by false impressions that emerge from the qualitative data (EISENHARDT, 1989, 538). MINTZBERG (1979, 587) states that theory building needs richness, and while relationships can be revealed through hard data, richness stems from qualitative data and is able to explain relationships of hard data. Furthermore, FLYVBJERG (2006, 26) states that „the advantage of large samples is breadth, while their problem is one of depth. For the case study, the situation is the reverse. Both approaches are necessary for a sound development of social science.”

This master thesis represents a case study research of RRI, with qualitative and quantitative data sources (documents, interviews, survey), producing an output of RRI statements for

sustainable development and environmental issues. The case studies of COLUMBUS and MARINA can be seen as exploratory as they provide insight in a field that has yet to be explored further. This study has elements of a comparative case study but does not put its focus on analysing differences between the projects, as the survey results do not allow for valid comparisons (the data collected is strongly biased; only 17% of the respondents were COLUMBUS stakeholders). This work mainly aims at exploring similarities between the projects, while also considering the most notable differences between them. The case studies were chosen to extend emergent theory about Responsible Research and Innovation. The fact that one of the projects under scrutiny is an explicit RRI project and the other one is not may represent possible drawbacks in this analysis as no full comparability is given, but it also opens up possibilities to find underlying similarities and differences between the projects. The goal of this case study is to produce statements that can foster the further implementation of RRI. The results found in this thesis are not generally valid, but present valid lessons learnt. FLYVBJERG (2006, 5) emphasises the fact that there is no such thing as context-independent knowledge and that summarising case studies is difficult but, he also states that "it is only because of experience with cases that one can at all move from being a beginner to being an expert".

3.2 Semi-structured expert interviews with project partners

The semi-structured expert interviews with the project partners form the core method applied in this thesis. The objective of the interviewer was to gain insight knowledge in the projects' processes and to investigate the role that RRI plays or can play in the projects themselves and in sustainable environmental development. In-depth information that was not expected to be found in documents or in a survey was therefore extracted from semi-structured interviews, which allowed for a thorough inquiry of issues. The method applied for the qualitative analysis is the Meuser/Nagel method, a method based on the documentary interpretation of BOHNSACK (1989), the narrative interview of SCHÜTZE (1981) and the objective hermeneutics of OEVERMANN (1979). Objective hermeneutics are a procedure that detect and retain social actions in texts, in order to "interpret it hermeneutically with regard to action-generating latent meaning structures" (REICHERTZ, 2004, 290).

Expert interviews are a popular instrument in qualitative empirical research studies and are designed to explore expert knowledge (MEUSER and NAGEL, 1991). There are different forms of qualitative expert interviews (semi-structured, unstructured, etc.) and, since a clear distinction among them is difficult, the chosen approach of an expert interview and respective modifications have to be explained in detail (ULLRICH, 2006, 100). An expert can be defined as someone who is "addressed because the researcher assumes that she or he has knowledge which she or he may not necessarily possess alone, but which is not accessible to anybody in

the field of action under study" (MEUSER and NAGEL, 2009, 18). In semi-structured expert interviews the researcher follows a prepared interview guide (a list of questions/topics that cover fields of interest for the research). Even though the questions are predetermined, there is flexibility in how and at what point the questions are asked, and moreover, this way of interviewing enables the researcher to probe questions and gives space to interviewees for answering on their own terms (EDWARDS and HOLLAND, 2013, 29). Although adaptable for and flexible in each different interview situation, the interview guide provides structure for comparison across interviewees and ensures comparability (ibid.). When developing the interview guide, the following things have to be taken into consideration: "the focus of inquiry; what they want to learn from the person they are speaking with; how much time they have available and the kind of access they have; and how much they already know about their research topic" (ibid., 54).

There are different types of interview forms; the explorative, the systematizing, and the theory-generating interview; the exploratory expert interview is used to provide orientation, the systematizing expert interview targets the systematic retrieval of information, and the theory-generating expert interview aims at reconstructing social interpretative patterns (BOGNER et al., 2009, 7). The explorative expert interview is the approach chosen for this master thesis and serves to explore a field of interest. This interview form helps to exploit new and basic information about unexplored fields and also allows for a reduction of the original procedure for qualitative analysis as proposed by MEUSER and NAGEL (ULLRICH, 2006, 100). MEUSER and NAGEL (1991, 446) distinguish between company knowledge ("Betriebswissen") and contextual knowledge ("Kontextwissen"). When exploring Betriebswissen, the experts are the target group of interest, and the interviews allow for analysis of specific intern structures and processes (ibid.). When exploring Kontextwissen, the research focus lies on understanding circumstances and framework conditions of expert knowledge (ibid.). In this thesis, the experts are not only actively engaged, they are also spectators of processes and therefore hold contextual knowledge. In this thesis, the Meuser/Nagel approach was executed as described, but the last step is not executed as proposed by the authors. The classic Meuser/Nagel approach consists of six consecutive steps (all of which are further outlined on the following pages); transcription, paraphrasing, coding, thematic comparison, sociological conceptualization, and theoretical generalisation. Theoretical generalisation is important for studies that explore Betriebswissen in order to prove whether hypotheses are inadequate, false or true (MEUSER and NAGEL, 1991, 455). As this study's objective is to explore RRI characteristics and not to test hypotheses, the last step was left out.

Data sources

There is no standardised definition of an “expert” so in this case study, people who had experience and knowledge about RRI were considered as experts. The choice of interview partners for the semi-structured expert interviews about COLUMBUS and MARINA was mainly based on recommendations given by F. Huron (COLUMBUS) and I. Gin (MARINA), other recommendations were given by interview partners later on (snowball technique). All interviewees were project partners. The interviewees were chosen according to their alleged knowledge about RRI, their transdisciplinary work in one of the projects and their ability to speak English (all interviews were conducted in English). Moreover, people from different institutions and from different EU-countries were contacted and, following the RRI approach, a gender balance among the interviewees chosen was envisaged (final interviews: 60% women, 40% men). 10 interviewees were chosen for this research because after the tenth interview no significantly new information seemed to add to the interviews already conducted. All interviewees were adults; no further information was collected regarding the interviewees’ ages as this was not of interest for the research questions. 10% of the interviewees have an economical background, 20% have an environmental background, 30% have a background in communication/public sciences/sociology, and 40% have a background in other technical sciences (e.g. electronic engineering, medical informatics, nanomaterials). At the time of the interviews, 30% of the interviewees held job positions in the field of project management, 40% held positions in the research field, 10% held a position as executive-director, 10% were head of department, and 10% held a position as a H2020 communication officer. A description of each interviewee can be found in Appendix C.

The participants were contacted via e-mail and informed about; the researcher’s position in the projects (internship), the purpose of the research work, the fact that the interviews were going to be recorded, and the estimated time the interviews were going to take (45min). The interview with F. Huron and the pretest with I. Gin were conducted on the premises of Nausicaa and recorded via mobile phone, the other interviews were conducted via Skype (J. Hansen and R. Fernandez via video conversation on Skype) and recorded via the programme MP3 Skype Recorder. The interviews were conducted over 2 months between June 20, 2017 and October 2, 2017. The big time-gap between the first and the second interview can be explained by the fact that in the summer, a lot of interviewees were not available. Moreover, as the interviews were conducted via Skype, the interviewees were in their offices during our talk, which means that they explicitly had to make room for the interview during their work time. This required time planning and scheduling well in advance with all interviewees. The interviews lasted between 35min and 75min; thus, the average length was 55min. All interviewees filled out an informed consent form, and all of them agreed to their data and names being used in this research work.

The interview session conducted with C. Buongiovanni and M. Bezzi is considered as one interview, as the answers they gave were often confirmative and/or complementary. Table 4 and Table 5 list the interview partners and relevant interview data from both projects.

COLUMBUS

Table 4 List of COLUMBUS interview partners

Company (Country)	Interviewee	Date, time, duration
Nausicaa – Centre National de la Mer (France)	Florence Huron	20 July, 10.00, 35min
EurOcean - Fundacao Eurocean (Portugal)	Ned Dwyer	8 Aug, 11.00, 58min
CETMAR - Centro Tecnológico del Mar (Spain)	Rosa Fernandez	12 Sep, 10.00, 61min
AquaTT (Ireland)	Cliona NÍ Cheallacháin	2 Oct, 10.00, 37min

MARINA

Table 5 List of MARINA interview partners

Company (Country)	Interviewee(s)	Date, time, duration
CNR - Consiglio Nazionale delle Ricerche (Italy)	Fernando Ferri	1 Aug, 12.00, 1h
APRE - Agency of Promotion of European Research (Italy)	Chiara Buongiovanni and Margot Bezzi	4 Aug, 15.00, 62min
CIC nanoGUNE – Associacion centro de investigacion cooperativa en nanociencias (Spain)	Nagore Ibarra Gonzalez	9 Aug, 15.30, 54min
ISPRA - Istituto superiore per la protezione e la ricerca ambientale (Italy)	Sasa Raicevich	22 Aug, 15.00, 75min
Aalborg Universitet – AAU (Denmark)	Jesper Rohr Hansen	7 Sept, 13.00, 51min

Preparation of the semi-structured interview guide

The same interview guide was used for all interviewees, with differing questions or additional questions (alternative questions) asked if the course of the interview demanded it. The interview guide was based on the literature and the fields of interest. The investigated topic areas are; Responsible Research and Innovation in the projects (COLUMBUS/MARINA), knowledge exchange in the project, sustainable development and the environment in the project and with regard to RRI. The wording of the questions in the MARINA interview guide slightly differs from the wording in the COLUMBUS interview guide because the use of RRI is different in both projects and, moreover, the technical language of the project differs as well; e.g. “how are the RRI dimensions implemented?” (MARINA) and “where do you see RRI realised in the project’s activities?” (COLUMBUS). All the open questions (except the closing question at the end of the guide) follow the 5W1H approach (also referred to as Kipling method, 1906), which asks questions beginning with; who, what, where, when, why and how. This

method ensures that the interviewee elaborates their answer about a given subject instead of answering with “yes” or “no.” Questions were left out if the interviewer came to the conclusion that they were not necessary (because the interviewee had already talked about the topic) or because the interviewer struggled with a certain topic (no specifying questions were asked). The interviewer also came up with spontaneous questions (e.g. for clarification, for encouragement to elaborate the answer). The interview guide can be found in Appendix A.

Pretest

The pretest was conducted to try out the interview questions with an interviewee fulfilling all the characteristics of an eligible expert. The pretest was conducted face-to-face with I. GIN, who works at NAUSICAA and is currently involved in the MARINA project as a project partner. This trial served as a basis for adapting and modifying the semi-structured interview in case questions asked were worthy of improvement (in terms of linguistic expression, order, thematical adaptions, redundancy, etc.) as well as to estimate the duration of the interview. The pretest induced modifications of the interview guide that were judged as significant. As comparability among the interviews is important for the analysis, the pretest was not included in the latter. After the pretest and the first interview, a memory log was written and helped the researcher reflect on the questions asked during the interview, the course of conversation, behaviour and feelings of the interviewee, as well as encountered difficulties. These memory logs helped to adjust and improve the conduct of the following interviews.

Transcription

The transcription followed the original dicton and terminology of the experts (ULLRICH, 2006, 104). All the interviews (except the pretest) were transcribed verbatim and listened to multiple times for corrections. Expert interviews focus on generalities among interview statements, hence the exact transcription of pauses, vocal pitches as well as nonverbal and paralinguistic elements were not considered in the transcription (in accordance with MEUSER and NAGEL, 1991, 455). Words that were not understood are marked with an “[X]”, words that could not be identified with certainty were marked with a “[?]” and words that were censored (for ethical reasons) were marked with a “[Y]” (this was the case for one interview when the interviewee was talking about national differences and cited certain countries). In this study, all transcriptions were exhaustive in order not to omit potentially important statements and expert interpretations. Statements that proved to be irrelevant were left out later in the analysis.

Paraphrases

All the interviews (except the pretest) were paraphrased, only some statements were left in their original version as provided by the interviewee, and some statements were not paraphrased because they were judged to be irrelevant. Paraphrases should correctly reflect the experts' statements (MEUSER and NAGEL, 1991, 456f) and therefore stay close to the experts' terminology. In this thesis, paraphrased passages start with "the interviewee claims/states/thinks/feels/confirms, etc.". Although the step of paraphrasing can be neglected when dealing with explorative studies (ULLRICH, 2006, 103), the paraphrases were judged important in this study because due to the experts' different uses of English, rephrased and arranged phrases were estimated to enhance the overall comprehensibility of statements. An example of paraphrasing can be seen in table 4.

Coding

In this step, coding is conducted separately for each interview, i.e. the paraphrased passages of each interview are arranged thematically by attributing codes/headlines to them. A code describes or represents a passage's main statement and should take up the initial terminology of the expert (MEUSER and NAGEL, 1991, 457f). If possible, in vitro codes were applied. A passage can have multiple codes if it covers various topics, and different passages can have the same codes if dealing with the same topic (MAYER, 2013, 52f). Thus, the chronological sequence of the interview is neglected, which allows for assembling passages that treat the same topic. The objective of this analytical step is to reduce the material to specific important terms without compromising the complexity of the data collected (MEUSER and NAGEL, 1991, 459). The coding was conducted in the qualitative analysis software MaxQDA. The codes are inherent for each coded passage, and the coding followed a semantic and latent, and inductive approach in order to stay close to the original meaning of statements. If irrelevant passages had not been sorted out before, they were now left un-coded and therefore neglected. Code groups were created for each interview and collate codes of the same topic. This helped to better arrange them in the next steps. The number of codings attributed to an interview varied from 28 to 64. Table 6 exemplifies the coding, paraphrasing, code attribution and code group attribution.

Table 6 Example of coding, paraphrasing, code attribution and code group attribution

Original text	Paraphrase	Code	Code group
"Well the thing is, you need the process right? If you need the transition in which first you start talking about it, [X] to use the concept and at some point, if you think it	N. Gonzalez said that at first a process [like RRI] is introduced and used and if it works it should be made	Imposing RRI processes	RRI

is going to be useful and democratic, you should impose it". (Gonzalez, N., 2017, p. 9, line 249-251)	mandatory and be imposed.		
"I mean as Margo was saying, participation is something that we assume as some, let's say, something that citizens or stakeholders highly desire […], but actually it is, not often, not always like this". (Buongiovanni, C., 2017, p. 3, line 88-90)	C. Buongiovanni confirms that participation is assumed as something desirable but very often this is not the case.	Processes built on a value basis	Participatory tools
"[…] so, there are some problems in order to kind of pinpoint the value that people get out of participating in the project. Of course, you can be part of an online community, but I mean, what's the benefit really of it". (Hansen, J., 2017, p. 2, line 42-44)	J. Hansen claims that anyone can be part of an online community, but the benefit of participating isn't always clearly defined.	Pinpointing the value of participation is difficult	Engagement processes

Thematic comparison ("Thematischer Vergleich")

In this step, the level of the single interview is left; passages from different interviews that treat the same or similar topics are assembled, and their headlines are adjusted accordingly to allow more standardisation (MEUSER and NAGEL, 1991, 459). The terminology is still based on that of the experts. The data collected is further compressed, and the main questions asked in this step are; on which topics do experts agree?; where to their positions differ?; which topics are addressed by only a few?; who addresses what? (MEUSER and NAGEL, 1991, 461f). For this thesis, all the codings and codes from all 10 interviews were exported from MaxQDA to an Excel file. Similar codes/headlines of different interviews were put together on an excel sheet and their supra-individual similarities were extracted and expressed in a new code (thematic category). An illustration of this step can be found in Appendix D. During the thematic comparison, groupings of text passages can cause a loss of relevant information and can lead to wrong conclusions (MAYER, 2013, 53f), and that's why a constant revision of thematic comparisons took place throughout this study. After this comparison, relevant categories emerge that can be used for further analysis and categorisation.

Sociological conceptualization ("Soziologische Konzeptualisierung")

This step allows a detachement of the interviews and the interviewees' terminology (MEUSER and NAGEL, 1991, 462). The thematic categories (that were created before) are now formulated in a scientific language by taking into account theoretical knowledge bases and existing empirical studies (MAYER, 2013, 54). The objective of this step is to allow an empirical generalisation that is still limited to the data collected. For this thesis, the thematic categories are listed in Excel (some thematic categories are bundled) and assigned to corresponding

sociological/theoretical concepts. The conceptualisation is exemplified in Table 7. On the right side, the codes that were extracted from the thematic comparison are listed. In this case, three thematic categories all had the same underlying meaning and were therefore merged into one theoretical concept; “Reflexivity and responsiveness needed in RRI processes.”

Table 7 Thematic conceptualisation

Categories resulting from the thematic comparison	Conceptualisation
RRI is implemented top-down, people are not explicitly aware about it, sometimes they are not interested in participation and there should be more feedback on the need of RRI	Reflexivity and responsiveness needed in RRI processes
RRI has to be practicable, understandable, flexible and has to consider different practices and different priorities	
RRI can only function as a "game changer" if its implementation provokes real changes	
Experts feel that people can personally benefit from processes / approaches / concepts when they find them incentivising on a personal level, when processes / approaches / concepts increase competences and when they open up new opportunities on a professional level	Individual capacity building for stakeholders

3.3 Survey

A survey was applied in this study to collect impressions and opinions regarding the projects and RRI. The quantitative data forms a base of hard data to complement the findings in the qualitative analyses. In a first approach, the survey initially addressed external stakeholders of both the COLUMBUS and MARINA projects but was then extended to both internal and external stakeholders of both projects as the first approach did not yield enough responses. As the final response results were still low (24 responses), no inferential statistics were used for this data, but descriptive statistics were chosen to describe the data’s basic features. The steps taken for the survey creation and analysis are outlined on the following pages.

Pretests

Pretests are important to evaluate the duration of the questionnaire completion and to gain information about the comprehensibility of questions, difficulties experienced by respondents, frequency distribution, problems interviewers faced and technical problems with the tool/design (LENZNER et al., 2016, 1). For the survey, two kinds of pretests were conducted: cognitive pretesting and conventional pretesting. Cognitive pretesting was conducted with two persons who knew the MARINA project and who were willing to be interrogated about their understanding of the survey. Another eligibility criterion for participation in the cognitive pretest was that participants in the pretest were not native speakers of English. The reason for this was that the English wording had to be largely understood by every non-native speaker, as the

survey was going to be open to an international audience. The objective of cognitive pretesting was to find out how the questions were understood in general and which questions were not understood as intended by the researcher. Both cognitive pretests were conducted face-to-face, and notes were taken. Only the first pretest was recorded via mobile phone and then transcribed. Both participants signed informed consent forms and gave permission to use their statements. The techniques used in this cognitive pretest are the "think aloud-technique," the "probing technique," and the "paraphrasing technique" (LENZNER et al., 2016, 3). The think-aloud technique asks participants to verbalise their thoughts when reading and answering questions so that problems that participants have in understanding a question can be revealed. Probing implies asking concurrent follow-up questions about terms, questions and responses. The questions asked were mostly of comprehensive ("what do you understand by…?") or elaborative nature ("can you explain your answer in more detail?"). Paraphrasing involved asking the participants to repeat the question in their own words so as to reveal how the participant really understood the question. Certain terms and expressions were not understood or misunderstood by the participants in the pretest. Therefore, questions were transformed into an "international" wording (e.g. not "which factors hindered…?", but "what were the barriers…?" as the term "barrier" has Latin roots and can easily be understood in other Latin or even Slavic languages).[7] Other questions were neglected or merged in order to avoid redundancy.

The conventional pretest was also based on suggestions by LENZNER et al. (2016, 2), and administered under conditions similar to those that exist in the final survey. Eight colleagues at NAUSICAA who know both projects filled out the survey. The test survey was presented on the website sogosurvey.com. The objective of this conventional pretest was to test the operability of the test. Open-ended questions were asked at the end of the survey regarding the participants satisfaction with it ("were you satisfied with the length of the survey (time)?", "was the topic interesting?", "were you satisfied with the survey's design?"). All the questions were well understood. The visual design of the survey was changed afterwards on the advice of a colleague (graphical designer C. Bayeux).

Final online survey

The survey was eventually created on a Google Form Sheet as this proved to be the most convenient and neutral online design available and free of charge. The survey was then distributed to COLUMBUS project partners and MARINA workshop participants via e-mail and promoted on social media platforms (LinkedIn, Twitter). Furthermore, project partners shared

[7] Eng. Barrier; Ger. Barriere; Fr. Barrière; Span. Barrera; It. Barriera; Port. Barreira; Pol. bariera

the survey with other colleagues and project stakeholders. The survey consisted of multiple response (MR), multiple choice (MC) and short open-ended questions. Short open-ended questions were used to form response categories. Questions investigation satisfaction, likeliness of knowledge reuse, interest in R&I issues and perceived importance regarding certain R&I issues were formulated as Likert scales (LS)[8]. Likert scales are popular schemes for quantification of people's opinions on different issues (BISHOP and HERRON, 2015).

The survey consisted of seven major topics and 32 questions ("Stakeholder role": Q1-Q3, "Activities": Q4-Q7, "Your interests": Q8-Q9, "Knowledge in the project": Q10-A15, "Engagement": Q16-Q19, "Research and innovation": Q20-Q29, personal data: Q30-Q31). The "Stakeholder role" was formulated as a MR question so respondents could identify as more than one stakeholder type. A short open-ended question was asked in order to specify their professional work field. The section "Activities" asked about the stakeholder's motivation to engage in the project (MR), the activities they could do in the project (MR), stakeholder groups they would have wished to be more present in the activities (MR), and stakeholders they found most influencing (ranking). The section "Your interests" consisted of two short open-ended questions asking about interests in environmental issues. The questions in the section "Knowledge in the project" and "Engagement" are based on literature identified (see Chapter **2.3**) and cover the following topics: activities through which respondents exchanged knowledge (MR); satisfaction regarding relationships with other project participants (LS); the further use of knowledge (LS and a short open-ended question); different knowledge types that stakeholders acquired from the projects (MR). Knowledge exchange barriers as mentioned by literature were investigated (MR), e.g. "an arduous relationship between the source and the recipient" (by PAULIN and SUNESON, 2012, 84); conflicting participants' objectives (BLOK and LEMMENS, 2015, 21); and different cultures of stakeholders (here: language) (RIEGE, 2005, 24); as well as the methodologies used in the projects (knowledge transfer methodology in COLUMBUS, workshop methodologies in MARINA). The section "Engagement" covered questions regarding the times of engagement (MC); satisfaction about given opportunities to express one's opinion (LS); satisfaction regarding appreciation of personal inputs (LS) ("safe space"; REED et al., 2014, 341); and satisfaction regarding the knowledge received (LS). The section "Research and innovation" consists of multiple LS questions evaluating the respondents' perceived importance regarding the different RRI dimensions and other sustainability aspects. Personal data about gender, age, and nationality, was collected. The

[8] *Satisfaction* (Very satisfied, Satisfied, Somewhat satisfied, Neutral, Somewhat dissatisfied, Dissatisfied to Very Dissatisfied); *Likeliness of knowledge reuse* (Yes, definitely, Yes, very likely, Undecided, Not very likely, Definitely not); *Interest in R&I* (Extremely interested, Very interested, Moderately interested, Slightly interested, Not at all interested); *Importance R&I issues* (Highly important, Important, Neutral, Less important, Not at all important)

survey was available online from August 10, 2017 until November 1, 2017. The complete questionnaire can be found in Appendix B.

Analysis of survey

24 persons responded to the questionnaire, 4 of which were COLUMBUS stakeholders, the others were MARINA stakeholders. The response rate could not be evaluated as the number of people who received or looked up the survey on the internet without filling it out remained unclear. Due to the uneven distribution of votes between the projects, project-specific differences were not evaluated.

The satisfaction Likert scales in the survey originally ranged from “Very satisfied,” “Satisfied,” “Somewhat satisfied,” “Neutral,” “Somewhat dissatisfied,” “Dissatisfied” to “Very Dissatisfied”. In order to facilitate the understanding and to avoid getting lost in minimal deviations regarding satisfaction, these Likert scales were transformed in five items; “Very satisfied” (5), “Satisfied” (4), “Neutral” (3), “Dissatisfied” (2) and “Very Dissatisfied” (1). For the transformation in five items, the “Satisfied” and “Somewhat satisfied” items were merged, as well as the items “Dissatisfied” and “Somewhat dissatisfied.” The lowest and highest satisfaction were kept in order to distinguish mere satisfaction from a very high or very low satisfaction that might be more likely to leave rememberable positive or negative impressions on participants. The initial six items of the ranks regarding stakeholder influences were modified in three items; “Extremely influential” (6), “Very influential” (5), “Moderately influential” (4), “Slightly influential” (3), “Not at all influential” (2) and “Not present” (1) were transformed in the three items; “Very influential” (3; 5 and 6 merged), “Moderately influential” (2; 4 and 3 merged) and “Not influential” (1; 1 and 2 merged).

The data processing started with the registration of the data. The data from the Google Form Sheet was manually introduced to Microsoft Excel and rechecked for errors. Variables were transformed in numbers so they could be treated in the statistical programme RStudio® (e.g. satisfaction Likert scales data was coded in numbers from 1-5; MC and MR questions were coded as “0” if not ticked, “1” if ticked).

Statistical summaries help in giving a didactic and ingenious summary of the data collected and some tools for data analysing make it possible to discern data clearly, e.g. the use of the histograms and bar graphs (ONYANGO and ODEBERO, 2009, in: ONCHIRI, 2013, 1231). For the descriptive analysis, the responses collected were categorised and described through frequencies (MR questions) or median, mode and mean (MC questions). Since using mean values for Likert scales is seen as critical throughout literature (JAMIESON, 2004; BISHOP and HERRON, 2015), the median, mean and mode were noted for reasons of validity. The Chi-square test was used as a statistic tool to test significant relations between two categorial

variables. Chi-square χ2, "is a nonparametric test of significance appropriate when the data is in form of frequency counts occurring in two or more mutually exclusive categories," and compares proportions actually observed in a study with the expected observations to establish if they are significantly different (ONCHIRI, 2013, 1233). Due to the small sample, the distribution of the data is simulated by a Monte Carlo procedure, i.e. "the data are randomly permuted and the statistic is recalculated in each simulated sample" (BIRNBAUM, 2012, 97). This procedure is an alternative when the conditions for a Chi-squared test are not met (i.e. no cells with expected high enough values). According to literature, good relationships play an important role for knowledge processes and sustainability (REED et al. 2014; CORNELL et al., 2013); thus, possible factors (certain LS questions) influencing the stakeholder satisfaction regarding stakeholder relationships were investigated (Chi-square tests). Also, Chi-square tests would allow to investigate factors influencing the possible reuse of knowledge. By using this test, the variables are tested for independence. Only tests yielding significant results are presented in the result chapter. The calculations, summaries and statistical tests were conducted in Microsoft Excel and RStudio®, graphical images were created in both programmes.

3.4 Thematic Analysis of project documents

The objective of the Thematic Analysis is to identify RRI related features in the projects' public deliverables. The analysis is based on literature by BRAUN and CLARKE (2006) and ATTRIDE-STIRLING (2001). Thematic Analysis is a method for detecting, analysing and reporting themes in data (BRAUN and CLARKE, 2006). A theme captures or represents reoccurring patterns or meanings in the data, and there is no specification regarding the ratio of data that is necessary to constitute such a theme (BRAUN and CLARKE, 2006). The coding can follow various approaches; the data-driven (inductive) analysis derives themes purely from the data, whereas the theory-driven (deductive) data is based on the use of pre-existing theories/frameworks; semantic coding reflects the explicit content of the data, whereas latent coding reports concepts and assumptions underpinning the data; and, moreover, the approach applied can be realistic (reporting the reality of someone else) or constructionist (reporting the reality of a social construct) (ibid.). The Thematic Analysis is a simple and flexible method; it is commonly used for analysis of interviews in the psychologic and sociologic field but can be applied for any kind of written data (JAVADI and ZAREA, 2016, 34). Three kinds of themes exist in this study's Thematic Analysis, namely the themes created by ATTRIDE-STIRLING (2001); basic themes, organising themes, and global themes. Basic themes are the lowest level themes derived from the initial codes; organising themes are the middle-order themes that organise the basic themes into groups for representing similar matters; and global themes are the highest-level themes that encompass the principal metaphor(s) in the data (ATTRIDE-STIRLING,

2001, 388f). The documents chosen for the analysis (data corpus) are the projects' public deliverables available on the website at the moment of data collection (October 1, 2017). All collected data sets were analysed.

Table 8 Searched for features in the data sets

Public Engagement - Participation methods - Mutual understanding	Science Education - Increase the number of researchers - Equip researchers/societal actors with knowledge/tools
Open Access - Accessibility of (research) data - Intellectual property rights / confidentiality - Innovative approach for release	Ethics - Respect fundamental rights and ethical standards - Societal relevance / acceptability of R&I outcomes - High quality results
Gender Equality - Gender balance - Integrating a gender dimension	Governance - Foster RRI on an institutional level

This master thesis deploys a deductive, "top-down", Thematic Analysis in order to detect relevant RRI features in the data sets. The analysis is based on the framework summarised in Table 8. Table 8 lists short descriptions of different RRI features as presented in general definitions by the EC (EUROPEAN COMMISSION, 2017d). Thus, the data is searched for these features through a latent but also semantic approach, i.e. both implicit and explicit mentions of RRI are coded. CLARKE and BRAUN (2006, 12) argue that a deductive Thematic Analysis "tends to provide less a rich description of the data overall, and more a detailed analysis of some aspect of the data." Moreover, a constructionist approach was applied. Parts of the data sets were coded when the original text revealed that certain project activities, tools, inputs or outputs had features that related to RRI. Mere descriptions of RRI or vague suggestions about possible project results were not coded. The list of the analysed public deliverables can be found in Appendix I.

The aim of this Thematic Analysis was to examine how the global theme of RRI played out across the data. In that way, project activities, tools, inputs or outputs that are, in theory, explicitly and implicitly linked to RRI are revealed, and RRI's role in the projects can subsequently be analysed. The pages analysed for MARINA amount to 198, for COLUMBUS they amount to 460. This difference in text quantity can be explained by the fact that the MARINA project is still on-going and has not yet produced as many public deliverables, whereas COLUMBUS has arrived at the end of its duration. Moreover, RRI elements were easily found within MARINA deliverables, whereas COLUMBUS held much less RRI-relevant information per document, sometimes presenting dozens of pages not worth coding.

Analysis steps according to BRAUN & CLARKE (2006)

In a first step, the researcher familiarised with the data to get a better understanding of its content (Phase 1). Then, relevant passages relating to RRI elements were coded in MaxQDA and exported to Word. In Word, passages were again reviewed and commentaries (codes) were assigned to text segments (Phase 2). This coding method was chosen in order to first extract whole text passages, and then assign different codes to them without dissecting the text (by exporting only short coded extracts from MaxQDA) as this showed to result in a loss of meaning (especially problematic for numerations). As the codes were generated in a deductive manner, the data set was approached with specific questions in mind that the researcher wished to code around (see Table 4). Thus, assigned codes/commentaries identify a feature of the data that appears interesting to the researcher. The coded text segments and the assigned codes were exported to another Word document where they were searched for themes, rearranged in related groups (basic themes), and constantly re-read (Phase 3). Identified basic themes were then assigned to corresponding RRI dimensions (organising theme). The researcher reviewed all the themes (Phase 4), explained and defined them (Phase 5). Phase 6 involved writing the result report about the themes and developing the thematic maps which represent the findings of basic themes in each project (see results in Chapter **4.3**). Table 9 exemplifies the approach.

Table 9 Example of Thematic Analysis

Original text	**Initial code**	**Basic theme(s)**	**Organising theme**
"[…] A range of dissemination activities will take place particularly in the early phases of the project to raise awareness of the existence of the project, its objectives, partners and intended impacts […]" (COLUMBUS, 2015, Deliverable 7.1)	Dissemination for awareness raising and sharing of information	Outreach (Participation) Awareness (Equip societal actors with knowledge / tools)	Public Engagement Science Education
"[…] The facilitator will be flexible, unbiased, empathetic, a good listener and enthusiastic. They will develop a trustful relationship with the participants, be respectful and communicate in a clear and friendly manner […]" (MARINA, 2016, Deliverable 3.1)	Respectful treatment by facilitator	Respect (Respect fundamental rights and ethical standards)	Ethics

3.5 Research criteria

As this thesis deals with the case studies of two EU-projects, this study makes no claim to representativeness, neither in its qualitative data nor in its quantitative data.

SHENTON (2004) proposes a set of validity criteria for qualitative data based on literature by GUBA (1981). For this master thesis the following criteria are considered to be of relevance:

- credibility (internal validity);
- transferability (external validity/generalisability);
- dependability (reliability);
- confirmability (objectivity) (GUBA, 1981, in: SHENTON, 2004).

Credibility stands for e.g. the adoption of appropriate and recognised research methods, the use of different types of research methods, honesty with informants, and a good description of the phenomenon under scrutiny; transferability tackles the detailed description of the phenomenon in question to allow comparisons; dependability demands a thorough methodological description to allow the study to be repeated; confirmability demands that an investigator bias be reduced, there has to be a recognition of shortcomings in the study's methods and the methodological description should allow the integrity of research results to be scrutinised (SHENTON, 2004, 73).

In this thesis, credibility is ensured by the application of recognised research methods (Meuser/Nagel, descriptive statistics, Thematic Analysis), and the triangulation of these different methods should furthermore ensure credibility of research outcomes. The research questions and existing literature are described in as much detail as possible in the literature section and ensure that the most relevant aspects of the topics studied are comprehensible and can be related to the outcomes of this study. Transferability and dependability are important criteria because the author wants to ensure that the outcomes and lessons learnt in this case study can and will be used in future RRI projects. Thus, the approach and methodology applied are outlined in detail and emphasise the environmental perspective that this study is taking so as to be sure that the objectives, realisation and conclusions are understood. In order to ensure confirmability of this study, this thesis includes an honest report of the techniques applied and acknowledges errors or methodological pitfalls that eventually result in suggestions for further improvement (see chapter **5.2**).

Regarding the survey, validity is provided by genuine cognitive and conventional pretesting with two participants to make sure that the questionnaire measures what it intends to measure (content validity) (ZOHRABI, 2013, 258). The survey doesn't claim to be representative but provides descriptions about the basic features of the data set.

4 Results

In this chapter, the results of the three aforementioned methods are presented separately: the results of all the semi-structured interviews (Meuser/Nagel analysis); the descriptive analysis of the results of the online survey; and the Responsible Research and Innovation (RRI) themes found in COLUMBUS and MARINA (Thematic Analysis).
In the project COLUMBUS, knowledge transfer fellows are responsible person(s) for knowledge transfer activities.

4.1 Results of semi-structured expert interviews

In this chapter, the results of the semi-structured expert interviews (analysed through the Meuser/Nagel approach) are presented, referring to the research questions of how the RRI dimensions are realised in the projects COLUMBUS and MARINA, what change is brought to knowledge processes by RRI, and what changes the projects can bring to the environmental domain regarding sustainable development. To facilitate a comprehensive overview, the results (theoretical concepts) are subsumed under four major topics: Responsible Research and Innovation; Knowledge; Sustainable development and the environment; and Project context. Each theoretical concept is exemplified by paraphrases of interviewees which are referenced (with the interviewees' permission).

4.1.1 Responsible Research and Innovation

All interviewees addressed the subject of RRI to a greater or lesser extent. The statements of interviewees vary between descriptions of the project, personal experiences with RRI, their opinions, and proposals on how to implement the approach. Main topics addressed are RRI's structure, its effects, conditions for a full embedment of RRI in general, RRI in COLUMBUS and MARINA, and needs and demands that should be considered by the approach. References that connect RRI to the environmental domain and sustainability are treated in chapter **4.1.3**.

RRI: a conceptualisation of known cross-cutting issues

This theoretical concept deals with interviewees' statements that address the conceptual approach of RRI. RRI is well known to all interviewees, some addressed the fact that RRI is not new to them and their professional field. Four experts in particular, N. Dwyer, R. Fernandez (COLUMBUS) and S. Raicevich and J. Hansen (MARINA) doubt the novelty of RRI elements themselves, as they describe them as known cross-cutting issues (elements linking traditionally separate/independent interests) that have been dealt with before throughout

various domains and sectors. RRI is seen to have an innovative character in the way it conceptualises these known elements (e.g. Public Engagement, Science Education, Open Access, Gender Equality, Ethics) under a single umbrella term.

> *In Europe, RRI dimensions are "pretty much all being addressed to either a greater or lesser extent, in different ways, but obviously with different strengths, depending on the project type". RRI is not new but brings together concepts that, previously, haven't been considered together. (cf. Dwyer, N., 2017, page 10-11, line 300-306).*

> *R. Fernandez feels that, from her long experience with knowledge transfer activities, it is good to "package this concept around one kind of title". She thinks it's good to transmit the RRI approach, but she also states that some things "behind RRI have been happening for many years." (cf. Fernandez, R., 2017, page 3, line 71-75).*

> *J. Hansen states that in [Y], people feel their country is already a well-structured democracy that doesn't face corruption or gender-based repression, meaning that a lot of the RRI dimensions are already being realised, "perhaps not as good as we could, but […] it's not like it's a brand new kind of thing" (cf. Hansen, J., 2017, page 4, line 103-109).*

Furthermore, S. Raicevich and J. Hansen (MARINA) state that RRI's conceptual framework gains strength or cutting-edge through the combination of the different RRI dimensions. According to them, the assembling of different dimensions represents a new force/novelty that did not exist before, when RRI's elements were considered separately.

> *S. Raicevich states that the whole is more than the sum of its parts. He claims that one RRI dimension does not have the same "strength" as all of the RRI dimensions together. (cf. Raicevich, S., 2017, page 5, line 141-143).*

> *J. Hansen feels that the novelty of RRI lies in its ambition to create a conceptual approach in research and innovation. He claims that the combination of the RRI dimensions has cutting edge and is "quite intriguing." (cf. Hansen, J., 2017, page 4, line 112-118).*

Organisational change management for RRI

Several interviewees mentioned how the embedment of RRI would have to go about in organisations, institutions and other structures. R. Fernandez, C. Ni Cheallacháin (COLUMBUS) and N. Gonzalez, C. Buongiovanni and M. Bezzi (MARINA) addressed the fact that the full embedment of RRI (or elements of it) requires management changes of different natures. A cultural change (changing values, attitudes, norms), change of resources (more available time), and a change of practices (behaviour, actions) are seen to be crucial for the full implementation of RRI. Interviewees mention that these changes would directly affect and benefit the work and participation of different kinds of stakeholder types; researchers, funding

agencies, those engaging in participatory processes, media, companies, and public administrations. Thus, when embedding RRI, allocating resources is seen as necessary in order to fully carry out RRI. Moreover, changing organisational structures implies that authorities play a role in providing the aforementioned resources for RRI (as mentioned by M. Bezzi and N. Gonzalez).

> *The realisation of RRI will take time, there will have to be changes of culture, resources, recognition and practices. She states that the difficulty lies in the fact to "have all the elements suitably combined at the same time to make progress consistently." (cf. Fernandez, R., 2017, page 10, line 319-323).*

> *"[Researchers and funding agencies] need the tools and resources to effectively improve their ability to carry out Responsible Research and Innovation." (cf. Ni Cheallacháin, C., 2017, page 3, line 87-89).*

> *Public administration should decide less top-down and became "enabler" of stakeholder discussions. "This implies a lot of inner structural reforms and cultural changes in terms of actions." An institution that wants to promote and publicly release their documents needs to go through a "deep cultural change." (cf. Bezzi, M., 2017, page 11, line 356-361).*

Regulation types for RRI

Almost all the interviewees, C. NÍ Cheallacháin, R. Fernandez, F. Huron and N. Dwyer (COLUMBUS) and F. Ferri, J. Hansen, S. Raicevich and N. Gonzalez (MARINA), addressed the issue whether RRI should be mandatory or not and they provided suggestions on the matter. Opinions regarding this topic are divided. Proposed RRI implementations are categorised as follows; RRI could be promoted without imposing specific rules (status quo), as some issues (Ethics) are subjective and would be hard to generalise; there could be incentives for RRI, but no obligations (soft laws); given guidelines could help to incorporate RRI (e.g. soft laws, informational instruments); RRI should be an objective but, the context, circumstances and possibilities for its implementation should be considered (e.g. self-regulation of firm/institution); RRI evaluation could put emphasis on the justification of RRI failures; RRI certification (who is good at it, who is not?) could be mainstreamed (industry self-regulation through certification); or RRI related processes (Public Engagement) could by imposed by authorities (hard regulation, e.g. through legal instruments). This listing moves from possible soft regulation by the government (e.g. soft laws, economic or informational instruments), to firm self-regulation (codes of conduct, strategic RRI), to industry self-regulation (certification), and, finally, to hard regulation (laws, sanctions) by the government.

> *F. Huron states that the recruitment of people depends on the evolution of the company and the profiles of the people postulating. Respecting a fifty-fifty gender quota would not always be*

reasonable, because, in the case of NAUSICAA (higher share of women than man), this would oblige NAUSICAA to favour applications of male recruits over the applications of qualified women. Therefore, in some cases, it is good that there are no mandatory RRI requirements for companies. (cf. Huron, F., 2017, page 9, line 252-258).

RRI could be transformed into a "mainstream concept" to be applied by business. A certificate would evaluate actions and assess whether one is good or not good at practicing RRI. (cf. Hansen, J., 2017, page 5, line 143-146).

Degrees of RRI formalisation

C. NÍ Cheallacháin, N. Dwyer, F. Huron (COLUMBUS) and N. Gonzalez, J. Hansen, S. Raicevich (MARINA) addressed the implementation of RRI in the project processes. RRI dimensions are perceived differently in both projects. The experts' responses regarding the implementation of RRI varied over different formalisation grades of RRI; in MARINA, RRI takes place rather explicitly through the fulfilment of quotas, through explicit criteria in participatory processes, and through the production of publications for RRI, while in COLUMBUS, RRI is said to happen implicitly by building on and eventually contributing to RRI (especially through Open Access) or by integrating RRI elements through other concepts (e.g. Blue Society). This shows that RRI can be perceived and implemented differently and will thus yield different outcomes: results that explicitly fulfil RRI dimensions and contribute to RRI or results that are expected to connect to RRI without further clarification.

N. Gonzalez states that Science Education happens on the Marine Knowledge Sharing Platform. Science Education and Governance are covered throughout the policies. Gender Equality appears in the configuration of the consortium and also in the MMLs which are organized to be gender-balanced. […] Governance happens through the policy making in MARINA. Open Science is covered by the fact that MARINA wants to publish results from the workshops (cf. Gonzalez, N., 2017, page 1, line 15-23).

F. Huron states that the general objective and the everyday work of COLUMBUS is linked to RRI because Blue Society relates to RRI. Good Governance, the engagement of the public and Science Education are integrated in the project because they are integrated in the Blue Society concept. (cf. Huron, F., 2017, page 3, line 67-76).

Responsiveness and reflexivity needed in RRI processes

Reflexivity and responsiveness manifest themselves through several theoretical concepts. N. Gonzalez, F. Ferri, J. Hansen and M. Bezzi and C. Buongiovanni (MARINA) mentioned that RRI was top-down implemented, people were not asked about their wish for RRI implementation and did not necessarily get excited about it. A suggestion was made to assess

or evaluate RRI dimensions by stakeholder feedback. A better understanding about stakeholders' perceptions and wishes could therefore help adapt the RRI approach according to the stakeholder needs and expectations and to enhance their motivation to work with RRI. The needs and wishes of stakeholders are emphasised by interviewees. This strongly relates to the concepts of responsiveness (responding to emerging perspectives, views and needs of stakeholders).

> *Mere dissemination about RRI is not sufficient, people should also be asked whether they really want to work with this concept because sometimes the European Commission proposes new concepts and things and people feel obliged to work with this but in reality they do not really want this. (cf. Gonzalez, N., 2017, page 3, line 74-77).*
>
> *She has had feedback from people telling her that some people are not interested in RRI and that projects start from the assumption that RRI and active participation will be well received by all stakeholders. Some people are not interested in these processes. While promoting bottom-up processes, the participation in RRI is actually implemented in a top-down approach. It is taken for granted that people are interested in these processes. (cf. Bezzi, M., 2017, page 2, line 35-43).*
>
> *He thinks that it is relevant to better explain the concept and to get more feedback on […] RRI dimensions (Gender Equality and Ethics). (cf. Ferri, F., 2017, page 4, line 120-122).*

J. Hansen, S. Raicevich, M. Bezzi and F. Ferri (MARINA) furthermore state RRI should be practicable, understandable and flexible. RRI is not understood by everyone who works with it, and it should consider different practices and different priorities. As the approach will be used for different domains, stakeholders and issues, it should be adaptable. This implies responsiveness and reflexivity as RRI is required to be responsive to given circumstances and the approach of its activities.

> *J. Hansen thinks that it would be good to formulate RRI more specifically. But EU politicians have to balance reasons regarding which dimensions are feasible and which are not. He claims that not everything in RRI can be done and that doing a little bit of RRI is better than nothing. (cf. Hansen, J., 2017, page 11, line 337-340).*

In addition, F. Huron (COLUMBUS) and J. Hansen (MARINA) mentioned that RRI can be visionary and innovative if its implementation entails responsiveness and generates real change. If implemented according to the needs and challenges of given circumstances, RRI could have a transformational power. Thus, RRI can be estimated as negligible if it does not trigger real changes. If RRI elements are already well realised in a structure, organisation or country, it will not bring about any new benefits.

The RRI concept doesn't bring a lot of changes to NAUSICAA since RRI is already integrated in NAUSICAA's activities, but other companies would go through bigger changes as they would have to adapt their activities accordingly. (cf. Huron, F., 2017, page 8, line 238-243).

He claims that the RRI dimension of Gender Equality would be "like dynamite" in certain countries and they would bring more novelty to certain countries than to others. (cf. Hansen, J., 2017, page 8, line 256-259).

Value attribution for participatory tools and processes

S. Raicevich and F. Fernando (MARINA) think that collaboration platforms allow for engaging people and enable sharing and building of knowledge (supposed benefits), but J. Hansen and M. Bezzi and C. Buongiovanni (MARINA) think that the value of this participatory tool isn't always evident. Many different kinds of participatory tools exist already, and people need to get some benefit out of a new participatory tool, otherwise they will not be likely to use it. J. Hansen and M. Bezzi and C. Buongiovanni feel that some stakeholders cannot pinpoint a value in the participation and do not find usefulness in the engagement process, and this has to be changed in order to better promote engagement and to make it more attractive. Personal benefits (value) are therefore an issue regarding participation. In this case, "value attribution" stands for the identification and subsequent communication of benefits that participants can get out of a participatory tool or any kind of engagement process, as this might increase stakeholders' motivation to participate.

They should understand that there is a process happening; a process that can make a difference. Stakeholders need to receive value, create impact and need to perceive usefulness about what they are doing. This helps people to get engaged. (cf. Bezzi, M., 2017, page 7, line 226-231).

Conceptual design and goal setting in participation

R. Fernandez (COLUMBUS) and N. Gonzalez, J. Hansen, S. Raicevich and M. Bezzi and C. Buongiovanni (MARINA) state that project processes that are structured and systemised, having precise frameworks with clearly communicated objectives, can encourage people to participate in projects and to work towards a goal. This means that stakeholders need to comprehend what the outcomes of the process are going to be, and that structure and objectives are necessary to boost stakeholder motivation and to guide them in a certain direction.

Local businesses (e.g. port businesses) would be easier to attract if they were told that a series of workshops with the same participants was taking place, with the organizers as process consultants, and in the end, a catalogue of good suggestions would be produced in order to facilitate a policy round for national policy makers. (cf. Hansen, J., 2017, page 7, line 205-214).

It is difficult to realise Public Engagement because in order for participants to be active, they need to be encouraged and "motivation is linked to the capability to achieve an outcome." (cf. Raicevich, S., 2017, page 9, line 275-278).

Open Access for knowledge exchange

R. Fernandez, C. Ni Cheallacháin and F. Huron (COLUMBUS) and F. Ferri and N. Gonzalez (MARINA) explicitly mention the importance of Open Access. Open Access in the projects is represented through the publication of open, accessible, and meaningful knowledge for stakeholders. Open Access is perceived as an intrinsically positive dimension that will facilitate stakeholder exchange by opening knowledge to stakeholders involved. Without Open Access, the realisation of certain activities (COLUMBUS knowledge transfer of project results or Science Education in general) or the use of certain tools would not be possible. F. Huron states that confidential data can block the use of knowledge. Thus, above all, Open Access can be seen as a prerequisite for knowledge transfer and knowledge sharing.

She says that making knowledge available is not sufficient for knowledge transfer. It is important to make knowledge available and accessible. She claims that "accessible" should mean "make it available in a way that any user can easily understand that this is something that can be worthy to explore." (cf. Fernandez, R., 2017, page 4, line 101-105).

F. Huron states that for her, Open Access is the most important dimension within RRI because it enables the use of results from EU projects. (cf. Huron, F., 2017, page 7, line 184-185).

4.1.2 Knowledge in the projects

Knowledge was addressed to a greater or lesser extent by all interviewees. As a reminder, throughout this thesis, knowledge is perceived as an entity, not as a process, in order to better distinguish knowledge that is being held by someone and knowledge that is being processed (e.g. transfer, sharing)

Knowledge exploitation

R. Fernandez (COLUMBUS) and F. Ferri (MARINA) address the issue of working across different domains or collaborating with external people that are relevant to the project. The involvement of different profiles and institutions cannot only help increase internal capacity and help find solutions, but also enables the exploitation of proper project results elsewhere and ensures that they will be used in the future. Furthermore, working with a wide and divers network helps in reaching a wider audience. Thus, both projects benefit of external knowledge exploitation, i.e. bridging otherwise divided communities to enable a flow of knowledge and

resources. Knowledge flows are therefore expected to multiply when the projects connect with external contacts from the same or other disciplines.

> *Different focal areas in COLUMBUS enhance the creation of multidisciplinary capacity, allowing exchange with different profiles and institutions. A wide network offers more possibilities for interaction with other stakeholders, but this network has to be organized in order to be efficient. (cf. Fernandez, R., 2017, page 7, line 217-222).*
>
> *There are many domains and issues involved in the marine sector and it is important to work with results from other sectors in order to find different solutions. (cf. Ferri, F., 2017, page 5, line 154-158).*

F. Huron (COLUMBUS) and S. Raicevich (MARINA) stated that project features or outcomes could be of use for other projects, i.e. they could benefit stakeholders from other domains or professions. This implies that project tools need to be transferable and useful for a similar purpose in different contexts and domains.

> *F. Huron states that the main goal of COLUMBUS is to demonstrate that project results can be used more efficiently and that the methodology used in COLUMBUS is useful and can be applied and used in new knowledge transfer projects and for bigger amounts of results. (cf. Huron, F., 2017, page 6, line 167-171).*
>
> *S. Raicevich states that the knowledge sharing platform could be a tool used by other groups and stakeholders in order to work collectively. (cf. Raicevich, S., 2017, page 10, line 310-312).*

N. Dwyer, F. Huron, R. Gonzalez (COLUMBUS), S. Raicevich and F. Ferri (MARINA) think that outcomes can be useful for other domains and stakeholders. Outcomes need to be spread and promoted in diverse domains and should have characteristics that enable their exploitation elsewhere.

> *S. Raicevich claims that the guidelines and the roadmap as well as lessons learnt about barriers that impede the implementation of RRI are sustainable outcomes of MARINA. "These elements will be something that could be transversal [sic] and usable also in other domains and not only in the marine domain." (cf. Raicevich, S., 2017, page 10, line 307-310).*

R. Gonzalez, F. Huron (COLUMBUS) and F. Ferri (MARINA) further state that project outcomes persist after the end of the project (through a legacy), they will continue to be discussed (platform, conferences), to be presented (through exhibitions, meetings) and to be used (through guidelines, roadmap, collaborations). This shows that project outcomes are expected to outlive the duration of the project and to be of use for a longer time period (self-preservation of project results).

The collaboration is "activated" during the project and will persist after the project because communities will continue to share information on the platform. (cf. Ferri, F., 2017, page 2, line 43-48).

F. Huron claims that there are many European projects with valuable research and technology results that should be valorised through a legacy. Communication about the COLUMBUS knowledge transfer methodology to professionals, politics, and the European Commission is crucial in order to ensure that the knowledge transfer methodology and its legacy will be used in the future. (cf. Huron, F., 2017, page 4, line 109-113).

Following examples, learning and replicating

Experts from MARINA state that stakeholders contact each other because they want to get in touch and learn from other stakeholders. N. Gonzalez, S. Raicevich, F. Ferri and C. Buongiovanni and M. Bezzi (MARINA) mentioned this topic. This may also be true for COLUMBUS, as R. Fernandez states that stakeholders could learn through the experience of other stakeholders by following their example. Thus, working with and learning from other stakeholders is perceived as a stakeholder desire or is expected to serve as an incentive. In the projects, learning could happen through informal processes (learning by observing, seeking advice) or non-formal process (workshops).

Experience can be shared, and different knowledge users can learn from each other. She thinks that someone will get more interested in knowledge transfer when he/she sees how a colleague of his/her has efficiently transferred knowledge. (cf. Fernandez, R., 2017, page 4-5, line 131-138).

Moreover, R. Fernandez, C. NÍ Cheallacháin and F. Huron (COLUMBUS) mention how successful and replicable examples are important for promoting project outcomes. Experiences translated in practical "lessons learnt" allow presenting the project outcomes via a practical approach, and the demonstration of success could incentivise others to follow the project approach used, its methods, tools, etc. This shows that practical experience is useful for other stakeholders.

The knowledge fellows will prioritise individual knowledge outputs and write case studies about them to highlight the impact that the knowledge transfer activities have had. This is a more practical approach in knowledge transfer and less theoretic. (cf. NÍ Cheallacháin, C., 2017, page 3, line 69-77).

J. Hansen and S. Raicevich (MARINA) state that outlining prototype-like innovative processes and typical examples of success would be useful for creating other effective project processes for innovations. Learning by examples and by observation is estimated to play an important role in the uptake of knowledge and could encourage other people to use former methods,

tools and knowledge. This implies that it would be useful to specifically highlight successful examples (project outcomes) to encourage further innovative activities.

S. Raicevich mentions how the lack of engagement and participation ended in the refusal of innovations. Public money was wasted for products/innovations that were not accepted by society ("typical example of failure"). He thinks that more typical examples of successful participation are needed. (cf. Raicevich, S., 2017, page 6-7, line 192-197).

Data, information, knowledge and expertise

C. Ni Cheallacháin (COLUMBUS) and S. Raicevich, C. Buongiovanni and N. Gonzalez (MARINA) mentioned that different types of knowledge are collected, shared or built. There is a clear recognition of different knowledge types that are exchanged among stakeholders. Based on their statements and estimations, different characteristics, types and formats of knowledge emerged and relate to; knowledge type (science based/beliefs), provenance (personal/local/professional), type/formats (data sets, methods, documents), time (recent/best practices/knowledge from past projects) or domain (marine/ecological/administrative knowledge).

COLUMBUS defines knowledge outputs as "unit[s] of knowledge" that have already been generated, e.g. methodologies, grey knowledge, data sets, etc. (not necessarily de novo knowledge). (cf. Ni Cheallacháin, C., 2017, page 2, line 50-54).

C. Buongiovanni states that stakeholders exchange documents, papers, material from events. She states that, after having interacted on the platform, stakeholders take up their interactions in real life. (cf. Buongiovanni, C., 2017, page 7, line 212-216).

N. Gonzalez states that the knowledge exchanged in workshops is based on knowledge from peoples' personal and professional lives. (cf. Gonzalez, N., 2017, page 10, line 280-282).

Trust and reliability

N. Dwyer (COLUMBUS) states that respect, honesty and trust are important in relationships with end-users. The honesty level especially plays a role for the quality of the knowledge that is being exchanged.

N. Dwyer states that building trust between the end-users and knowledge fellows is important. There needs to be "respect in both ways, that both respect each other as professionals". […] N. Dwyer states that honesty is important, i.e. the knowledge fellow doesn't "oversell" the knowledge output, realizes its shortcomings and whether it's suitable for an end-user or not. (cf. Dwyer, N., 2017, page 5, line 103-108).

F. Ferri and M. Bezzi (MARINA) go one step further and state that trust in and reliability of knowledge avoids misconceptions about knowledge and science in bigger populations (institutional level).

> *"Some people do not really think that they can make a difference". People have lost or have never had trust in institutions or in science and they are not able to follow scientific approaches. She mentions the emergence of fake science postings on social media and alternative thinking approaches and that freedom and open access on the internet allow people to find their own trustworthy or not-trustworthy information. (cf. Bezzi, M., 2017, page 2, line 55-65).*

There is a personal level on which trust is built (e.g. in-depth relationships), and a more institutionalised level for which trust plays an important role (especially in science). Trust can be seen as a premise in good relationships, and its absence could therefore be seen as counterproductive in larger scale relationships and knowledge exchanges.

4.1.3 Sustainable development and the environment

This chapter subsumes all the codes/concepts that address any forms of sustainable development and sustainability in the environment. The social and economic components are not left aside as the three dimensions are interconnected. Many interviewees mentioned RRI in relation with sustainable development and the environment.

Projects foster sustainable outcomes for the environment

R. Fernandez, N. Dwyer, F. Huron (COLUMBUS) and C. Buongiovanni and N. Gonzalez (MARINA) stated that the environmental outcomes of the projects depend on the project inputs (ideas, investigated EU projects), and the projects both are said to enhance environmentally-friendly and environmentally-relevant management with their outputs (through products or actions). MARINA more strongly emphasises the importance of stakeholder engagement in finding sustainable or environmentally-friendly outcomes, e.g. dependencies on people's interest in the issue and willingness to work on it, whereas COLUMBUS wants to promote its findings and focus on the effects that these findings will have on the environment and sustainability. MARINA concentrates on its social elements (participation), whereas COLUMBUS has a more technical character.

> *The ideas depend on the workshop theme, the mentality of the people who participate in those workshops and the education of these people. From her personal experience in the workshops, people were very "pro-sustainability", but it might happen that participants are not interested in the environment. (cf. Gonzalez, N., 2017, page 7, line 177-182).*

R. Fernandez states that the knowledge in COLUMBUS is technical and comes from research and innovation projects […]. She states that around 90-95% of the results from the case studies will be important for the environment, e.g. anti-fouling coatings, good environmental status indicators, software tools, assessment tools for environmental performances in ports, marine litter subjects. A lot of outcomes have been collected/produced in the marine renewables sector. (cf. Fernandez, R., 2017, page 8-9, line 264-273).

COLUMBUS' objective is to find more environmentally sustainable tools and types of management. (cf. Huron, F., 2017, page 7, line 199-203).

Environmental literacy

R. Fernandez, C. NÍ Cheallacháin, N. Dwyer, F. Huron (COLUMBUS) and F. Ferri, and M. Bezzi (MARINA) mentioned that people need to be reached and made aware of environmental issues, they need to understand the role they are playing for the environment (locally and globally), or what role the environment plays for them. Thus, raising awareness is important for people to understand why they should act. Moreover, scientific education enables people to increase their scientific knowledge, to get more interested in research, and it allows them to understand the natural environment they live in and the implications of human activities. Furthermore, environmental solutions are expected to be found through the involvement of stakeholders. Thus, the following consecutive steps can be identified; raising awareness, scientific education and, eventually, environmental literacy. Interviewees mention both informal learning (exhibitions, publicity) and formal learning (teaching, schools) for Science Education.

N. Dwyer states that there is a need for education regarding environmental issues because people will only change their behaviour if they know that what they are doing is an issue. People often do not realise that their choices have environmental impacts. Education needs to begin in schools and then, through stakeholder engagement, wider education can happen. All those who can contribute to reducing environmental impacts need to be engaged and find solutions together. (cf. Dwyer, N., 2017, page 10, line 272-277).

The participation of any kind of stakeholders is needed because the problems we are facing are complex and solutions will not be effective if people do not understand the relevance of the environmental preservation for human mankind. Hence, Science Education is important in order to increase knowledge, teaching and education for people so that they can understand environmental preservation. (cf. Ferri, F., 2017, page 4, line 109-115).

Top-down policies to enhance environmental stewardship

N. Gonzalez et M. Bezzi (MARINA) mentioned the importance of policies, legislations and administrations for governing environmental issues. They particularly address the importance of changing people's behaviour to enhance environmental stewardship and beneficial

environmental changes. The interviewees think that people need to feel a necessity or motivation to change their behaviours; hence, people can and will change their behaviour if they are incentivised and given opportunities (soft regulation) or forced (hard regulation). C. NÍ Cheallacháin (COLUMBUS) also mentions the importance of giving people perspectives for changing their behaviour and becoming environmental stewards. Thus, the policy level plays an important role in changing people's behaviours.

> *N. Gonzalez states that "we will make a change, if the policies change". A change in policies would trigger an automatic change. With RRI, a change will happen at the bottom, the change will go up (to the policies) and to the bottom again (society and stakeholders). N. Gonzalez is sure that something that is imposed from the top will happen. (cf. Gonzalez, N., 2017, page 8, line 220-224).*

> *M. Bezzi states that people only change their behaviour when they are given solutions as well as opportunities from public administrations. People need solutions and alternatives. Knowledge such as rational knowledge, data knowledge and information knowledge does not change people's behaviours. (cf. Bezzi, M., 2017, page 10, line 320-325).*

RRI for agenda-setting and environmental stewardship

Regarding RRI, N. Dwyer (COLUMBUS) and S. Raicevich and F. Ferri (MARINA) address how RRI processes can define agendas and address problems. By taking into account different stakeholders' perceptions and suggestions, RRI is expected to produce socially accepted outcomes that are in favour of a better environmental management. These are all suggested RRI potentials. N. Dwyer and F. Ferri furthermore emphasise the importance of different stakeholders working together for finding sustainable environmental solutions.

> *RRI could allow to dedicate more effort to the improvement and preservation of the environment "to understand how it functions and also to develop technological solutions to emerging problems". Solutions should be acceptable for society and that's where the RRI dimensions come in; for defining the agenda and selecting the priorities. People have the perception that the environment is under threat and therefore, a link will be created between RRI and the improvement of the environment. (cf. Raicevich, S., 2017, page 11, line 342-349).*

RRI and sustainability

C. NÍ Cheallacháin and F. Huron (COLUMBUS) and S. Raicevich and J. Hansen (MARINA) feel that RRI is fed by the need of society. Innovations that meet Societal Challenges are or should be prioritised through RRI. RRI-related activities are expected to catalyse impacts for society, include everyone, protect the environment and improve businesses. Innovations are demanded and needed by stakeholders and eventually benefit them on various levels; the

environmental level (protection), the societal level (good life quality) and the economic level (job creation) (three dimensions of sustainability).

> *R. Fernandez feels that COLUMBUS is closely connected to RRI because COLUMBUS wants to "increase or catalyse impact from research and innovation efforts […] and this impact materialises in benefits for people, for organisations". COLUMBUS transfers knowledge to e.g. protect the environment, to improve business processes, to generate good quality employments and to increase food safety. (cf. Fernandez, R., 2017, page 3, line 83-88).*

F. Huron (COLUMBUS) and S. Raicevich and F. Ferri (MARINA) state that RRI affects the creation of products and technologies and also links to environmental, social and economic sustainability. Therefore, RRI can be seen to have an innovative and economic focus. It wants to contribute to an improved economy, be it through the creation of jobs or by aligning the economy with environmental needs.

> *He states that in the next few years, there are big challenges for science. He states that these challenges are related to the gross national product (GNP) which is linked to different activities, the sea and all branches of sciences in different countries. The growing GNP creates serious problems to the marine ecosystems and applying RRI could mean that the preservation of the marine environment and the economic growth can be combined. (cf. Ferri, F., 2017, page 1-2, line 30-35).*

C. NÍ Cheallacháin, F. Huron (COLUMBUS) and S. Raicevich and J. Hansen (MARINA) furthermore mention that RRI can lead to sustainability because it possesses elements that are needed for and automatically or eventually boost sustainable development. This reveals that interviewees expect RRI to automatically create a link between innovations and sustainable development.

> *F. Huron states that the whole RRI approach is linked to the three pillars of sustainability. She states that Public Engagement strengthens social development of sustainability, and that if companies/projects could integrate RRI, this would automatically lead to the embedment of sustainability elements (cf. Huron, F., 2017, page 8, line 232-238).*

Policy impact in the environmental domain

N. Gonzalez, R. Fernandez, J. Hansen and M. Bezzi (MARINA) stated that projects collect inputs and create outputs and knowledge to form a channel for influencing policies, with the overall objective of improving the marine environment. C. NÍ Cheallacháin, R. Fernandez and N. Dwyer (COLUMBUS) state that COLUMBUS wants to contribute to Blue Growth and to the implementation of marine and maritime policies. Thus, MARINA mainly aims at influencing

policies (bottom-up), while COLUMBUS aims at contributing to their implementation (top-down).

N. Gonzalez thinks that the outcomes of MARINA can be sustainable in the way they are used later on, e.g. convincing policy makers that collected ideas from the workshops can be taken into account for decision-making in policy. (cf. Gonzalez, N., 2017, page 6, line 169-171).

R. Fernandez states that the overall objective of COLUMBUS is "to contribute to Blue Growth agenda and to the implementation of most relevant marine and maritime policies in the European countries". (cf. Fernandez, R., 2017, page 6, line 181-183).

Community building as a sustainable outcome

F. Huron (COLUMBUS), J. Hansen and M. Bezzi (MARINA) state that communities and people working with other people can be defined as sustainable project outcomes. Interviewees suggest that sustainability implies the existence of social relations that have the potential to continue after the end of the project. Furthermore, collaborations would enhance stakeholders' capacity to work sustainably, as working sustainably as an individual actor is estimated to be difficult. The community created in MARINA (platform) is said to become an "independent subject" that lives on through its social collaborations. The same could be true for COLUMBUS and its established partnerships and collaborations.

M. Bezzi states that the overall objective is the community building which becomes an independent subject. (cf. Bezzi, M., 2017, page 8, line 269-270).

F. Huron says that working with new persons might be another sustainable outcome as through partner projects, many different stakeholders are involved in meetings, brokerage events, annual conferences and at the Blue Society award. (cf. Huron, F., 2017, page 8, line 226-229).

4.1.4 Project context

This chapter describes theoretic concepts that could not be bundled with the others but contain relevant information regarding internal project processes. Partners from both projects addressed the involvement of stakeholders, professional and personal benefits that stakeholders could get out of their participation, as well as situational awareness.

Individual inclusion of stakeholders

R. Fernandez, C. NÍ Cheallacháin and N. Dwyer (COLUMBUS) mentioned how, in engagement processes, people need to be targeted, how they should be understood, how their needs should be investigated earnestly, and how an enabling framework should be created for them. Stakeholders need to feel that they are valued and appreciated. Responsiveness and

reflexivity play a role in creating suitable inclusion processes for stakeholders. The stakeholders and their needs seem to be perceived as a priority in exchanges.

> *N. Dwyer states that knowledge exchange activities strongly build on good personal relationships between the knowledge fellow and the potential end-users. The knowledge fellow needs to fully understand the knowledge output in order to present it to potential end-users with whom they should have "an intelligent and in-depth dialogue so they can explain what the knowledge output is about and understand what the needs of the stakeholders and the potential of the end-user is." (cf. Dwyer, N., 2017, page 5, line 97-106).*

Moreover, C. Buongiovanni (MARINA) states that it is especially important to enable those that want to engage. She also thinks that participation should be targeted, as it is not realistic to attempt to include everyone in the process. Furthermore, people cannot be forced to participate. Targeted engagement would allow putting a focus on the engagement of willing stakeholders.

> *She thinks that the first step is to accept that co-creation and cooperation have a premise; which is that you should enable those that want to collaborate and not force those that do not. […]. Participation should be targeted and cannot include everyone. […] The focus should be on the stakeholders that want to collaborate and they should be sensitised and an enabling framework should be constructed for these stakeholders. (cf. Buongiovanni, C., 2017, page 3, line 88-100).*

Individual capacity building for stakeholders

C. NÍ Cheallacháin and F. Huron (COLUMBUS) and J. Hansen, F. Ferri and C. Buongiovanni (MARINA) explicitly or implicitly mentioned the importance of capacity building for stakeholders because people can personally benefit from processes when they find them incentivising on a personal level, when the processes increase competences and when they open new opportunities on an individual. The individual level is therefore important when engaging stakeholders, i.e. stakeholders' personal or a professional perspective should be considered for engagement processes so as to provide them with something they can find useful.

> *Capacity building is important for citizens, stakeholders, researchers and research institutions. By capacity building she means not just knowing about RRI but being engaged in the processes and the creation of value. It's important to understand how this could be realized and how the embedment of capacity building could happen in the overall process. (cf. Buongiovanni, C., 2017, page 4, line 117-135).*

> *C. NÍ Cheallacháin states that researchers might benefit from a project like COLUMBUS on a personal level because they can learn how to build capacity and how to carry out knowledge transfer in order to have more impact. (cf. NÍ Cheallacháin, C., 2017, page 4, line 116-119).*

Situational awareness to enhance commitment

This issue was addressed by R. Fernandez (COLUMBUS) and M. Bezzi and C. Buongiovanni (MARINA). Awareness raising about project processes themselves is important for stakeholders to understand the context and to be more committed in the respective process. Participants' competences have to be respected by explaining to them what they are engaging in so that they can get a better understanding of the meaning of their participation. R. Fernandez states that participants will then be able to replicate what they have learned.

> *She claims that the stakeholder awareness is very important because understanding the context and principles of COLUMBUS is crucial in order to replicate similar methodologies in the marine domain and also in other domains. (cf. Fernandez, R., 2017, page 9, line 295-299).*

4.2 Descriptive statistics of the online survey

This chapter describes and illustrates the data that was collected through the online survey. The complete survey can be found in Appendix B. The data collected contains individually obtained information from respondents about project activities, stakeholder interests, knowledge types in the projects, stakeholder satisfaction about their participation and their estimation on how important the RRI dimensions are. 24 responses were collected, thus in this chapter N (=24) is the sample size (unless noted otherwise) and n represents a part of this sample size N. It has to be noted that 4 respondents (17%) were COLUMBUS stakeholders, the rest (83%) were MARINA stakeholders. Therefore, the survey is biased, and the results do not allow for comparisons between both projects. For the analysis, it was decided to neglect ranked stakeholder influences (N°7) and times of participation (N°16), as these variables were not of interest for the research questions. Furthermore, due to the small N and uneven distribution of stakeholder types, the following descriptive statistics do not make conclusions about responses according to the stakeholder role. Many respondents chose to identify as more than one stakeholder type, so the stakeholder type cannot be seen as independent variable. All multiple choice (MC) and multiple response (MR) questions were answered (mandatory questions), some open-ended questions (voluntary) were left unanswered by certain respondents (N<24). Due to a technical problem, question N°25 (How important is it to you that scientific publications and data are made publicly available?) was not right away registered in the survey. After the problem was identified, the question was published, resulting in a slightly smaller N for this question only (19 responses instead of 24). Percentages are rounded to the whole (no decimal points).

4.2.1 Project activities and stakeholders' interests

This chapter represents the respondents' profiles, respondents' votes on their personal motivation for their participation (MR), their wish for the engagement of other stakeholders (MR), and which stakeholders they thought were the most influencing ones (ranks).

Respondents profiles

The respondents could choose to identify as various stakeholder types (MR question). 33% (n=8) of the respondents chose more than one stakeholder type, 17% (n=4) even identified as 3 stakeholder types. 50% (n=12) of the respondents were part of a team involved in the projects (project partners and project coordinator). 33% (n=8) of the respondents identified as researchers, 21% (n=5) identified as citizens, 13% (n=3) identified as Business and Industry, 8% (n=2) identified as Civil Society Organisation (CSO), 8% (n=2) identified as knowledge transfer associate (i.e. knowledge transfer fellow or knowledge transfer consultant), 4% (n=1) identified as communication officer, 4% (n=1) identified as educator, and 4% (n=1) identified as journalist. None of the respondents identified as policy-maker. Figure 7 shows the bar chart of relative frequencies of votes per stakeholder type.

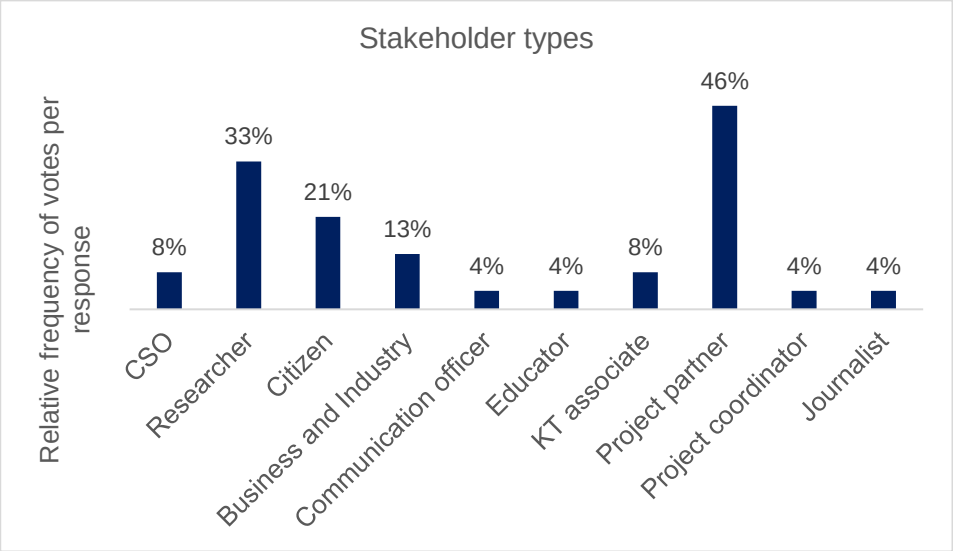


Figure 7

20 respondents specified the domains they are working in professionally (open-ended questions); 25% (N=20, n=5) of the respondents work in marine and maritime related fields (e.g. marine conservation, fisheries, innovation management, infrastructures), 15% (N=20, n=3) work in business related fields (development and strategy), 15% (N=20, n=3) work in the domain of communication, 10% (N=20, n=2) work in educational institutions (one person having retired), 10% (N=20, n=2) work in society related studies, while the following

professional domains were addressed once, amounting to 5% (N=20, n=1) each; sustainable environment, research, European project management, nanotechnology, and water sports.

20 respondents answered the open-ended questions regarding their gender, age and nationality. 65% (N=20, n=13) of the respondents were female, the rest (35%, N=20, n=7) were male. 13% (N=20, n=3) of the respondents were between 18 and 30 years old, 13% (N=20, n=3) were between 30 and 40 years old, 42% (N=20, n=10) were between 40 and 50 years old, 13% (N=20, n=3) were between 50 and 60 years old, and one person was between 60 and 70 years old (5%, N=20). The mean age amounts to 44.8 years. The youngest person was 25, the oldest 69 years old.

25% (N=20, n=5) of the respondents were Italian, 25% (N=20, n=5) were French, 15% (N=20, n=3) were Spanish, 15% (N=20, n=3) were Irish, while the following nationalities were represented by one individual, amounting to 5% (N=20, n=1) each; Turkish, Cypriote/Danish, Portuguese, and American. This shows that two respondents from non-EU countries also participated in the survey.

Aims and opportunities

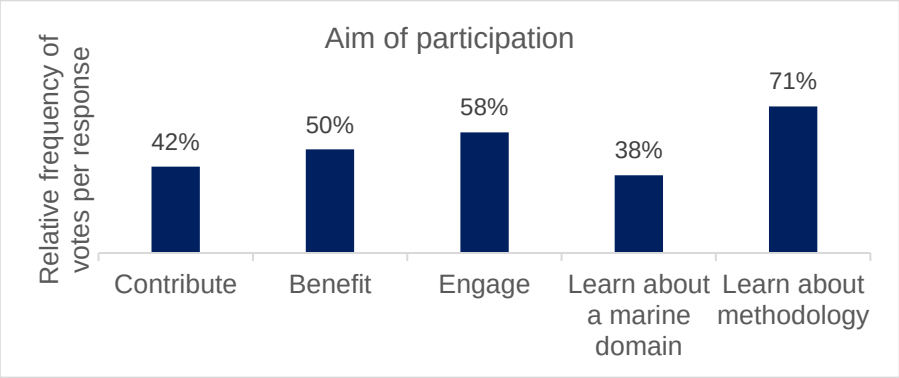


Figure 8

The aim of participation describes the main motivations of people for getting engaged in the project. Multiple responses (MR) were possible. The MR question showed that 71% (n=17) wanted to learn about the methodology applied (knowledge transfer methodology/workshop methodology); 58% (n=14) wanted to get engaged with different participants/stakeholders; 50% (n=12) wanted to benefit by learning about a product/service/knowledge; 42% (n=10) wanted to contribute to the activities introducing a product/service/methodology/knowledge; 38% (n=9) wanted to learn about a marine/maritime domain of interest. Learning about the methodology used was the motivation/aim most voted for, while learning about a marine domain was the aim the least voted for. Figure 8 shows the bar chart of relative frequencies for the aim of participation.

The participants were given different opportunities to work on certain issues. The possible MRs encompass activities and issues that implicitly or explicitly represent RRI dimensions. 71% (n=17) of the respondents could have insight in the project's processes; 67% (n=16) could engage with a wide range of different people from society (who have different jobs, different interests, etc.); 58% (n=14) could anticipate future opportunities, weaknesses, challenges and risks of a given subject; 54% (n=13) could learn about a new scientific topic and this topic was explained to them in such a way that they could understand it and explain it to others (Scientific Education); 46% (n=11) could access freely available data (documents, publications, research findings, etc.) (Open Access); 46% (n=11) could learn about needs of others involved in this project; 46% (n=11) could work on research questions that can solve societal and economic problems; 42% (n=10) could work on the concept of sustainable development; 33% (n=8) could speak their mind and consequently influence decision-making in Research and Innovation; 25% (n=6) could produce results that follow ethical principles (Ethics); 8% (n=2) could change decision-making in policies (Governance); 4% (n=1) could support equality between women and men throughout their participation (Gender Equality). Thus, getting insights in the projects was the most voted for response, while gender issues only received one vote. Figure 9 represents the bar chart of relative frequencies of votes.

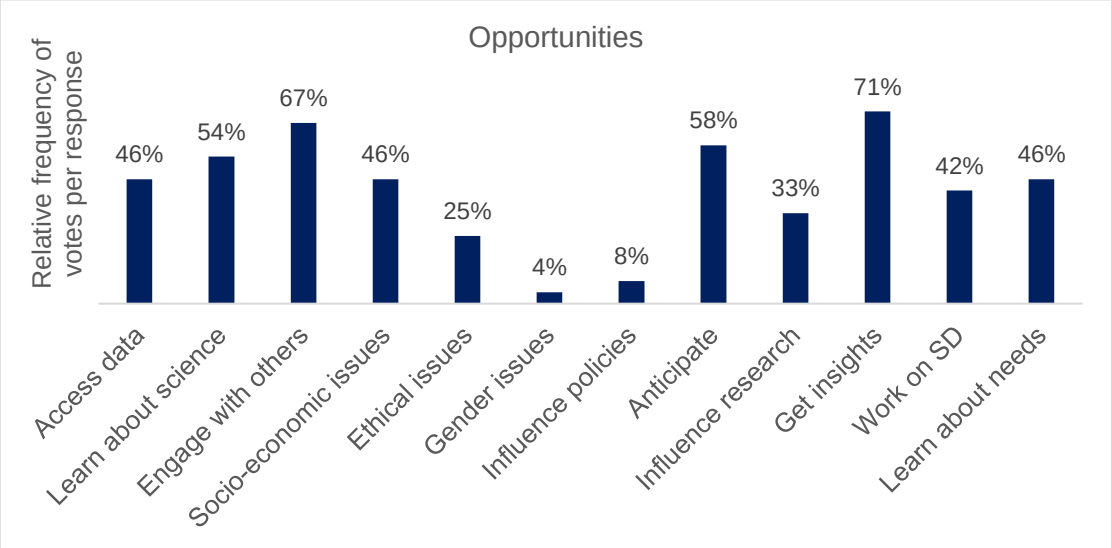


Figure 9

Stakeholders were asked whether they wished that a certain stakeholder group be more present or engaged throughout the project processes (MR question). 58% (n=14) of the respondents wished more policy makers were or had been engaged in the project, 46% (n=11) wished more citizens were or had been engaged, 42% (n=10) wished more journalists were or

had been engaged, 33% (n=8) wished more business people were or had been engaged, 33% (n=8) wished more educators were or had been engaged, 25% (n=6) wished more CSOs were or had been engaged, 21% (n=5) wished more researchers were or had been engaged. To sum up, policy makers were most desired in project processes, while researchers were the stakeholder group that received the least votes.

Stakeholders interests

In two open-ended non-mandatory questions, respondents were asked to enter; what environmental issues they were most interested in during their participation in the projects; and, what environmental issues they would have liked to talk about more during the project activities. The first question yielded 22 individual responses. 41% (N=22, n=9) of the answers explicitly mentioned sustainability issues (related to human consumption and tourism), and 23% (N=22, n=5) responses addressed marine pollution or water quality, while the following topics were addressed once, amounting to 4% (N=22, n=1) each; recycling; consumer solutions; policies and good environmental status; invasive species; greenhouse emissions; fishing/aquaculture/urban development/human activities; underwater mining; Marine Protected Areas criteria; eco-tourism; deep sea mining.

The second question (What environmental issues would you have liked to talk about more during the project activities?) yielded 14 responses, 29% (N=14, n=4) of which referred to marine pollution, 14% (N=14, n=2) tackled coastal topics, while the following topics were addressed once, amounting to 7% (N=14, n=1) each; deep-sea mining, recycling, influencing policy makers and legislators, sport and environment, bio-technology, sustainability, Marine Protected Areas criteria, public engagement.

4.2.2 Knowledge in the projects

The knowledge in the projects was investigated by MR questions, by Likert scales regarding satisfaction and, furthermore, Chi-square tests were effectuated for relevant relationships between variables. Only tests yielding significant results are presented in this chapter.

Knowledge exchange and acquired knowledge

In the projects, knowledge exchanges with other participants and stakeholders take place through various opportunities and communication channels. The MR question yielded that; 83% (n=20) of the respondents exchanged knowledge in workshops; 58% (n=14) exchanged knowledge in direct meetings; 50% (n=12) exchanged knowledge via social media; 46% (n=11) exchanged knowledge in conferences; 33% (n=8) exchanged knowledge on marine events;

and 8% (n=2) exchanged knowledge on brokerage events. 1 (4%) open response was given; “1-1 calls”.

Regarding knowledge acquired, the MR question yielded that; 71% (n=17) of the respondents acquired knowledge about other stakeholders’ needs and interests; 63% (n=15) acquired knowledge about the methodology used; 54% (n=13) acquired knowledge about a product / service / methodology; 42% (n=10) acquired knowledge about marine / maritime issues; 42% (n=10) acquired knowledge about societal issues; 38% (n=9) acquired knowledge about environmental issues other than the marine or maritime domain; 25% (n=6) acquired knowledge about policies; and 13% (n=3) acquired knowledge about economic issues. Hence, most people acquired knowledge about other stakeholders and only few acquired knowledge about economic issues. Figure 10 shows the bar chart of relative frequencies for the different kinds of knowledge that were acquired.

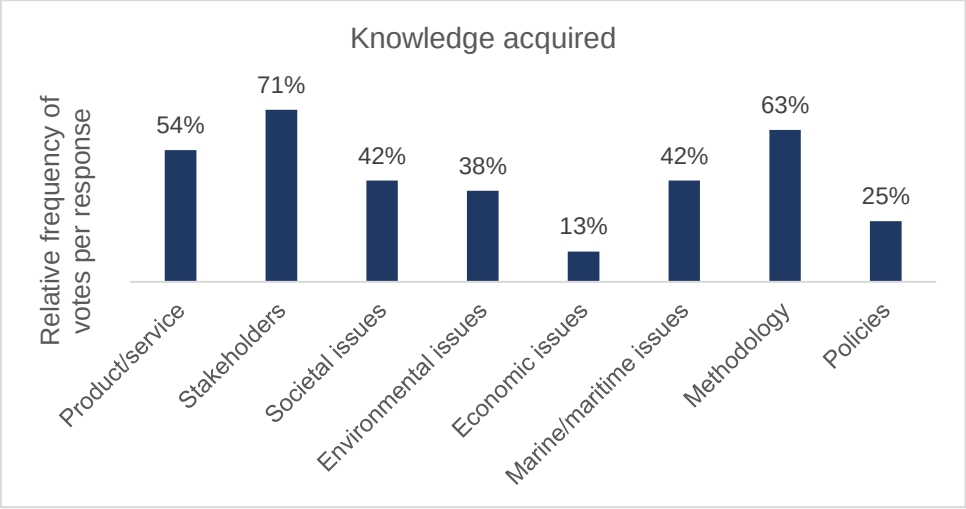


Figure 10

Satisfaction with knowledge and willingness to continue using knowledge

The satisfaction with received knowledge and the willingness to continue using the acquired knowledge were factors investigated in the survey. On a Likert scale of five items; “Very satisfied” (5), “Satisfied” (4), “Neutral” (3), “Dissatisfied” (2) and “Very dissatisfied” (1), the satisfaction with the knowledge acquired has a median of 4, a mean of 4.2 and a mode of 4, indicating good overall satisfaction. 25% (n=6) of the participants were very satisfied with the knowledge, 71% (n=17) were satisfied and 4% (n=1) had a neutral perception towards the knowledge they had acquired (Figure 11).

The willingness to continue using the knowledge acquired was presented on a Likert scale of five items; “Yes, definitely” (5), “Yes, very likely” (4), “Undecided” (3), “Not very likely” (2), “Definitely not” (1). This single choice question yields a median of 4, a mean of 4.2 and a mode

of 4, so most participants (n=12, 50%) are very likely to use the knowledge they acquired in the project elsewhere. 25% (n=6) will definitely use their knowledge, and 25% (n=6) have not decided yet (Figure 12).

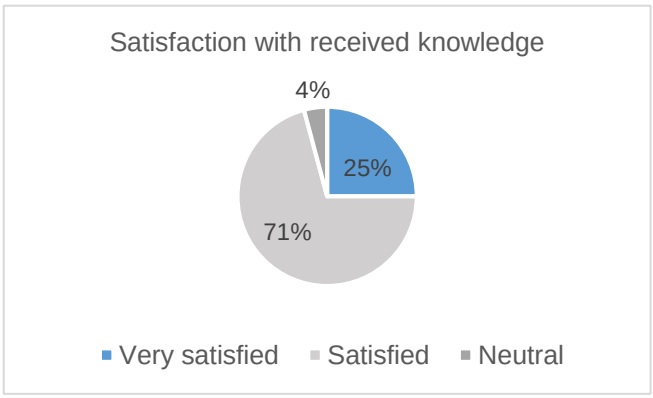


Figure 11

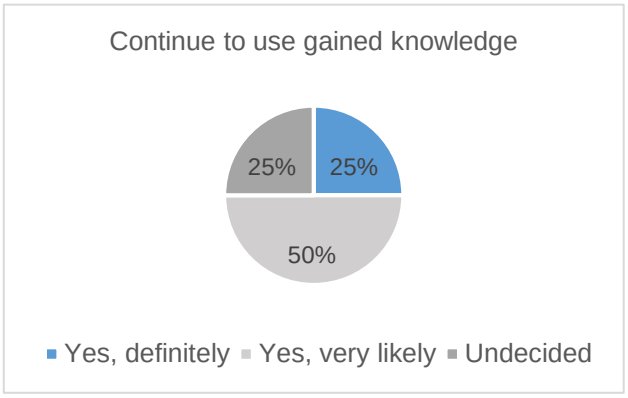


Figure 12

13 responses were given to the open-ended question: “How will you use the experiences you made in the project's activities for your private or professional life? (Please give some short examples)”. 46% of the respondents (N=13, n=6) wanted to use knowledge acquired in other activities or integrate new knowledge in already existing knowledge, 23% (N=13, n=3) wanted to communicate about what they have learned and disseminate knowledge acquired, and 23% (N=13, n=3) wanted to use their knowledge for/in social activities.

Barriers

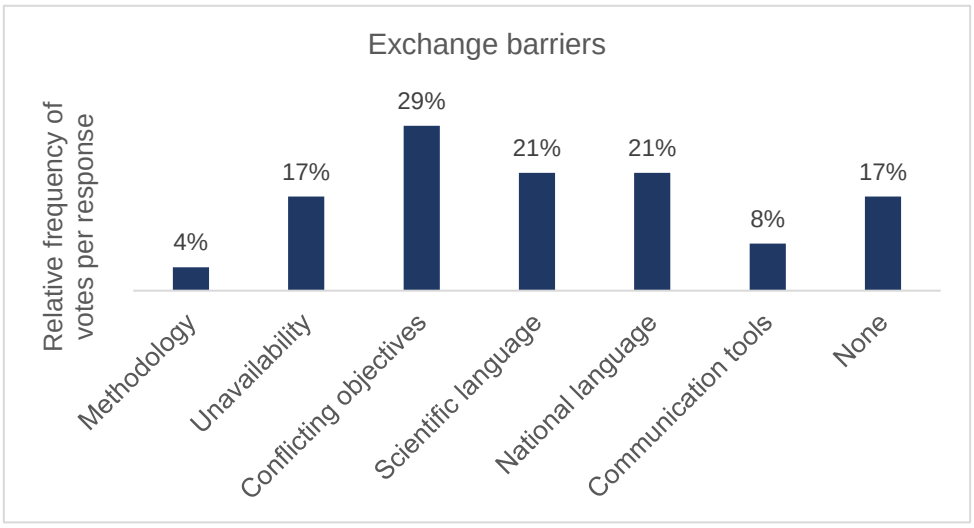


Figure 13

Different kinds of barriers in the knowledge exchange were identified. A MR question shows that 29% (n=7) experienced conflicting objectives among stakeholders in the project; 21% (n=5) felt that different scientific or technical languages lead to misunderstandings; 21% (=5) felt national languages led to misunderstandings; 17% (n=4) say that project partners / participants were unavailable; 17% (n=4) did not encounter any barriers in knowledge exchanges; 8% (n=2) felt that the communication tools chosen were ineffective; and 4% (n=1) felt that the methodology applied is complicated. Figure 13 shows the bar chart of relative frequencies for different exchange barriers in the project.

Satisfaction on other levels

Satisfaction of additional factors that, according to literature, might play a role for knowledge exchange were investigated by using Likert scales of five items; “Very satisfied” (5), “Satisfied” (4), “Neutral” (3), “Dissatisfied” (2) and “Very dissatisfied” (1). The satisfaction regarding the opportunities given to express opinions indicates that; 25% (n=6) were very satisfied; 58% (n=14) were satisfied; 13% (n=24) were neutral; and 4% (n=24) were dissatisfied (med=4, mean=4, mode=4).

The satisfaction regarding the value that was given to participants’ input has a median of 4, a mean of 4.1 and a mode of 4, indicating that the majority of participants were satisfied (n=24, 67%); 21% (n=5) were very satisfied; and 12% (n=3) were unaffected. The satisfaction regarding relationships that participants had with other participants (med=4, mean=4.2, mode=4) shows that the majority (n=15, 63%) was satisfied; 29% (n=7) were very satisfied; and 8% (n=2) were unaffected. Hence, all the investigated factors were satisfactory, the relationships being, overall, slightly more satisfactory than the other factors.

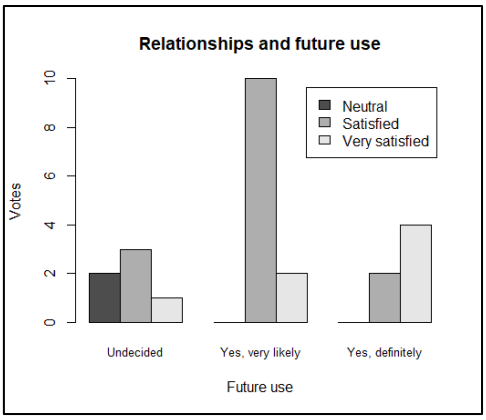


Figure 14

Further Chi-squared tests were effectuated to examine if the factors of satisfaction about the acquired knowledge, satisfaction about input value, satisfaction about opportunities to express one’s opinion, and satisfaction about relationships affected the future use of acquired knowledge/methods. The Chi-square test of independence between satisfaction about

relationships and the future use of knowledge shows a significant result (X^2 (NA, N = 24) = 11.657, p < 0.05). People that were satisfied with the relationships also said they were very likely to continue using the acquired knowledge (Figure 14). The Chi-square test of independence between satisfaction about the opportunities to express oneself and the continued use of knowledge showed a significant result (X^2 (NA, N = 24) = 13.286, p < 0.05) (Figure 15). People who were satisfied with the opportunities which they had to speak their mind, also said they were more likely to use their acquired knowledge in the future.

Chi-square tests were performed to test whether the satisfaction about relationships in the projects shows a relationship with the satisfaction about opportunities to express opinions; value given to input; and the knowledge received. The relationship between the satisfaction about the relationships with other stakeholders and the satisfaction about the received knowledge proved to be significant (X^2 (NA, N = 24) = 16.636, p < 0.05). This result reveals that people who had had satisfactory relationships in the projects were also more satisfied about the knowledge they acquired in the projects (Figure 16).

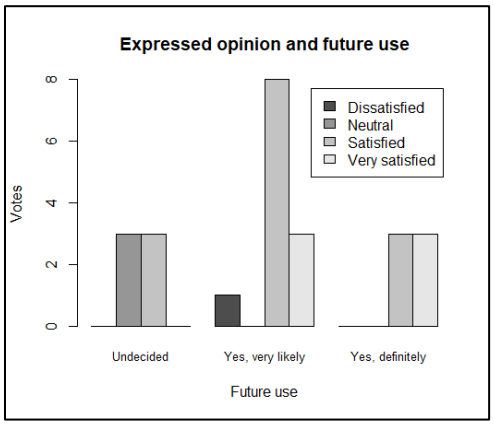


Figure 15

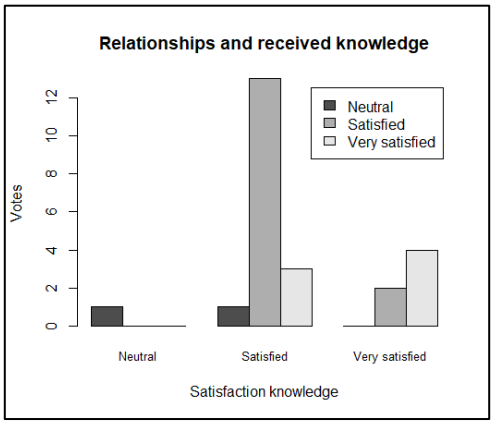


Figure 16

4.2.3 RRI dimensions and sustainable development

Respondents were asked about their interest in Research and Innovation on a Likert scale of 5 items; “Extremely interested” (5), “Very interested” (4), “Moderately interested” (3), “Slightly interested” (2) and “Not at all interested” (1); 50% (n=12) of the respondents answered they were highly interested in Research and Innovation, 33% (n=8) were very interested and 17% (n=4) moderately interested. Hence, all of the respondents (100%) were interested in R&I to a smaller or larger extent, none of the persons showed disinterest concerning R&I.

The Likert scales for each RRI dimension (except Governance) and the three sustainable development dimensions (environment, society, economy) had the items “Highly important” (5), “Important” (4), “Neutral” (3), “Less important” (2) and “Not at all important” (1). The “overall importance” stands for the summed-up importance that all stakeholders perceived regarding a

particular dimension. Since using mean values for Likert scales is seen as critical throughout literature (JAMIESON, 2004, 1217; BISHOP and HERRON, 2015, 298f), the median and mode were noted for reasons of validity.

The single choice question about the importance of having the possibility to engage with other people in finding solutions to urgent societal, economic and environmental issues was answered with; 67% (n=16) of respondents finding it highly important; 25% (n=6) finding it important; one respondent 4% (n=1) being neutral; and one respondent (4%, n=1) finding it less important. 46% (n=11) of the respondents find it highly important and 54% (n=13) find it important to learn about Research and Innovation issues and to acquire scientific competences. 46% (n=11) of the respondents find it highly important, 37% (n=9) find it important and 17% (n=4) are neutral to whether gender equality should be supported throughout Research and Innovation processes. 83% (n=20) of the respondents find it highly important and 17% (n=4) find it important that Research and Innovation anticipate future opportunities, challenges and risks for the next generations. 63% (N=19, n=12) of the respondents find it highly important, 32% (N=19, n=6) find it important and 5% (N=19, n=1) are neutral to whether scientific publications and data are made publicly available. 75% (n=18) of the respondents find it highly important, 21% (n=5) find it important and 4% (n=1) are neutral regarding the respecting of ethical principles in research and innovation. 33% (n=8) of the respondents find it highly important, 46% (n=11) find it important and 21% (n=5) are neutral to whether Research and Innovation solve economic concerns. 92% (n=22) respondents find it highly important and 8% (n=2) find it important that Research and Innovation respect the environment and natural resources. 67% (n=16) of the respondents find it highly important, 29% (n=7) find it important and 4% (n=1) are neutral to whether politics support society-centred Research and Innovation programmes. Figure 17 represents the percentage distribution of different levels of importance for each question. The survey questions are abbreviated with a term describing the respective RRI or sustainability dimension.

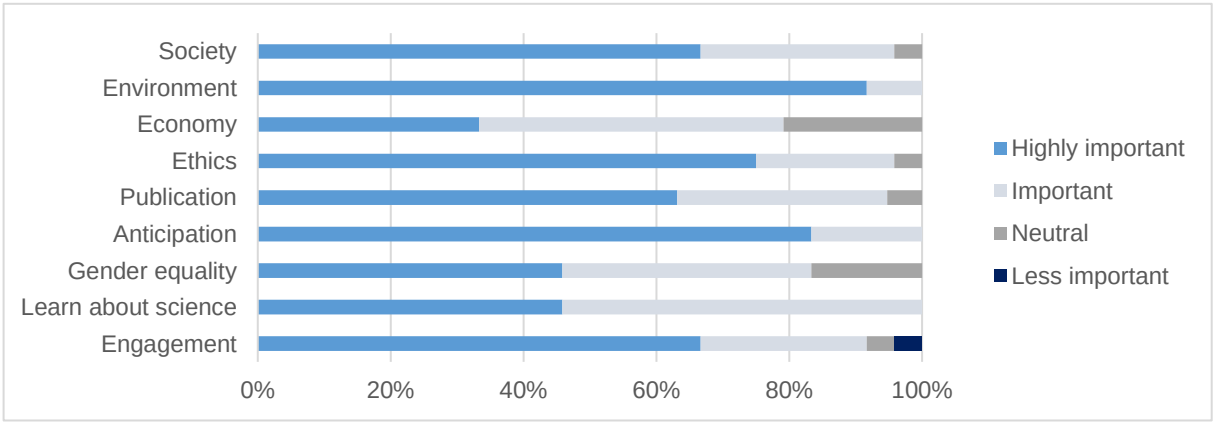


Figure 17 Relative frequency of votes per Likert scale question (100%)

Thus, the descriptive statistics show that dimensions are ascribed different levels of importance. To sum up, solving economic concerns through R&I yields the lowest statistical numbers (mode; med=4, mean=4.1, mode=4), while respecting the environment (natural resources) in R&I yields the highest (med=5, mean=4.9, mode=5); thus, the latter can be said to have a higher importance for the survey respondents than economic issues. Table 10 represents median, mean and mode of each LS question.

Table 10

Dimension	Med	Mean	Mode
Society	5	4.6	5
Environment	4	4.9	5
Economy	4	4.1	4
Ethics	5	4.7	5
Publication	5	4.6	5
Anticipation	5	4.8	5
Gender Equality	4	4.3	5
Learn about science	4	4.5	4
Engagement	5	4.5	5

Other Chi-squared tests were effectuated to find out whether there was a relation between the interest in R&I and the importance that was ascribed to the different RRI dimensions. No such relation was found to be significant in the Chi-square tests conducted (i.e. the interest in R&I and the importance attributed to RRI dimensions or sustainability elements by the respondents are not related).

4.3 Thematic Analysis findings

The Thematic Analysis (TA) serves to present and provide an overview of both the COLUMBUS and MARINA projects in relation to RRI. The basic themes detected are commented on in detail, and some of them are exemplified by extracts from the public deliverables. The themes are then presented graphically for each project. Interconnections and overlapping of RRI dimensions are mentioned, but, for reasons of clarity, not included in the visual presentation of the dimensions.

4.3.1 Themes in COLUMBUS

The themes identified in COLUMBUS are; Public Engagement (Participation), Open Access (Accessibility of data and intellectual property rights), Science Education (Equipping researcher/societal actors with knowledge/tools), Ethics (Societal relevance) and Governance

(Policies). The issue of gender parity is identified once (gender parity of interviewees), but this was judged too little evidence for the creation of a Gender Equality theme. Multidisciplinarity is an overarching theme in the project: it is noticeable in the composition of the consortium (various professional backgrounds), and the structure of the project (nine different marine/maritime focal areas are covered and interactions between them are examined in order to find cross-sectorial solutions). Thus, COLUMBUS recognises the importance of an efficient holistic approach of the marine/maritime sector. Knowledge transfer is abbreviated; KT.

Public Engagement

Public Engagement appears in different forms of participation and consists of the basic themes: Outreach and One-on-one attention.

Outreach: Outreach describes all the activities that are carried out to reach potential external project stakeholders, including the wider public, through different communication and dissemination channels (one-way promotion) such as; website, social media, publications in peer review journals, external events, networking, and brokerage events. Outreach aims at raising awareness regarding KT, and wants to communicate about marine/maritime issues, the impact of research on society, and project activities. Communication tools are adapted according to targeted audiences (science, policy, industry, society) in order to make communication more effective. Outreach activities are based on an informing level as they aim at raising the visibility of the project, and they also include consulting activities (e.g. surveys) to obtain a wide range of stakeholder opinions regarding KT-related issues. Moreover, COLUMBUS attends brokerage events to establish face-to-face contact with interested parties and holds discussions with external stakeholders in order to investigate KT-relevant issues. Thus, outreach describes a) the establishment of loose contact with a wide range of stakeholders with the objective of giving information (informing) and, b) conducting surveys and holding discussions (consulting) in order to receive information and further project purposes (e.g. develop the KT).

One-on-one attention: One-on-one attention describes the inter-personal level of stakeholder engagement. It is based on consulting and involving activities with stakeholders in order to ensure that their concerns/needs are understood and considered. This theme consists of three categories; a) strong relationships; b) targeted user profile; and c) exploration. a) Strong relationships with project coordinators/knowledge owners/portal coordinators are built through interviews that help to capture, understand, and validate transferable knowledge held by the interviewees; b) Identifying and profiling individual knowledge users helps to understand their

responsibilities, knowledge use/needs, attitude, practice, etc. Profiles provide information that allows to develop a tailored KT, using communication preferred by knowledge users; and c) Exploration happens through one-no-one interviews with KT-experienced individuals in order to improve KT and examine related perceptions/barriers/needs. Interviews and other one-on-one interactions help to provide in-depth information and detailed responses. Hence, one-on-one attention towards stakeholders allows for a deeper understanding of personal knowledge, perceptions or needs, thus enabling a better examination of individual situations and, eventually, enhancing the effectiveness of the KT for engaged individuals.

> *"Communication with the Scientific Community: Through the activities of the Competence Nodes, the Knowledge Transfer Fellows will develop relationships with the knowledge owners through peer to peer interviews by phone, Skype or face to face" (COLUMBUS, Deliverable 7.1, s.p.).*
>
> *"Objective: To be able to develop a successful Knowledge Transfer Plan (KTP) by selecting the appropriate messages, communication channels, materials and tools customised to the Target User profile" (COLUMBUS, Deliverable 2.2, 17).*

Science Education

Science Education in COLUMBUS informs stakeholders about project specific topics (Awareness) and gives them opportunities to replicate tools and activities (Enablement).

Awareness: Through its outreach activities, COLUMBUS can raise the visibility of knowledge activities and highlight EU-strategies as well as sustainable development issues. Outreach activities can be an introductory approach to the topics of Blue Growth, Blue Society and KT. Thus, in a first step, COLUMBUS draws attention to these issues. Here, raising awareness means presenting the project in an understandable way to all audiences who in return gain new knowledge about the existence of issues they did not know or know well before. The "COLUMBUS Blue Society award for impactful Knowledge Transfer" is an event highlighting this theme by raising awareness about responsible KT activities that are innovative, tailored, integrated, impactful, empowering, sustainable and link to RRI. Hence, in COLUMBUS, awareness raising happens through presentations (Outreach) and encouragement by rewarding exemplary KT activities and thus incentivising stakeholders to follow the example.

> *"Dissemination is a form of knowledge transfer, but is seen as one-way promotion and is effective in raising awareness and sharing information. A range of dissemination activities will take place particularly in the early phases of the project to raise awareness of the existence of the project, its objectives, partners and intended impacts." (COLUMBUS, Deliverable 7.1, s.p.).*

"The overall outcome of the COLUMBUS Blue Society awards will be to raise awareness of the importance of carrying out Knowledge Transfer and to provide recognition where significant effort has been applied." (COLUMBUS, Deliverable 7.5, s.p.).

Enablement: COLUMBUS targets the improvement and distribution of tools for stakeholders, i.e. equipping targeted stakeholders with new tools/knowledge. Enablement describes the contribution that COLUMBUS makes to educate and enable societal actors, researchers and policy-makers in regard to KT issues. COLUMBUS attends and hosts events where it introduces the project's KT methodology to stakeholders, offers trainings, advice, and accompaniment for KT. COLUMBUS wants to create a larger community of trained KT professionals to help broker knowledge. Moreover, COLUMBUS produces detailed KT guidelines, allowing other stakeholders to adopt and replicate KT activities conducted in the project. Furthermore, short case studies are produced to demonstrate successful and unsuccessful KT in COLUMBUS towards science, policy, industry, and society. Case studies aim at illustrating implementation and adaptation of the KT methodology for different KT purposes. Hence, stakeholders are given opportunities to learn from COLUMBUS and to use the methods developed autonomously. The project has educational character in the way it conveys instructional, practical information, advising stakeholders on how to effectively conduct KT for their own purposes. Thus, the form of learning happening in COLUMBUS links to professional, non-formal learning.

"The COLUMBUS Knowledge Transfer Handbook will be developed in order to communicate the KT methods in a level of detail that will allow others to adopt and replicate them. It will be shared with the wider stakeholder community and is also suitable for use by partner organisations for internal capacity building." (COLUMBUS, Deliverable. 7.1, s.p.).

Open Access

Open Access relates to intellectual property rights, accessibility of data (Data use), and also to innovative release options (Fostering Open Science).

Data use: This theme tackles the use of data/knowledge[9] in COLUMBUS. The project makes knowledge collected publicly available on an online platform (Marine Knowledge Gate) and strives for knowledge validation by project coordinators/knowledge owners before publication so as to ensure quality and accuracy of collected and potentially transferrable knowledge. COLUMBUS puts a focus on finding a balance between adequate protection of the knowledge

[9] Knowledge (output) in COLUMBUS is defined as: a unit of knowledge/learning generated by or through research activity, including new methodologies/processes, adaptations, insights, alternative applications of prior know-how/ knowledge (COLUMBUS, Deliverable 7.1, s.p.)

while enhancing exploitation, it gathers information about confidentiality issues, potential applications of collected knowledge, and possible intellectual property rights. The project establishes safeguards in consultation with legal advisors, if actions involving utilisation of information become subject to aforementioned issues. Moreover, COLUMBUS publishes results following Open Access requirements (green and gold Open Access routes). Hence, knowledge confidentiality, accuracy, and accessibility play an important role for Open Access in COLUMBUS. This dimension shows that COLUMBUS puts measures in place to address and act upon Open Access requirements which form the basis for further use of knowledge in the project, and also allow for knowledge sharing with other stakeholders (online platform).

> *"If knowledge outcomes become available e.g. Knowledge Transfer case studies, COLUMBUS, partners are encouraged to publish results in relevant publications. Papers will be published through free online repositories ('green' open access) and open-access journals ('gold' open access)." (COLUMBUS, Deliverable 7.1, s.p.).*

Fostering Open Science: COLUMBUS provides an in-depth analysis of some marine data portals/repositories and wants to increase their visibility due to the gap between available knowledge/data resources and the actual uptake by users. First, end-user needs regarding data are identified and, secondly, relevant repositories able to address identified needs are examined. Furthermore, COLUMBUS project partners developed guidelines for more effective engagement of data holders with data users. This implies that the project explores innovative ways and options to promote a culture of more open sharing. Regarding the data repositories, COLUMBUS gives recommendations on how to improve respective data portals' applicability and accessibility. Some suggestions tackle the need for mandatory open-access data policies, the simplification of current data systems, and the enhancement of their visibility. By giving recommendations and proposing solutions, COLUMBUS can be seen as an active contributor and supporter of data accessibility and usability, paving the way for Open Science actions.

> *"Section 7.2 details how the COLUMBUS monitoring and observation node is interacting with public data initiatives and key users to elaborate dedicated transfer activities. In addition, this report also exposed a wide range of other underexploited data resources, as well as bottlenecks in data uptake, which are beyond the scope of work in the COLUMBUS project but which could be taken forward by public marine observation and data sharing initiatives to raise the visibility of their resources and promote their uptake." (COLUMBUS, Deliverable 4.2, 6).*

Ethics

Ethics in COLUMBUS play out in the project's ambitions to create outcomes that are beneficial for individuals and society and contribute to Blue Growth (Societal relevance).

Anticipation: This basic dimension addresses the fact that the project carefully plans KT activities. COLUMBUS gains an understanding of relevant knowledge, foresees eventual impacts that could be achieved through knowledge application, and identifies those who could use the knowledge and realise these impacts. The series of steps in the KT are systematic and structured, and demand foresight throughout the whole process, as the purpose of each knowledge output is to reach an impact in the future. Anticipation involves foreseeing and analysing possible intended future impacts of knowledge and allows planning a KT towards a desirable outcome in the future. Without anticipation, the creation of a KT would not be feasible.

> *"Gathering all the relevant information about a KO landscape will make it easier to determine who the individual target and end-users will be, what kind of actions may be needed to reach them and how to get their commitment to use the knowledge. This will also inform Knowledge Fellows to characterise impact (which is essential to determine the indicators that will be needed to measure this impact)." (COLUMBUS, Deliverable 5.2, s.p.).*

Responsiveness: The project receives feedback (via consulting activities) and assesses how stakeholders and end-users perceive mechanisms and challenges in knowledge transfer. This information is needed for the construction, adaptation, and improvement of the COLUMBUS KT methodology. In addition, project partners working with the developed COLUMBUS KT methodology provide feedback, allowing the methodology to be adapted and improved according to practical experience. Thus, responsiveness addresses two issues: a) it wants to ensure relevance and importance of the created KT methodology by considering external stakeholder input and hence, responding to existing needs, and b) it adapts and improves the KT methodology in response to practical experience made by project partners. Thus, responsiveness has the overall goal of effectively using input to further project processes.

> *"From the online survey, stakeholder workshop and interviews common and recurring messages were found across all end user sectors." (COLUMBUS, Deliverable 8.2, 20).*
>
> *"[The Knowledge fellow] provides feedback and observations of working within the COLUMBUS methodology, allowing it to be improved if required within the framework of the project." (COLUMBUS, Deliverable 2.1, 5).*

Value creation: COLUMBUS wants to respond to the existing gap between project results and actual uptake by users resulting in Blue Growth. Value creation is noted as a theme because the project's overarching objective is the creation of value for a wide range of stakeholders, namely through the exploitation of past EC-funded projects. Value creation is based on multiple issues; a) Responding to knowledge needs: knowledge outcomes that respond to existing needs will be perceived as useful by individual stakeholders and will have the potential to create value. This implies that needs are investigated beforehand; b) Uptake and application:

initiatives for knowledge uptake and application (by individuals in policy, industry, science, and wider society) are crucial in order to eventually create value. Therefore, knowledge has to be perceived as usable by stakeholders; c) Final value creation: On the individual level KT activities can represent an added value for individuals by generating benefits, e.g. enhancing researchers' motivation by successfully transferring knowledge. Final value creation on a macro level addresses the fact that KT enhances the overall use of research outcomes, changing existing social, economic or environmental systems. In COLUMBUS, created value aims at improving Blue Growth, contributing to the implementation of policies, as well as strengthening the Blue Society. Hence, value creation follows a step-wise development and plays out on a personal and macro level. This basic dimension furthermore shows to be dependent on the functioning of all other dimensions, as it represents the final result of KT.

> *"COLUMBUS has been designed to demonstrate Value Creation of EU funded research outputs for a wide range of end users in the Blue Growth, and Marine and Maritime Policy context." (COLUMBUS, Deliverable 5.2, s.p.).*

Governance

This theme is mentioned in order to provide a comprehensive overview of COLUMBUS and to present its implication for policies and governance issues. COLUMBUS does not explicitly foster Responsible Research and Innovation in policies but sets out to support other concepts that are intrinsically linked to RRI.

Policy realisation: The transfer of collected knowledge to different end-users should result in a tangible contribution for sustainable Blue Growth and support the effective implementation of the Marine Strategy Framework Directive, and the revised Common Fisheries Policies. Moreover, COLUMBUS aims at supporting the Blue Society vision which is said to relate to Responsible Research and Innovation principles. Thematic overlaps existing between COLUMBUS, RRI and the Blue Society can be seen in; science and innovation (e.g. improvement of management practices), effective enforcement (balance between ocean exploitation and preservation), education (awareness and basic knowledge about the ocean), and collaboration (engagement and collaboration of stakeholders for finding solutions). Moreover, the basic theme Fostering Open Science describes how COLUMBUS contributes to the realisation of Open Access, investigating and presenting options for its implementation.

> *"In order to do so, COLUMBUS will focus on unlocking the potential of past and current relevant research results of EC-funded projects that better address existing knowledge gaps and needs to foster Blue Growth, as well as assisting in the implementation of marine legislation, including the Marine Strategy Framework Directive (MSFD) and the revised Common Fisheries Policies*

(CFP) among others, through a proven innovative methodology." (COLUMBUS, Deliverable 4.1, 5).

Figure 18 visualises the global theme (RRI), organising themes and basic themes found in COLUMBUS.

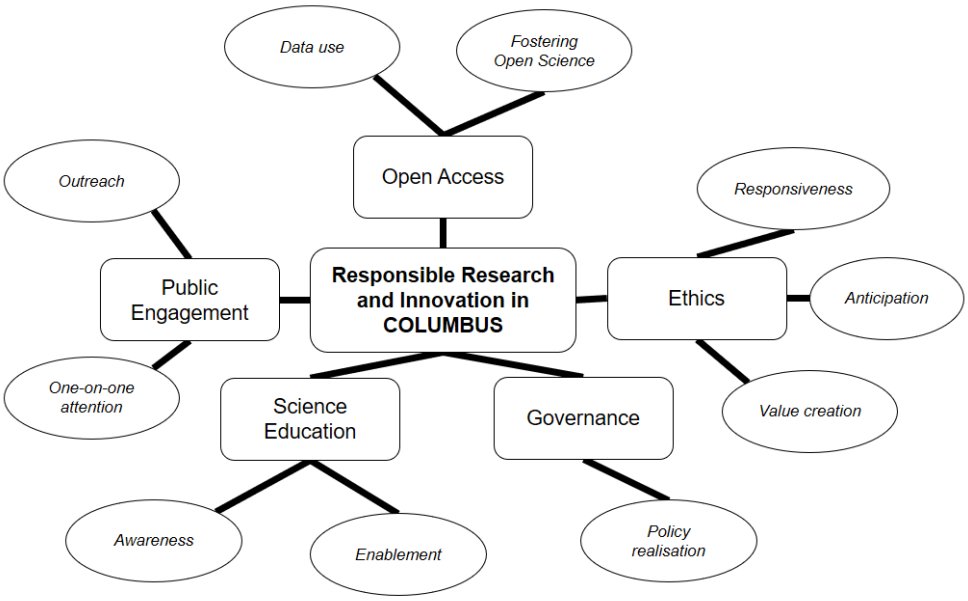


Figure 18 RRI themes in COLUMBUS

4.3.2 Themes in MARINA

The thematic map of MARINA assembles all RRI dimensions; Public Engagement, Science Education, Open Access, Gender Equality, Ethics and Governance. MARINA builds on a multidisciplinary approach; the project consortium consists of partners belonging to different activity sectors and having different expertise. Moreover, working with multidisciplinary partners is expected to enhance the exploitation of project outcomes in other domains. Thus, MARINA fosters a holistic approach regarding RRI implementation.

Public Engagement

Public Engagement in MARINA is realised through Participation, with the basic themes Outreach, Bonding, Inclusion and Interactions.

Outreach: Outreach stands for activities that present and raise awareness about the project, project results and relevant marine/maritime topics through appropriate communication, e.g. advertisements, presentations to interested groups, social media, newsletters, journals, conferences, exhibits, websites, MARINA workshops, etc. Multiple outreach tools are crucial

to reach heterogenous audiences and, moreover, MARINA adapts outreach activities according to the stakeholder type. Personal contacts (e.g. at events, conferences) are seen as important to reach stakeholders and share project results. Furthermore, project participants are informed about and invited to MARINA events, and they are consulted on outputs of the workshop and lessons learnt. Hence, Outreach can be categorised as a) informing activities that provide accurate information to assist stakeholders in getting familiar with the project and project-related issues, but it also involves b) consulting, i.e. collecting feedback from stakeholders regarding project processes. Hence, outreach stands for an exchange between the project and its stakeholders in order to give (informing) or receive information (consulting).

> *"Inform and invite them to participate in other MML workshops by means of the WKSP services (e.g. real time streaming and chat); Inform them about the results of other MML workshops; Inform and invite them to participate in the international RRI practitioner and policy workshops and conferences by means of the WKSP services (e.g. real time streaming and chat); Inform and invite them to attend other events related to MARINA project" (MARINA, Deliverable 7.8, 18).*

Bonding: MARINA wants to involve participants individually and engage them in project activities. Therefore, stakeholders are contacted and the knowledge that has been built during project activities is supported. The theme of Bonding happens through constant informing (e.g. events), consulting regarding project processes/outputs, but also through involvement (cooperative exchange), i.e. ensuring continued exchange with participants in order to consider their perceptions (e.g. platform). Thus, Bonding is characterised by regularity and back and forth knowledge exchange. This shows that MARINA wants to stay in touch with participants and ensure that they feel part of a community. Furthermore, collaboration plays an important role, encourages stakeholders to interact with others and asks for their continuous inputs and engagement. After the end of the project, participants are expected to continue this knowledge exchange (collaboration) and spread the knowledge acquired in MARINA. Thus, three steps can be identified: a) informing, consulting and involving activities help participants to familiarise with the project and evoke the feeling that the project considers their concerns; b) collaborating activities help participants to establish relationships; c) solid relationships could culminate in the creation of a RRI community that has the potential to enlarge its network.

> *"Regular communication, mutual consultation and cooperative exchange of knowledge with the stakeholders all along the duration of the MARINA project are the key to the overall success to their involvement. It is the basis for building a long-term relationship with them. Therefore, maintaining the relationship with the participants on the WKSP after the MML workshop is essential to the engagement process." (MARINA, Deliverable 3.1, 18).*

Inclusion: Inclusion in MARINA aims at engaging different kinds of stakeholders in the project, as heterogenous stakeholder perspectives should enable a holistic solution. For the workshops, stakeholder involvement strategies are defined, potential participants are identified and, according to their profile, they are contacted and invited. Thus, in MARINA, inclusion can be characterised as ensuring a balance of different stakeholder types, different ages (but not younger than 18 years), nationalities and genders. The online platform is open to the public and shares documents and workshop videos. This basic dimension shows that in order to ensure stakeholder inclusion, MARINA does not leave participant engagement to chance. Thus, inclusion consists of a) representativeness: MARINA wants to engage and represent a variety of chosen stakeholder types[10]; and b) accessibility: everyone over 18 can apply for workshop participation, the online platform is public, and the project enables remote participation (workshop videos/recordings) for those unable to attend workshops.

> *"Be inclusive and involve participants who live on the coast and in the hinterland and who represent the activity sectors linked to the hot topic in direct in indirect ways. Don't just reach the usual 'suspects.'" (MARINA, Deliverable 3.1, 13).*

Interaction: Collaborative tools in MARINA (workshops, online platform) play an important role in assembling different stakeholders, enabling a stimulant exchange of knowledge between them in order for them to create a common, holistic vision (co-creation of knowledge). It is considered that a wide involvement of stakeholders will result in finding better solutions for marine and Societal Challenges. Stakeholders exchange knowledge, experience, opinions, ideas, and they get to know other perspectives and priorities. These interactions represent the main collaboration by way of which MARINA partners look for ideas and solutions and incorporate participants' inputs in the outcomes of the project. The open dialogue between heterogenous stakeholder types is expected to result in strengthened connections between them. Moreover, the workshops, conferences and online platform aim at federating and enlarging existing RRI communities. MARINA provides the tools and encouragement in order to achieve independent stakeholder commitment. Thus, Interaction is defined by the following consecutive steps: a) enabling social interactions;
b) enhancing mutual understanding; c) changing individual stakeholder perspectives;
d) creating a common consensus; and e) thus, establishing a (RRI) community.

> *"Provide easy to use knowledge platform to enable sharing knowledge across diverse groups." (MARINA, Deliverable 7.8, 31).*

[10] MARINA stakeholders can be categorised as: citizens, civil society organisations, policy makers, policy implementers, scientists, research organisations/funding bodies, educational organisations, students, business and industry, SMEs, the EC, media local administration and municipalities

Science Education

The main objective of Science Education in MARINA is to equip societal actors with knowledge and participatory tools.

Awareness: MARINA addresses different levels of awareness and also uses persuasive efforts, in order to encourage stakeholders to work with RRI. In a first step, outreach activities have the potential to; a) raise awareness about the project, project results and relevant marine/maritime topics. Dissemination of information can draw attention to marine/maritime issues, as well as RRI, and reach a wide range of stakeholders. Moreover, material provided by MARINA is supposed to inform and teach stakeholders about project tools and organisation, raise their (b) situational awareness and encourage further engagement. For instance, workshops serve as an introduction to MARINA and make participants familiar with project-relevant topics. Thus, stakeholders gain knowledge about the existence, importance and functioning of marine/maritime and RRI issues. Here, situational awareness means that stakeholders not only know about, but understand their position and environment. c) Collective awareness can be built in workshops and on the social platform, namely through exchange with other people. Social interactions (interactive learning) can then result in the creation of shared beliefs/ideas regarding marine/maritime and RRI issues.

> *"The Website and the Knowledge Sharing Platform provide evidence of the project activities and results raising awareness to the RRI issues in the marine research." (MARINA, Deliverable 7.1, 10).*

Interactive learning: The participatory tools in MARINA (workshops and online platform) foster knowledge sharing and creation through the interaction of people. Workshops specifically foster discussions on implications, usefulness and possibilities of RRI. Moreover, workshops aim at creating collective awareness, they encourage dialogue, knowledge sharing and decision-making. The platform enables knowledge sharing (e.g. information, ideas, comments, articles, papers, photos and videos), raises awareness on RRI in marine/maritime issues, and gathers knowledge on stakeholders (database). Thus, within MARINA's participatory tools, learning occurs in different forms; social learning, i.e. learning through observation/imitation/interactions with others (workshops); learning by doing, i.e. informal learning through co-creation of knowledge (e.g. creating and assessing RRI roadmaps), and mutual learning (workshops and online platform), i.e. develop mutual understanding and joint solutions regarding specific topics. This shows that in MARINA learning is tied to social aspects, i.e. learning with or from other people. Furthermore, results from the workshops are planned to be disseminated for educational purposes, e.g. aquariums, schools, exhibitions,

etc. (non-formal learning). The workshops are introductory tools (regarding RRI, marine and maritime issues in general) in the first place, and the platform represents a tool for further discussion and learning.

> *"Activate participants to develop a holistic vision of the marine and Societal Challenges relating to the hot topic by sharing knowledge and experience and learning other actors' perspectives and priorities." (MARINA, Deliverable 3.1, 5).*

Knowledge base: Providing the participants with information is a crucial activity in MARINA. Project-related information (e.g. videos, interviews, podcasts, photos, roadmaps, reports, research results, scientific information, public documents, etc.) is shared on the online platform before, during and after each workshop to prepare stakeholders for their participation, to provide a better understanding about the whole project as well as treated marine and maritime issues, and to support stakeholders should they want to continue working with marine/maritime issues or RRI. Moreover, created "hot topic templates" are the basic documents that represent workshop topics, and introduce stakeholders to discussions. This basic theme describes the project's objective of providing stakeholders with different types and formats of knowledge in order to educate them. This implies that participants already know the project and are part of the community (registered on the platform). Stakeholders are provided diverse in-depth knowledge in order to gain thematic knowledge and the ability to discuss diverse themes.

> *"The Marina Knowledge Sharing Platform website is the main promotional tool for publishing research results as well as a dynamic database compiling public documents and the scientific information relative to the Marina context." (MARINA, Deliverable 7.8, 20).*

Open Access

Open Access throughout MARINA activities is tackled through data issues and accessibility of data for participants.

Data use: MARINA stores personal stakeholder data (e.g. first name, family name, e-mail, organization, type of stakeholder, gender, age, etc.). Therefore, the project requests participants to sign an informed consent form allowing the use and online publication of some of their data as well as recorded data (e.g. video and audio recording of workshops), but at the same time MARINA ensures that data will not be handed out to third parties, thus ensuring confidentiality. The informed consent form follows European and international data protection laws, regulations, and personal data treatment obligations, and if not signed, participants are not able to participate in the workshops or on the online platform. Hence, for stakeholders the approval regarding use and/or publication of their personal data represents a prerequisite for participation in the project.

Accessibility: MARINA populates the online platform with various kinds of data and also puts in place a RRI taxonomy allowing users to find information quickly on the platform. The data search system aims at providing different stakeholders with the type of information that they are most likely to look for. Moreover, the online platform contains a stakeholder database, allowing stakeholders to connect with other people registered on the platform, but refusing access to minors. Moreover, the data used and published on the platform is collected with permission from participating stakeholders. Thus, the MARINA online platform tries to ensure easy access to a variety of public data (openness and data sharing), user-friendliness (operability), and establishment of contact (enhanced reachability). All in all, accessibility describes the possibility for anyone over 18 to access the platform, as well as included data, tools, and stakeholders.

> *"Video recording, discussions, documents and other material (either on paper or in a digitalised form) will become a basis for extracting lessons learnt and analysis. They will be shared in the MML workshop virtual space to spark further discussion." (MARINA, Deliverable 3.1, 84).*
>
> *"The database of stakeholders is a compilation of all the stakeholders who are keen on environmental issues related to MARINA and the RRI concept. The WKSP needs to have a searching engine of stakeholders with advance permission from them." (MARINA, Deliverable 7.8, 17).*

Ethics

In MARINA, Ethics is represented through Fundamental rights and ethical standards, covering: Respectful treatment, Disclosure and Responsiveness.

Respectful treatment: Respectful actions are integrated in the activities of the projects, and in particularly address a respectful handling of the participants. The workshop facilitator is required to develop trustful relationships with participants, be respectful, friendly, ensure equal treatment of participants, etc. Furthermore, MARINA has a work package dedicated to Ethics (WP1), an Ethical board to set rules for stakeholder engagement in the project and defines treatment of personal data that must comply with EU regulations. The informed consent form represents a crucial part of this dimension, as it allows participants to understand their engagement in the project and explains the use of their inputs. Here, the ethical aspect is realised on an interpersonal level, such as a lack of pressure in the participation, and a respect of the person, emphasising the voluntary character of the participation.

> *"The facilitator will be flexible, unbiased, empathetic, a good listener and enthusiastic. They will develop a trustful relationship with the participants, be respectful and communicate in a clear and friendly manner." (MARINA, 3.1, 17).*

Disclosure: This basic dimension describes actions and information that help foster a better understanding of project activities among participating stakeholders, especially before engaging in the MARINA workshops. Participants are informed about the project, the process of participation, the treated topics, required data, and they are given information to prepare their engagement in the workshops. Hence, the information disclosed addresses stakeholders' personal interests and allows for transparency of project processes. Moreover, the informed consent form discloses risks or inconveniences, and possible benefits. Thus, through the information provided, stakeholders know what to expect from their participation and can better understand their role in the project.

Responsiveness: Responsiveness refers to the fact that the project considers participants opinions, needs and visions during the workshops and in the follow-up processes. The workshops are assessed by participants (satisfaction questionnaire), giving value to the participants' opinions and perceptions regarding topic clarity, the workshop objectives, etc. Difficulties, success, questions, lessons learnt, and best practices are identified and considered in subsequent processes. Moreover, the ideas that emerge in the workshops will be transferred to the policy level and have potential to create actions in response to the workshop outcomes. MARINA aims at influencing decision-making in policies and establishes a dialogue with policy makers (through policy workshops). Moreover, the project analyses policy needs through direct contact with policy-makers. By considering participants' inputs and policy makers' views, the MARINA project aims at developing a better alignment between R&I and societal needs. Furthermore, the project wants stakeholders to become responsive to other stakeholders' needs and situations during knowledge exchanges (workshops and online platform). Thus, responsiveness in MARINA refers to, a) the capacity to change R&I processes according to stakeholder/policy-maker inputs (consulting), b) the transfer of participants' ideas to the policy level (bottom-up), and c) the creation of responsiveness on a micro-level, e.g. stakeholders change their attitude to respond to other stakeholders' needs.

> *"The MML workshops will stimulate and include reflections on institutional needs for consolidating RRI into EU policy, based on experience and vision from participants. Such items will be highlighted in the MML workshop reports" (MARINA, Deliverable 3.1, 39).*

Gender

The Gender Equality dimension is explicitly covered in MARINA and mainly aims at ensuring the equal participation of both men and women in the project.

Integration: The Gender dimension is implemented throughout the activities, especially in the workshops a balance of genders is envisaged. Integration stands for the practical approach that MARINA takes regarding gender balances, as the focus lies on integrating it in its activities by making sure there is a balance in the participation of men and women in the workshops (50% women, 50% men), and by implicitly encouraging women to partake in science. Thus, Gender Equality is mainly addressed through quotas.

> *"Apply ethical rules with a pragmatic approach, meaning that each organiser will engage stakeholders in compliance with the principles of gender equality and in the respect of privacy rules." (MARINA, Deliverable 3.1, 6).*

Governance

An explicit objective of MARINA is to strengthen RRI in R&I and foster RRI on a policy-level.

RRI embedment: MARINA aims at fostering capacities to embed RRI in institutions, as well as in R&I. RRI embedment mainly happens through; Generalisability and Suggestions. a) Generalisability addresses the fact that MARINA produces results (e.g. experience, tools) that have the potential to be embedded and exploited in other projects/activities/domains, affecting the way current activities in different disciplines and domains are carried out. MARINA results could serve as an example for the standardisation of RRI activities; b) Suggestions are delivered by MARINA roadmaps of RRI-driven solutions developed by MARINA participants. Roadmaps propose actions to solve marine and Societal Challenges in relation to RRI. All in all, MARINA aims at raising awareness regarding RRI and enabling RRI change through communication of lessons learnt and social experiences from the workshops. By building on experience and stakeholder inclusion, MARINA follows a bottom-up approach, emphasises credibility, and hence justifies proposed RRI actions.

> *"(i) It could be possible to transfer the lessons learnt to other research projects related to [sic] environment (ii) It could be possible to transfer the RRI into non-environmental projects as well." (MARINA, Deliverable 7.8, 16).*

Authorities: MARINA establishes a dialogue with policy makers and identifies and analyses their needs, concerns and priorities related to the integration of RRI principles into policies. Therefore, surveys and interviews are conducted with national/international policy makers and, furthermore, lessons learnt and best practices from workshops and RRI projects are conveyed to policy-makers in order to encourage them to institutionalise RRI results and change policies (bottom-up approach). Hence, MARINA provides recommendations and policy options for RRI issues at sub-national and EU levels. Thus, the establishment of contact with policy makers is given special attention and is seen as crucial for the promotion of RRI. This implies that

authorities are seen as a pivotal factor for successful RRI realisation, showing that MARINA builds on bottom-up (RRI recommendations), but also top-down actions (engaging policy-makers and encouraging RRI institutionalisation).

> *"The results of the local and international workshops of the second round will contribute to the second and third international RRI practitioner and policy workshops." (MARINA, Deliverable 3.1, 7).*

Figure 19 visualises the global theme (RRI), organising themes and basic themes found in MARINA.

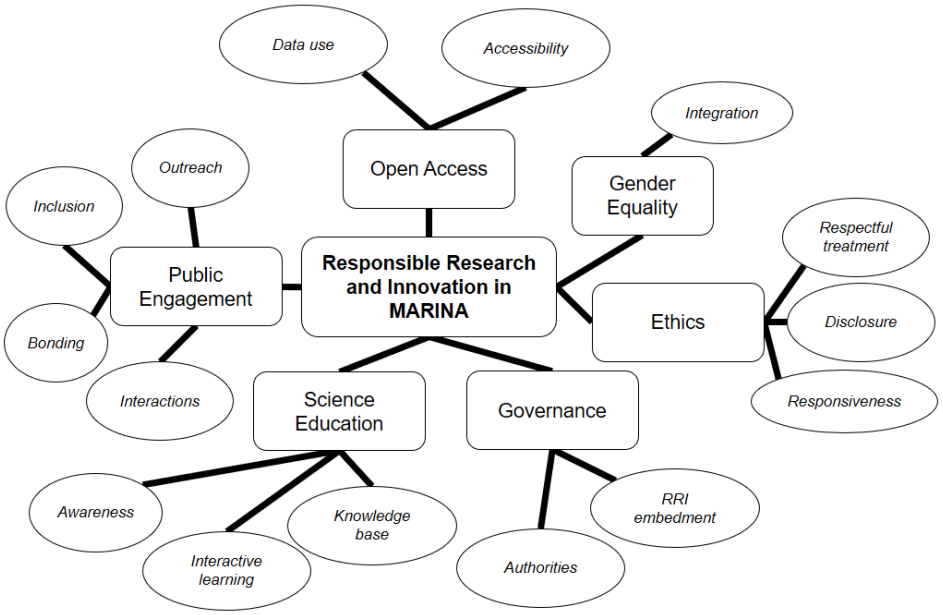


Figure 19 RRI themes in MARINA

5 Discussion

In this chapter the results from the semi-structured expert interviews, survey and Thematic Analysis are interpreted and linked to the research questions (chapter **1.1**) and to the theoretic background (chapter **2**). Significant results and those that seem particularly interesting for the research questions are discussed. Moreover, the employed methodology in this study is discussed through a critical approach.

5.1 Discussion of results

The main findings of this thesis show that the RRI dimensions Public Engagement and Science Education are visibly intertwined in both projects, with the consequence that it is difficult to consider them separately. Moreover, the findings underpin the importance of personal value gain for stakeholders in knowledge processes (REED et al., 2014). Furthermore, it is shown that knowledge processes in RRI are similar to those discussed in literature. The evidence gathered further suggests that COLUMBUS and MARINA both have ambitions and the potential to contribute to sustainability by enhancing chances of knowledge reuse, and by fostering interdisciplinary work which is a driving factor in realising sustainability (CORNELL et al., 2013; DALE, 2005). It is furthermore argued that an environmental dimension be integrated in RRI, and that future research develop binding RRI practices – with the objective of producing tangible environmentally sustainable outcomes. These and other relevant findings are explained in more detail in the following paragraphs.

Regarding Public Engagement (PE), findings from the Thematic Analysis (TA) show that both projects implement variations and combinations of known participation methods. Both carry out informing activities to provide stakeholders with project or marine/maritime related information via one-way promotion. The most notable engagement feature in COLUMBUS is its ambition to create in-depth, one-on-one exchanges with stakeholders, whereas MARINA emphasises activities related to regular, iterative participation (Bonding), and the enhancement of knowledge sharing between heterogenous stakeholders (Inclusion, Interaction). Interviewees from both projects also mention the importance of targeted engagement. Moreover, some bring up the importance of trustworthiness in stakeholder relationships, addressing trust on a personal level, and reliability of knowledge in wider knowledge exchanges. Trust and credibility are established through regular engagement with stakeholders (e.g. Bonding), and by demonstrating that stakeholder participation is taken seriously (LEMOS and MOREHOUSE, 2005, 61). Furthermore, interviewees from both projects state that structured, well-understood processes and communicated objectives can encourage stakeholder participation in projects. All these PE-related findings are supported by the study

from REED et al. (2014) who emphasise that it is important to carefully identify stakeholders for engagement, and to make research relevant for them; to ensure inter-personal trust between researchers and research users; and to brief stakeholders about expected impacts of knowledge exchanges, the participation procedure, and possible benefits. MARINA interviewees state that stakeholders should gain value from participatory processes, but very often they do not understand the purpose or benefit of their participation. This relates to the fact that knowledge activities need to deliver "tangible outputs that are of real value", meaning outputs that provide stakeholders with new/concrete knowledge (REED et al., 2014, 341f). This implies that knowledge produced should be "tailored to fit stakeholders' needs and uses" (LEMOS and MOREHOUSE, 2005, 62). Regarding PE, interviewees from both projects, including those who perceive difficulties in providing stakeholders with value, mention the importance of communicated objectives/benefits, e.g. capacity building, new competences/opportunities (forms of learning). In response to the finding above, this shows that practitioners are aware of how to provide stakeholders with useful outcomes but encounter difficulties in practice.

Regarding Science Education (SE), interviewees from both projects state that stakeholders contact each other, or they are encouraged to do so, in order to exchange or share knowledge through interactive and informal learning. The TA shows that awareness plays a role in both projects; COLUMBUS encourages engagement in knowledge transfer, MARINA fosters individual and collective consciousness. Knowledge offered by COLUMBUS is professionally- and research-oriented (Enablement), has strong practical implications, and the structured knowledge transfer results in concrete outcomes (Value creation), whereas MARINA mainly enables forms of interactive learning bound to social interactions and co-creation of knowledge (knowledge sharing), without specifying how individual stakeholders could make use of knowledge acquired. These findings link to two types of adult learning; learning for professional and learning for personal purposes (CEDEFOP, 2009, 44f). Learning for personal purposes contributes to knowledge and skills development, but individuals often feel that this type of learning is less valuable than learning for professional purposes (ibid.). Social forms of learning are prevalent in MARINA and might mainly relate to personal learning, explaining why some stakeholders do not seem to perceive value in their participation.

The TA shows that, regarding Open Access (OA), COLUMBUS aims at contributing to a wider open data sharing and follows green and gold OA requirements, whereas MARINA tackles OA mainly by sharing and publishing project data, and respecting data privacy. Interviewees from both projects state that OA is a crucial prerequisite for knowledge transfer and sharing, and, thus, open data is generally welcomed. Hence, in the projects, OA first and foremost enables PE, and authorises knowledge use and publication for project purposes. In the projects, OA is represents an inevitable issue at the beginning of knowledge processes and is tied to legal

requirements, thus distinguishing OA from other RRI dimensions. OA links to all RRI dimensions as it enables knowledge exchange in the first place, but the identification of its concrete implications is difficult and may require further inquiry of external stakeholders.

The TA shows that the dimension of Gender Equality (GE) is not fully addressed in COLUMBUS activities. MARINA aims at ensuring a gender balance in PE but does not show further implications of the dimension. In addition, the survey shows that only one respondent (4%, N=24) says they engaged in GE issues in the projects. Thus, GE is, by far, the least addressed RRI issue in the projects. A notable message was communicated by interviewees from both projects, stating that GE is negligible if it does not bring about new benefits to existing structures. Addressing the issue of GE is still important in activities, as gender may be "a significant factor in how research-based knowledge is linked with action" (VAN KERKHOFF and LEBEL, 2006, 457). However, the interviewees' statements draw attention to the fact that gender bias sometimes is not an issue. GE is not the only form of discrimination, and therefore, this thesis suggests that, depending on prevailing research/work circumstances, other discriminatory features in R&I might be just as well worthy of investigation, e.g. age, minority groups, underprivileged, etc.

In both projects, Ethics relate to responsiveness (STILGOE et al., 2013); both projects consider stakeholder input in order to adjust project processes and as a result, the overall outcomes can change. Furthermore, MARINA tackles Ethics by ensuring respect on an inter-personal level and also supports responsiveness by encouraging stakeholders to become responsive to one another. In COLUMBUS, value creation is detected on a personal level (stakeholder motivation through research valorisation), and on a macro level (knowledge transfer contributing to sustainability). These findings show that, whereas actions on the micro-level are individual-centred, ethical actions on the macro-level seem to relate to society-centred objectives – deontological as well as utilitarian thinking are present in both projects. Thus, besides aiming for justification/effectiveness of actions, RRI elements have the potential to stimulate positive emotions and socially desired actions among individuals. This relates to literature by VAN DEN HOVEN et al. (2013, 23), stating that RRI focuses on societal and ethical aspects in the process, while making decisions substantively good.

The TA shows that COLUMBUS contributes to the effective implementation of marine/maritime policies (top-down) but also investigates Open Science options, hence contributing to the realisation of OA in general. By fostering Open Science (EUROPEAN COMMISSION, 2016b), COLUMBUS could also facilitate the realisation of other RRI dimensions, e.g. easier access to knowledge resulting in enhanced PE. MARINA aims at embedding RRI in other projects/domains and makes efforts to engage policy-makers with the objective of convincing them to institutionalise RRI (top-down). Both projects recognise a need for cultural changes in

order to implement RRI elements. Moreover, interviewees from both projects address the fact that the embedment of RRI requires changes of culture, resources, and practice in institutions. This result shows that people working with RRI do not expect the approach to merely function as a practical supplement, but that RRI embedment will require effort by those who work with it. These findings confirm the assertions according to which RRI has to be taken up through institutional and cultural changes (RIP, 2014, 8). Moreover, MARINA interviewees state RRI should be practicable and adaptable for different domains and stakeholders. This finding refers to RRI literature, emphasising the fact that the design of RRI has to be vague enough to allow for broad adherence (FELT, 2017, 3). Hence, a concretisation of the RRI approach could result in a reduction of its applicational possibilities. Regarding RRI's engaging character, MARINA interviewees state that stakeholders are often not motivated to work with RRI. This shows that RRI is questioned regarding its practical meaningfulness, a dilemma that can be related to the fact that RRI was introduced top-down (ZWART et al., 2014). Designing RRI processes with stakeholders right from the start could strengthen bottom up approaches, as well as increase public impact. Regarding RRI in general, several interviewees from both projects feel that RRI has an innovative and strengthened character in the way it conceptualises its dimensions, suggesting that the ensemble of different dimensions entails positive interactions that do not occur when considering the elements separately. This relates to findings in this thesis, showing that interactions between PE and SE are evident. Moreover, these dimensions show to link to known knowledge processes (in stakeholder participation and learning) discussed in literature.

Regarding knowledge processes, the survey reveals that internal and external stakeholders who had generally satisfactory relationships in the projects, and those who were generally satisfied with opportunities to speak their mind, are very likely to use their acquired knowledge in the future. Still, no examined variable significantly contributes to ensured knowledge use. These findings relate to the study by REED et al. (2014), stating that, knowledge exchanges can lead to "sustained, long-term impacts", if stakeholders feel valued and listened to. Some survey respondents describe how they want to continue using their knowledge acquired, referring to forms of knowledge processing (NONAKA and TAKEUCHI, 1995); respondents want to pass on knowledge (externalisation); use or improve a knowledge methodology (internalisation and combination); or use knowledge for/in social exchanges (socialisation). This result reveals that explicit and tacit knowledge emerging from the projects can persist and create new knowledge, thus having potential to allow knowledge to be reused and identify and new problems (WARD et al., 2009, 6). Hence, determining crucial factors that encourage further knowledge use is important; otherwise participation could be perceived as pointless by stakeholders, and knowledge potentially benefiting sustainability could risk to stagnate. Moreover, most survey respondents wanted to learn about methodologies, and most acquired

knowledge about other stakeholders. This shows that non-thematic knowledge attracts and reaches more people than thematic knowledge. A reason for this could be that methodologies and social knowledge are more easily perceived as useful by many stakeholders, whereas interest in thematical issues most likely depends on the stakeholder type. For PE, this suggests that, in order to arouse interest and increase knowledge uptake among heterogenous stakeholders, stakeholders be best provided with adaptable knowledge that most of them can find useful and usable.

Interviewees from both projects highlight the reciprocal relationship between the environment and society: people need to understand the role they are playing for the environment, and what role the environment plays for them. This finding relates to literature, stating that "human and natural systems are dynamically interdependent and cannot be considered in isolation in order to resolve critical issues" (DALE and NEWMAN, 2005, 352). Moreover, interviewees from both projects mention forms of learning in order to achieve environmental literacy. Regarding education, DALE and NEWMAN (2005) state that environmental sciences require interdisciplinarity, and should be considered along with society, the economy, and politics. Thus, a shift from environmental literacy to sustainability literacy is needed. Interviewees from both project address the cooperation with other domains and state that involving different profiles and sharing transferable knowledge can enhance solution finding and knowledge reuse. This shows that not only does sustainable development require an interdisciplinary approach, practitioners appreciate interdisciplinary thinking and social connections. Moreover, interviewees from both projects state that social connections are sustainable project outcomes; they have the potential to persist, and to expand capacity for sustainable work. Regarding this, literature states that sustainability is a learning process, encompassing social, economic and environmental challenges, and enabling stakeholders to implement actions together (CORNELL et al., 2013). In addition, interviewees from both projects state that heterogenous stakeholder perceptions in R&I are expected to produce socially accepted outcomes that improve environmental management. Here, it has to be noted that the interviewees assume that those involved care about environmental issues and have the same agenda/visions/motives, but often this is not the case (BLOK and LEMMENS, 2015). Survey results underline the fact that conflicting objectives are a notable knowledge barrier for knowledge exchanges. Considering these findings, cooperation can be estimated to effectively contribute to sustainability and environmental stewardship if those engaged are on the same page. Regarding environmental issues, the survey shows that environmental concerns in R&I receive highest votes regarding importance, whereas economic concerns received the lowest. Furthermore, most respondents from the survey replied that, in regard to environmental issues, most were interested in sustainability. This result substantiates the link between environmental and sustainability

interests. RRI lacks an explicit environmental component in order for it to be designated a sustainable concept. Hence, it is suggested that an explicit environment dimension be included in RRI (as proposed by WILFORD et al., 2016).

Interviewees from both projects propose options for RRI embedment in not further specified structures. The main opposing views come from those who support soft regulation for RRI and those who support hard regulation. Others advocate self-regulation, which could subsequently lead to industry self-regulation (e.g. certification). Regarding environmental issues, interviews show that policies/administrations are judged as important to encourage or pressure changes in environmental behaviour but giving people perspectives in order to change their habits is also important. These findings suggest that behavioural changes require external, change-driving factors (VAN KERKHOFF and LEBEL, 2006). Hence, when linking RRI to the environment, the concept will most likely have to integrate explicit requirements. On the other hand, the results in this thesis show that practitioners appreciate flexible approaches. The reflection arising from this discussion is whether it is necessary to design RRI as a universally adaptable research concept and uphold its controversial vagueness, or to eventually link it to domain and sector specific requirements, in order to enhance its effectiveness.

5.2 Discussion of methodology

In this section, the methodology of this master thesis study as well as its limitations, study design and analysis strategy are discussed. Moreover, suggestions for improvement are added.

When conducting the semi-structured expert interviews via Skype, the interviewer had few to no influence on the interview environment, distraction sources or temporal loss of attention on the part of the interviewee. This physical absence could have affected the way the interviewee answered. Moreover, in some interviews, connection problems caused interruptions. Furthermore, as the interviewees were in their offices during the interview, some of them had work obligations right after the interview, so their availability was restricted, and the interviewer was obliged to cover the most relevant questions in the arranged time-slot (about 50min). However, the prepared interview guide ensured full coverage of all the relevant research topics in each interview, and, moreover, allowed for further inquiry in cases where interviewees had more time to elaborate.

Regarding the survey, few responses were collected, especially for COLUMBUS. The results are biased as 83% of the respondents were MARINA stakeholders. This did not allow for conclusions regarding project specific characteristics and therefore limited the scope of the analysis. Evaluating project characteristics would have allowed for comparison of the projects and for pinpointing project differences. To ensure this, the survey could have been published

online for a longer period (longer than three months). However, the promotion of the survey demanded constant engagement of project partners and after having shared the survey among them, the researcher did not want to continue bothering them and regularly promoted the survey herself.

One of the major drawbacks in the Thematic Analysis was that some COLUMBUS and MARINA project deliverables were confidential, or not yet published/available, and could therefore not be analysed. MARINA is still on-going and perhaps certain information regarding RRI dimensions will be found in future deliverables. Hence, relevant project processes and activities that did not appear in the public deliverables under scrutiny could not be considered in the analysis. However, the deliverables examined proved to contain sufficient information to allow for conclusions about all RRI dimensions. As a Thematic Analysis is always at risk to be biased by the researcher's perspective, the presentation and exemplification of the deductive approach, as well as the referenced citations in the results aim at enhancing credibility.

Case studies were chosen to develop a profound understanding of project processes and RRI's implication. Choosing an explicit RRI project and a project that implicitly applied RRI helped to detect similarities and differences and allowed to consider underlying RRI processes. The results cannot be representative for other RRI projects but should provide insight, impetus, and maybe lessons learnt which can be useful for the future use of RRI.

6 Conclusion

This thesis set out to contribute to the understanding of the emergent concept of Responsible Research and Innovation (RRI) and its importance for knowledge processes and the environmental domain and sustainability, since literature covering RRI's environmental implications is still scarce. The research questions of this thesis tackle how RRI dimensions (Public Engagement, Science Education, Open Access, Gender Equality, Ethics, and Governance) are explicitly or implicitly realised in the EU-funded marine/maritime projects COLUMBUS[11] and MARINA[12], how RRI appears to affect knowledge processes, and how the two projects are expected to affect the environmental domain in terms of sustainability and in relation to knowledge processes. The analysis of similarities and differences between two case studies allows for the development of instructive conclusions regarding different mechanisms of RRI elements. Semi-structured expert interviews were carried out with project partners, a survey was created and published online, and a Thematic Analysis was carried out to search available public deliverables from both projects for RRI elements. Limitations regarding the research methods were that the survey yielded not a lot of results, and that some project deliverables were confidential and could not be considered for the Thematic Analysis.

The main findings of this thesis suggest that the RRI dimensions Public Engagement and Science Education are intertwined in COLUMBUS and MARINA. RRI's innovative feature manifests itself through an underlying interconnectedness of its dimensions. Findings regarding Public Engagement, Science Education, and Ethics, highlight the importance of personal value gain for stakeholders in knowledge processes, an issue profoundly investigated by existing literature. Moreover, the evidence gathered further suggests that both projects have ambitions and the potential to contribute to sustainability by enhancing chances of knowledge reuse, and by creating collaborations which are seen as a driving factor in effectively realising sustainability (CORNELL et al., 2013). Regarding RRI implementation, it is argued that concrete and stipulated RRI practices could enhance RRI's effectiveness, and, coupled with environmental requirements, could produce tangible environmentally sustainable outcomes.

The following conclusions can be drawn from the major findings and will be relevant for RRI-interested practitioners of all sectors (e.g. research, public/private sectors, business, education, etc.), especially for those working in sustainable environmental development.

[11] Full title: COLUMBUS - Monitoring, Managing and Transferring Marine and Maritime Knowledge for Sustainable Blue Growth

[12] Full title: MARINA - Marine Knowledge Sharing Platform for Federating Responsible Research and Innovation Communities

Both projects under scrutiny have the potential to foster interdisciplinary knowledge exchanges and cooperation; a discussed advantage attributed to RRI (SMALLMAN et al., 2015, 14). If RRI manages to establish long-lasting collaborations, it could also effectively manage responsibilities and resources among stakeholders and multiply capacity for sustainability efforts in the long-term. Moreover, sound relationships between cooperating stakeholders could enhance long-term trust, and reliability of knowledge.

As can be seen in this thesis, some RRI dimensions indicate interconnectedness. Identifying and analysing intersection points between RRI dimensions can be crucial in order to effectively use and leverage interacting elements in knowledge activities. Furthermore, it might make more sense to emphasise mutually reinforcing activities and omit context-irrelevant RRI dimensions instead of blindly transforming RRI into a box-ticking exercise. Thus, responsiveness and reflexivity (STILGOE et al., 2013) regarding circumstances, inner project processes and stakeholder needs can play a crucial role in effective RRI implementation.

The personal level is important in stakeholder engagement, e.g. regarding personal value gain, respectful dealings, etc. Stakeholders should not only be informed about possible benefits, but also about how they can put acquired knowledge to use. Moreover, in engagement activities the focus should rather lie on the individual, than on the stakeholder type categorised by profession. Moreover, a moving away from professional categorisation to considering individuals' personal needs could enhance learning efforts as certain forms of learning (e.g. personal learning, social learning) are not necessarily related to professional interests. Successful engagement of stakeholders could be crucial for creation and future application of environmental knowledge.

The thesis substantiates the fact that RRI relies on existing tools and activities (RIBEIRO, 2016). Difficulties in knowledge processes that have been addressed throughout literature reoccur in project processes, either because pitfalls were not thoroughly investigated beforehand, or because they are still difficult to handle in practice. If RRI wants to deliver impacts and values towards stakeholders, it will have to work together with stakeholders in order to create knowledge processes in their interest and avoid pitfalls.

R&I should not only be conducted in compliance with environmental issues but has to put a focus on them in order to fully address them. Thus, an environmental dimension should officially be integrated in RRI in order to show that environmental issues are wilfully recognised and not dealt with on the side. Moreover, environmental sustainability affects stakeholders personally (food security, health, well-being, etc.) (THE BLUE SOCIETY, 2017), and "human and natural systems are dynamically interdependent" (DALE and NEWMAN, 2005, 352), hence environmental issues might be easier to highlight than others.

This thesis shows that RRI builds on known activities and techniques in knowledge processes, and some RRI elements could be standardised in order to produce effective outcomes, especially in regard to sustainability and environmental issues. Still, RRI will have to remain context-sensitive so as to ensure that outcomes are valuable for stakeholders. The combination of specific requirements and variations of free designs could create an effective RRI approach. Concerning this matter, further discussion on how to effectively realise RRI will be necessary.

6.1 Recommendations for further research

This master thesis serves as a preparatory work for further research on RRI or RRI-related issues. It aims at giving an overview over RRI-related project processes by investigating the subject of RRI in two projects through various approaches (semi-structured expert interviews, online survey, Thematic Analysis). Semi-structured interviews were conducted with internal stakeholders only. Investigating the personal experience of external stakeholders could reveal important perspectives regarding engagement processes that may remain hidden to RRI practitioners, e.g. personal value gain, professional/personal learning experiences, relationships with other stakeholders, etc. Further research in this direction will be important for practitioners, as this can help to design or adapt RRI processes accordingly.

Furthermore, research should focus on activities that support and guide new stakeholder knowledge towards effective implementation (e.g. day-to-day practices). Thus, the assessment of actual environmental outcomes of regular RRI processes could be evaluated in small-scale/regional case studies (e.g. environmental assessments, behavioural studies, etc.).

Case study approaches are judged as appropriate and useful for further studies regarding RRI-related processes, as RRI outcomes are estimated to be strongly context-dependent. Moreover, RRI is still in a developing phase and requires a deeper understanding of underlying knowledge processes.

7 References

Websites

CETAF (2017) : Engaging society for Responsible Research and Innovation (RRI): New options to move forward, at: www.cetaf.org/engaging-society-responsible-research-and-innovation-rri-new-options-move-forward [Accessed 26.09.2017].

COLUMBUS PROJECT (2017): at: http://www.columbusproject.eu/nausicaa [Accessed 26.09.2017].

COMMUNITY RESEARCH AND DEVELOPMENT INFORMATION SERVICE (2017): at: https://cordis.europa.eu/project/rcn/194809_en.html [Accessed 26.09.2017].

COMMUNITY RESEARCH AND DEVELOPMENT INFORMATION SERVICE (2017a): at: https://cordis.europa.eu/project/rcn/203169_en.html [Accessed 26.09.2017].

EUROPEAN COMMISSION (2017): Environment & Climate Action, at: http://ec.europa.eu/programmes/horizon2020/en/area/environment-climate-action [Accessed 26.09.2017].

EUROPEAN COMMISSION (2017b): Promoting Gender Equality in Research and Innovation, at: https://ec.europa.eu/programmes/horizon2020/node/797 [Accessed 26.09.2017].

EUROPEAN COMMISSION (2017c): Public Engagement in Responsible Research and Innovation, at: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/public-engagement-responsible-research-and-innovation [Accessed 26.09.2017].

EUROPEAN COMMISSION (2017d): Responsible research & innovation, at: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation [Accessed 26.09.2017].

EUROPEAN COMMISSION (2017e): Societal challenges, at: https://ec.europa.eu/programmes/horizon2020/en/h2020-section/societal-challenges [Accessed 26.09.2017].

LANCIAL, H. (2017): Le bassin de 10 000 m3 du futur Grand Nausicaá sera plein d'eau d'ici la fin de la semaine, La Voix du Nord, at: http://www.lavoixdunord.fr/140411/article/2017-03-29/le-bassin-de-10-000-m3-du-futur-grand-nausicaa-sera-plein-d-eau-d-ici-la-fin-de [Accessed 01.12.2017].

MARINA PROJECT (2017): at: http://www.marinaproject.eu/ [Accessed 26.09.2017].

MEDIZINISCHE UNIVERSITÄT WIEN (2017): Responsible Research and Innovation (RRI) – Eine Frage der Verantwortung, at: http://www.wtz-ost.at/veranstaltungen/responsible-research-and-innovation-rri-eine-frage-der-verantwortung/ [Accessed 01.10.2017].

NAUSICAA (2017): at: http://www.nausicaa.fr/ [Accessed 26.09.2017].

RESPONSIBLE RESEARCH AND INNOVATION IN PRACTICE (2017): at: https://www.rri-practice.eu [Accessed 01.12.2017].

RRI TOOLS (2016): Is RRI a fashion? Arie Rip on the future of RRI, Youtube, 16.02.2016, at: https://www.youtube.com/watch?v=LaBA2P-YQQw [Accessed 26.09.2017].

RRI TOOLS (s.a.): at: https://www.rri-tools.eu/about-rri [Accessed 26.09.2017].

UNIVERSITY OF OSLO (2017): Responsible Research and Innovation, Oslo Summer School in Comparative Social Science Studies 2017, at: http://www.sv.uio.no/english/research/phd/summer-school/courses-2017/responsible-research-and-innovation.pdf [Accessed 01.06.2017].

Project documents

EUROPEAN COMMISSION (2016d): Project document MARINA, Coordination and Support Action.

COLUMBUS public deliverables

Deliverable D2.1 (2015): Internal Project Management System, Lead parties for Deliverable: AQUATT

Deliverable D2.2 (2015): Guidelines on carrying out COLUMBUS Knowledge Transfer and Impact Measurement, Lead parties for Deliverable: AQUATT

Deliverable D4.1 (2016): Inventory of Relevant Projects by Priority Focus Area, Lead parties for Deliverable: EUROCEAN FOUNDATION

Deliverable D4.2 (2016): Portals and Repositories and their role in Knowledge Transfer to support Blue Growth, Lead parties for Deliverable: SEASCAPE CONSULTANTS

Deliverable D5.2 (2016): Progression of Knowledge Outputs To Knowledge Transfer, Lead parties for Deliverable: CETMAR

Deliverable D7.1 (2015): Dissemination and Exploitation Plan, including website. Lead parties for Deliverable: AQUATT

Deliverable D7.5 (2016): Blue Society Award Rules, Lead parties for Deliverable: AQUATT

Deliverable D8.1 (2016): Report on current metrics for research performance, Lead parties for Deliverable: UPMC

Deliverable D8.2 (2016): Report on existing knowledge transfer initiatives including their positive and negative attributes from an end user point of view, Lead parties for Deliverable: NERC-NOC

MARINA public deliverables

Deliverable D3.1 (2016): MML Workshop Methodology Approach and Actor Inclusion Criteria, Main author: GIN, I.

Deliverable D7.1 (2016): Definition of Dissemination and Communication Strategy, Main authors: EMANUELA DANÉ and MARA GUALANDI

Deliverable D7.8 (2016): Exploitation Plan, Main author: KNEZ, M.

Literature

ALAVI, M. and LEIDNER, D.E. (2001): Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues, MIS Quarterly, Vol. 25, Iss. 1, pp. 107-136.

ATTRIDE-STIRLING, J. (2001): Thematic networks: an analytic tool for qualitative research, Qualitative Research, London, Thousand Oaks, CA and New Delhi: SAGE Publications, Vol. 1, Iss. 3, pp. 385-405.

BARBESGAARD, M. (2016): Blue growth: saviour or ocean grabbing?, pp. 1-16, at: http://portal.research.lu.se/portal/files/11205193/5_ICAS_CP_Barbesgaard.pdf [Accessed 01.12.2017].

BARDONE, E. and LIND, M. (2016): Towards a phronetic space for responsible research (and innovation), Life Sciences, Society and Policy, Vol. 12, Iss. 1, pp. 1-18, DOI: 10.1186/s40504-016-0040-8, at: https://lsspjournal.springeropen.com/track/pdf/10.1186/s40504-016-0040-8?site=lsspjournal.springeropen.com [Accessed 01.12.2017].

BENDER, S. and FISH, A. (2000): The transfer of knowledge and the retention of expertise: the continuing need for global assignments, Journal of Knowledge Management, Vol. 4, Iss. 2, pp.125-137.

BIRNBAUM, M.H. (2012): A statistical test of independence in choice data with small samples, Judgment and Decision Making, Vol. 7, No. 1, pp. 97–109.

BISHOP, P.A. and HERRON, R.L. (2015): Use and Misuse of the Likert Item Responses and Other Ordinal Measures, International Journal of Exercise Science, Vol. 8, Iss. 3, pp. 297-302.

BLOK, V. and LEMMENS, P. (2015): The emerging concept of responsible innovation – Three reasons why it is questionable and calls for a radical transformation of the concept of innovation, pp. 19-35, in: KOOPS, B.J.; OOSTERLAKEN, I.; ROMIJN, H., SWIERSTRA, T.,

VAN DEN HOVEN, J. (eds.): Responsible Innovation 2, Springer, Cham, DOI: 10.1007/978-3-319-17308-5_2.

BOGNER, A.; LITTIG, B. and MENZ, W. (2009): Introduction: Expert Interviews – An Introduction to a New Methodological Debate, pp. 1-13, In: BOGNER, A.; LITTIG, B. and MENZ, W. (eds.): Interviewing experts, Basingstoke: Palgrave Macmillan.

BRAUN, V. and CLARKE, V. (2006): Using thematic analysis in psychology, Qualitative Research in Psychology, Vol. 3, Iss. 2, pp. 77-101.

BURGET, M.; BARDONE, E. and PEDASTE, M. (2017): Definitions and Conceptual Dimensions of Responsible Research and Innovation: A Literature Review, Science and Engineering Ethics, Vol. 23, Iss. 1, pp. 1–19, DOI: I 10.1007/s11948-016-9782-1.

CEDEFOP (2009): European guidelines for validating non-formal and informal learning, Luxembourg: Office for Official Publications of the European Communities, ISBN 978-92-896-0602-8. [Accessed 01.12.2017].

CORNELL, S.; BERKHOUT, F.; TUINSTRA, W.; TÀBARA, J.D.; JÄGER, J.; CHABAY, I.; WIT, B.; LANGLAIS, R.; MILLS, D.; MOL, P.; OTTO, I.K.; PETERSEN, A.; POHL, C. and KERKHOFF, L. (2013): Opening up knowledge systems for better responses to global environmental change, Environmental Science & Policy, Vol. 28, pp. 60-70, DOI: http://doi.org/10.1016/j.envsci.2012.11.008.

DALE, A. and NEWMAN, L. (2005): Sustainable development, education and literacy, International Journal of Sustainability in Higher Education, Vol. 6, Iss. 4, pp. 351 – 362, at: https://doi.org/10.1108/14676370510623847 [Accessed 26.09.2017].

EDWARDS, R. and HOLLAND, J. (2013): What is qualitative interviewing? London, New York: Bloomsbury Publishing Plc, ISBN 9781780938523.

EISENHARDT, K.M. (1989): Building theories from case study research, Academy of Management Review, Vol. 14, Iss. 4, pp. 532-550, DOI: 10.2307/258557.

EUROPEAN COMMISSION (2010): Europe 2020 - A European strategy for smart, sustainable and inclusive growth, at: http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf [Accessed 26.09.2017].

EUROPEAN COMMISSION (2012): Commission Recommendation of 17.7.2012 on access to and preservation of scientific information, at: http://ec.europa.eu/research/science-society/document_library/pdf_06/recommendation-access-and-preservation-scientific-information_en.pdf [Accessed 01.12.2017].

EUROPEAN COMMISSION (2012a): Responsible Research and Innovation - Europe's ability to respond to societal challenges, DOI: 10.2777/11739, at: https://ec.europa.eu/research/swafs/pdf/pub_public_engagement/responsible-research-and-innovation-leaflet_en.pdf [Accessed 26.09.2017].

EUROPEAN COMMISSION (2013): The Grand Challenge - The design and societal impact of Horizon 2020, Directorate-General for Research and Innovation, DOI: 10.2777/85874, Luxembourg: Publications Office of the European Union.

EUROPEAN COMMISSION (2014): HORIZON 2020 in brief – The EU framework programme for Research & Innovation, DOI: 10.2777/3719, Luxembourg: Publications Office of the European Union.

EUROPEAN COMMISSION (2014a): Vademecum on Gender Equality in Horizon 2020, RTD B7, at: http://ec.europa.eu/research/swafs/pdf/pub_gender_equality/vademecum_gender_h2020.pdf [Accessed 1.12.2017]

EUROPEAN COMMISSION (2016): H2020 Programme - Guidance on Gender Equality in Horizon 2020, Directorate-General for Research & Innovation, at: http://eige.europa.eu/sites/default/files/h2020-hi-guide-gender_en.pdf [Accessed 05.10.2017].

EUROPEAN COMMISSION (2016a): Horizon 2020 – Work Programme 2016-2017 – Science with and for Society, at: http://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-swfs_en.pdf [Accessed 26.09.2017].

EUROPEAN COMMISSION (2016b): Open Innovation, Open Science, Open to the World – a vision for Europe, DOI: 10.2777/061652, at: http://www.openaccess.gr/sites/openaccess.gr/files/Openinnovation.pdf [Accessed 26.09.2017].

EUROPEAN COMMISSION (2016c): Strategic Engagement for Gender Equality from 2016-2019, Luxembourg: Publications Office of the European Union, DOI: 10.2838/454429, at: http://ec.europa.eu/anti-trafficking/sites/antitrafficking/files/strategic_engagement_for_gender_equality_en.pdf [Accessed 26.09.2017].

EUROPEAN COMMISSION (2017a): Guidelines to the Rules on Open Access to Scientific Publications and Open Access to Research Data in Horizon 2020, at: http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf [Accessed 01.12.2017].

EUROSTAT (2015): Sustainable development in the European Union - 2015 monitoring report of the EU Sustainable Development Strategy, Luxembourg: Publications Office of the European Union, ISSN 2443-8480, at: http://ec.europa.eu/eurostat/documents/3217494/6975281/KS-GT-15-001-EN-N.pdf [Accessed 26.09.2017].

FELT, U. (2017): Responsible Research and Innovation, pp. 1-10, in: GIBBON, S.; BARBARA PRAINSACK, B.; HILGARTNER, S.; and LAMOREAUX, J. (eds.): Handbook of Genomics, Health and Society, London/New York: Routledge.

FLINT, R.W. (2013): Practice of Sustainable Community Development – A participatory framework for change, New York: Springer, DOI: 10.1007/978-1-4614-5100-6_2.

FLYVBJERG, B. (2006): Five misunderstandings about case-study research, Qualitative Inquiry, Vol. 12, No. 2, pp. 219-245, DOI: 10.1177/1077800405284363.

FORSBERG, E.-M.; SHELLEY-EGAN, C.; LADIKAS, M. and OWEN, R. (20178): Implementing Responsible Research and Innovation in research funding and research conducting organisations – what have we learned so far?, pp. 3-11, in: FERRI, F.; DWYER, N.; RAICEVICH, S.; GRIFONI, P.; ALTIOK, H.; ANDERSON H.T.; LAOURIS, Y. and SILVESTRI, C. (eds.): Governance and Sustainability of Responsible Research and Innovation Processes – Cases and Experiences, Cham: Springer.

GARCIA, D.; ZUAZUA, E. ; PERAT, B. and LÓPEZ, I. (2016): A practical guide to responsible research and innovation – Key lessons from RRI TOOLS, at: https://www.rri-tools.eu/documents/10184/16301/RRI+Tools.+A+practical+guide+to+Responsible+Research+and+Innovation.+Key+Lessons+from+RRI+Tools [Accessed 29.06.2017].

GHANEMI, K. and YAN, S. (2017): Companies and Responsible Innovation: Toward a Long-Term Success, MOJ Public Health, Vol. 6, Iss. 4: 00154, pp. 1-2, at: http://medcraveonline.com/MOJPH/MOJPH-06-00176.pdf [Accessed 29.06.2017].

GRAHAM, I.D.; LOGAN, J. ; HARRISON, M.B.; STRAUS, S.E.; TETROE, J.; CASWELL. W. and ROBINSON, N. (2006): Lost in knowledge translation: time for a map?, The Journal of Continuing Education in the Health Professions, Vol. 26, Iss. 1, pp. 13-24, at: http://onlinelibrary.wiley.com/doi/10.1002/chp.47/pdf [Accessed 29.06.2017].

GREEN, L.W.; OTTOSON, J.M.; GARCIA, C. and HIATT, R.A. (2009): Diffusion Theory and Knowledge Dissemination, Utilization, and Integration in Public Health, Annu. Rev. Public Health, Vol. 30, pp. 151-174, DOI: 10.1146/annurev.publhealth.031308.100049.

GUBA, E.G. (1981): Criteria for assessing the trustworthiness of naturalistic inquiries, Educational Communication and Technology Journal, Vol. 29, pp. 75–91.

GURZAWSKA, A., MÄKINEN, M. and BREY, P. (2017): Implementation of Responsible Research and Innovation (RRI) Practices in Industry: Providing the Right Incentives, *Sustainability 2017,* Vol. *9,* Iss. 10: 1759, pp. 1-26, DOI:10.3390/su9101759.

HAZELKORN, E.; RYAN, C.; BEERNAERT, Y.; CONSTANTINOU, C.P.; DECA, L.; GRANGEAT, M.; KARIKORPI, M.; LAZOUDIS, A.; CASULLERAS, R.P. and WELZEL-BREUER, M. (2015): Science Education for Responsible Citizenship, Directorate-General for Research and Innovation, Luxembourg: Publications Office of the European Union, DOI: 10.2777/12626 , at: http://ec.europa.eu/research/swafs/pdf/pub_science_education/KI-NA-26-893-EN-N.pdf [Accessed 01.12.2017].

ITALIAN PRESIDENCY OF THE COUNCIL OF THE EUROPEAN UNION (2014): Rome Declaration on Responsible Research and Innovation in Europe, at: https://ec.europa.eu/research/swafs/pdf/rome_declaration_RRI_final_21_November.pdf [Accessed 05.10.2017].

JAMIESON, S. (2004): Likert scales: how to (ab)use them, Medical education, Vol. 38, Iss. 12, pp. 1212-1218.

JAVADI, M. and ZAREA, K. (2016): Understanding Thematic Analysis and its Pitfall, Journal of Client Care, Vol. 1, Iss. 1, pp. 34-40, at:

https://journals.lexispublisher.com/jCC/download/Get/Pdf/MjAwMTE7 [Accessed 05.10.2017].

JHA, N.K. (2015): Integration of Green Design and Manufacturing for Sustainability in Undergraduate Engineering Curriculum, Conference: The Seventh International Conference on Engineering Education for Sustainable Development, June 9-12, 2015, Vancouver, Canada.

KETTNER, C., KÖPPLE, A. and STAGL, S. (2014): Towards an operational measurement of socioecological performance — Working paper, No. 52, WWW for Europe, at: http://www.foreurope.eu [Accessed 01.12.2017].

KHODZHAEVA, A.; SAND, M.; JOÃO MAIA, M.; WOLL, S.; VELLOSO, G.; FRANK, D. and ITAS (2014): Responsible Research and Innovation – Perspectives and Challenges: Report on the S.NET 6th Annual Meeting: "Better Technologies with No Regret?", pp. 111-114, Technikfolgenabschätzung – Theorie und Praxis 24. Jg., Heft 1.

LEMOS, M.C and MOREHOUSE, B.J. (2005): The co-production of science and policy in integrated climate assessments, Global Environmental Change, Vol. 14, pp. 57-68.

LENZNER, T., NEUERT, C. and OTTO, W. (2016): Cognitive Pretesting. GESIS Survey Guidelines. Mannheim, Germany: GESIS – Leibniz Institute for the Social Sciences, at: https://www.gesis.org/fileadmin/upload/SDMwiki/LenznerNeuertOtto_Cognitive_Pretesting.pdf [Accessed 01.12.2017].

LIYANAGE, C.; TAHA ELHAG, T.; BALLAL, T. and LI, Q. (2009): Knowledge communication and translation – A knowledge transfer model, Journal of Knowledge Management, Vol. 13, Iss. 3, pp. 1-23, at: http://centaur.reading.ac.uk/12272/1/KT%20Model%20-%20Liyanage%20et%20al_PREPRINT%20VERSION.pdf [Accessed 26.09.2017].

LUND DECLARATION (2009): Europe must focus on the grand challenges of our time, Conference "New Worlds - New Solutions", July 2009, at: http://www.vr.se/download/18.7dac901212646d84fd38000336/ [Accessed 26.09.2017].

LUND DECLARATION (2015): Europe must speed up solutions to tackle grand challenges through alignment, research, global cooperation and achieving impact, Conference "Lund Revisited - Next steps in tackling societal challenges", December 2015, at: https://www.vr.se/download/18.43a2830b15168a067b9dac74/1454326776513/The+Lund+Declaration+2015.pdf [Accessed 26.09.2017].

MAYER, H.O. (2013): Interview und Schriftliche Befragung: Grundlagen und Methoden Empirischer Sozialforschung, Auflage 6, München: Oldenbourg, ISBN 978-3-486-70691-8.

MEUSER, N. and NAGEL, U. (1991): ExpertInneninterviews - vielfach erprobt, wenig bedacht: ein Beitrag zur qualitativen Methodendiskussion, pp. 441-471, in: GARZ, D. and KRAIMER, K. (Eds.): Qualitativ-empirische Sozialforschung: Konzepte, Methoden, Analysen. Opladen: Westdt. Verl., ISBN 3-531-12289-4.

MEUSER, N. AND NAGEL, U. (2009): The Expert Interview and Changes in Knowledge Production, pp. 17-42, in: BOGNER, A.; LITTIG, B. and MENZ, W. (eds.): Interviewing experts, Basingstoke: Palgrave Macmillan.

MINTZBERG, H. (1979): An Emerging Strategy of "Direct" Research, Administrative Science Quarterly, Qualitative Methodology, Vol. 24, No. 4, pp. 582-589, DOI: 10.2307/2392364.

NONAKA, I. and TAKEUCHI, H. (1996): The knowledge creating company: how Japanese companies create the dynamics of innovation, New York: Oxford University Press, ISBN 978-0-19-509269-1.

ONCHIRI, S. (2013): Conceptual model on application of chi-square test in education and social sciences, Academic journals, Vol. 8, Iss. 15, pp. 1231-1241.

OWEN, R. (2015): Responsible Research and Innovation: Options for research and innovation policy in the EU, at: https://ec.europa.eu/research/innovation-union/pdf/expert-groups/Responsible_Research_and_Innovation.pdf [Accessed 26.09.2017].

OWEN, R.; MACNAGHTEN, P. and STILGOE, J. (2012): Responsible research and innovation: From science in society to science for society, with society, Science and Public Policy, Vol. 39, Iss. 6, pp. 751-760.

PAULIN, D. and SUNESON, K. (2012): Knowledge Transfer, Knowledge Sharing and Knowledge Barriers – Three Blurry Terms in KM, The Electronic Journal of Knowledge Management, Vol. 10, Iss. 1, pp. 81-91, at: www.ejkm.com [Accessed 01.12.2017].

REED, M.S; STRINGER, L.C.; FAZEY, I; EVELY, A.C and KRUIJSEN, J.H.J. (2014): Five principles for the practice of knowledge exchange in environmental management, Journal of Environmental Management, Vol. 146, pp. 337-345.

REICHERTZ, J. (2004): Objective Hermeneutics and Hermeneutic Sociology of Knowledge, pp. 290-295, in: FLICK, U., VON KARDORFF, E. and STEINKE, I. (eds.): A Companion to Qualitative Research, London: SAGE Publications Inc.

RIBEIRO, B.; SMITH, R. D. J. and MILLAR, K. (2016). A mobilising concept? Unpacking academic representations of Responsible Research and Innovation, Science and engineering ethics, Vol. 23, Iss. 1, pp. 1-20, at: https://kclpure.kcl.ac.uk/portal/files/46638187/Ribeiro_Smith_and_Millar_2016_A_mobilising_Concept.pdf [Accessed 01.12.2017].

RIEGE, A. (2005): Three-dozen knowledge-sharing barriers managers must consider, Journal of knowledge management, Vol. 9, Iss. 3, pp. 18-35.

RIP, A. (2014): The past and the future of RRI, Life Sciences, Society and Policy, Vol. 10, pp. 1-15, at: https://link.springer.com/content/pdf/10.1186%2Fs40504-014-0017-4.pdf [Accessed 01.12.2017].

RIP, A. (2016): The clothes of the emperor. An essay on RRI in and around Brussels, Journal of Responsible Innovation, Vol. 3, No. 3, pp. 290-304, at: http://www.tandfonline.com/doi/pdf/10.1080/23299460.2016.1255701?needAccess=true [Accessed 01.12.2017].

ROBINSON, J. (2004): Squaring the circle? Some thoughts on the idea of sustainable development, Ecological Economics, Vol. 48, Iss. 4, pp. 369 – 384.

RODRIGUEZ, H.; FISHER, E. and SCHUURBIERS, D. (2013): Integrating science and society in European Framework Programmes: Trends in project-level solicitations, Research Policy, Vol. 42, Iss. 5, pp. 1126–1137.

SCHMITHÜSEN, F. (2013): Three hundred years of applied sustainability in forestry, Unasylva, Vol. 64 (240), pp. 3-11.

SCHROEDER, D. and LADIKAS, L. (2015): Towards principled Responsible Research and Innovation: Employing the difference principle in funding decisions, Journal of Responsible Innovation, Vol. 2, Iss. 2., pp. 169-183, ISSN 2329-9460, at: http://clok.uclan.ac.uk/12757/ [Accessed 01.12.2017].

SCHWARTZ, D. G. (2006): Encyclopedia of Knowledge Management, Hershey, London: IGI Global.

SHENTON, A.K. (2004): Strategies for ensuring trustworthiness in qualitative research projects, Education for Information, Vol. 22, pp. 63–75.

SMALLMAN, M; LOMME, K. and FAULLIMMEL, N. (2015): Report on the analysis of needs and constraints of the stakeholder groups in RRI practices in Europe, RRI TOOLS – Fostering responsible research and innovation, D2.2, at: https://www.rri-tools.eu/documents/10184/107098/RRITools_D2.2-AnalysisNeeds+ConstraintsStakeholderGroupsRRI.pdf/83c55909-118c-4cad-b7e4-74d5a770c8a1 [Accessed 26.09.2017].

STAHL, B.C. (2013): Responsible research and innovation: The role of privacy in an emerging framework, Science and Public Policy, Vol. 40, Iss. 6, pp. 708–716.

STILGOE, J., OWEN, R. and MACNAGHTEN, P. (2013): Developing a framework for responsible innovation, Research Policy, Vol. 42, Iss. 9, pp. 1568–1580.

STRAND, R.; SPAAPEN, J.; BAUER, M.W.; HOGAN, E.; REVUELTA, G. and STAGL, S. (2015): Indicators for promoting and monitoring Responsible Research and Innovation – Report from the expert group on policy indicators for Responsible Research and Innovation, Directorate-General for Research and Innovation, Luxembourg: Publications Office of the European Union, DOI: 10.2777/9742, at: http://ec.europa.eu/research/swafs/pdf/pub_rri/rri_indicators_final_version.pdf [Accessed 26.09.2017].

SUTCLIFFE, H. (2011): A report on Responsible Research & Innovation, MATTER, at: http://www.diss.unimi.it/extfiles/unimidire/243201/attachment/a-report-on-responsible-research-innovation.pdf [Accessed 26.09.2017].

THE INTERNATIONAL ASSOCIATION FOR PUBLIC PARTICIPATION (s.a.): Foundations of public participation, at: https://c.ymcdn.com/sites/www.iap2.org/resource/resmgr/files/iap-006_brochure_a3_internat.pdf [Accessed 01.12.2017].

THE RESPONSIBLE-INDUSTRY PROJECT CONSORTIUM (2017): Responsible-Industry - Guide for the implementation of Responsible Research and Innovation (RRI) in the industrial

context, at: http://www.nanotec.it/public/wp-content/uploads/2017/07/R-I_02_Guide-6.pdf [Accessed 26.09.2017].

ULLRICH, P. (2006): Das explorative ExpertInneninterview: Modifikationen und konkrete Umsetzung der Auswertung von ExpertInneninterviews nach Meuser/Nagel, pp. 100-106, in: ENGARTNER, T., KURING, D., and TEUBL, T. (2006): Die Transformation des Politischen: Analysen, Deutungen und Perspektiven. Siebentes und achtes DoktorandInnenseminar der Rosa-Luxemburg-Stiftung, Berlin: Dietz.

UNEP (2013): Embedding the Environment in Sustainable Development Goals, UNEP Post-2015 Discussion Paper 1. United Nations Environment Programme (UNEP), Nairobi, at: https://sustainabledevelopment.un.org/content/documents/2037embedding-environments-in-SDGs-v2.pdf [Accessed 26.09.2017].

UNITED NATIONS (1972): Declaration of the United Nations Conference on the Human Environment, A/RES/2994, at: http://www.un-documents.net/aconf48-14r1.pdf [Accessed 26.09.2017].

UNITED NATIONS (1992): Agenda 21, in: United Nations Conference on Environment & Development, Rio de Janeiro, A/CONF.151/26, at: https://sustainabledevelopment.un.org/content/documents/Agenda21.pdf [Accessed 26.09.2017].

UNITED NATIONS (1992a): The Rio Declaration on Environment and Development, A/CONF.151/26 (Vol. I), at: http://www.unesco.org/education/pdf/RIO_E.PDF [Accessed 26.09.2017].

UNITED NATIONS (1997): Programme for the Further Implementation of Agenda 21, A/RES/S-19/2, at: http://www.un.org/en/ga/search/view_doc.asp?symbol=A/RES/S-19/2 [Accessed 26.09.2017].

UNITED NATIONS (2012): The future we want, A/RES/66/288, at: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/66/288&Lang=E [Accessed 10.09.2017].

UNITED NATIONS (2015): Transforming Our World: The 2030 Agenda for Sustainable Development, in A/RES/70/1, at: https://sustainabledevelopment.un.org/content/documents/21252030%20Agenda%20for%20Sustainable%20Development%20web.pdf [Accessed 26.09.2017].

VALLETTE, P. (2013) : Vers la Blue Society, *VertigO - la revue électronique en sciences de l'environnement, at :* http://journals.openedition.org/vertigo/14293, DOI : 10.4000/vertigo.14293 [Accessed 1.12.2017].

VAN DEN HOVEN, J.; NIELSEN, L.; ROURE, F.; RUDZE, L. and STILGOE, J. (2013): Options for strengthening Responsible Research and Innovation - Report of the Expert Group on the State of Art in Europe on Responsible Research and Innovation, Luxembourg: Publications Office of the European Union, DOI: doi: 10.2777/46253, at: http://ec.europa.eu/research/science-society/document_library/pdf_06/options-for-strengthening_en.pdf [Accessed 26.09.2017].

VAN KERKHOFF, L. and LEBEL, L. (2006): Linking Knowledge and Action for Sustainable Development, Annual Review of Environment and Resources, Vol. 31, pp. 445–77.

VON SCHOMBERG, R. (2011): Prospects for Technology Assessment in a framework of responsible research and innovation, pp. 1-19, in: DUSSELDORP, M. and BEECROFT, R. (eds.): Technikfolgen abschätzen lehren: Bildungspotenziale transdisziplinärer Methoden, Wiesbaden: Vs Verlag, in print, at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2439112 [Accessed 01.12.2017].

VON SCHOMBERG, R. (2013): A vision of responsible innovation, pp. 1-35, in: R. Owen, HEINTZ, M. and BESSANT, J. (eds.): Responsible Innovation. London: John Wiley, forthcoming, at: http://www.pacitaproject.eu/wp-content/uploads/2014/04/von-Schomberg-RRI-owenbookChapter.pdf, [Accessed 26.09.2017].

WARD, V.; HOUSE, A. and HAMER, S. (2009): Developing a framework for transferring knowledge into action: a thematic analysis of the literature, Journal of Health Services Research and Policy, Vol. 14, Iss. 3, pp. 1-15, DOI:10.1258/jhsrp.2009.008120, at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2933505/pdf/ukmss-31789.pdf [Accessed 01.12.2017].

WILFORD, S.; FISK, M. and STAHL, B. (2016): Guidelines for Responsible Research and Innovation, Centre for Computing and Social Responsibility, De Montfort University, Leicester, at: http://www.great-project.eu/Deliverables10 [Accessed 01.12.2017].

WINKLER, I.T. and WILLIAMS, C. (2017): The Sustainable Development Goals and human rights: a critical early review, The International Journal of Human Rights, Vol. 21, pp. 1023-1028, DOI: 10.1080/13642987.2017.1348695.

WORLD COMMISSION ON ENVIRONMENT AND DEVELOPMENT (1987): Our Common Future, Oxford: Oxford University Press, ISBN 019282080X.

YIN, R.K. (2012): Applications of case study research, 3rd edition, Thousand Oaks: SAGE Publications Inc.

ZOHRABI, M. (2013): Mixed Method Research: Instruments, Validity, Reliability and Reporting Findings, Theory and Practice in Language Studies, Vol. 3, Iss. 2, pp. 254-262.

ZWART, H. and NELIS, A. (2009): What is ELSA genomics? Science and Society Series on Convergence Research, EMBO Reports, Vol. 10, No. 6, pp. 540-544.

ZWART, H.; LANDEWEERD, L. and VAN ROOIJ, A. (2014): Adapt or perish? - Assessing the recent shift in the European research funding arena from 'ELSA' to 'RRI', Life Sciences, Society and Policy, Vol. 10, pp. 1-19, DOI: 10.1186/s40504-014-0011-x, at: https://lsspjournal.springeropen.com/articles/10.1186/s40504-014-0011-x [Accessed 01.12.2017].

8 Appendixes

The interview transcripts, the coded survey data, the Thematic Analysis Word documents, and the informed consent forms are available upon request.

Appendix A: Interview guide

- You have been working with RRI on the MARINA project. Could you tell me: How did you first get in touch with the concept of RRI? How did you first learn about it? / Columbus is a H2020 project that builds on the Blue Society as well as on Responsible Research and Innovation principles. How did you first get in touch with the concept of RRI?

A) Characteristics of RRI in the projects
B) Knowledge transfers and how RRI can be excepted to influence them
C) RRI and sustainable environmental development

A) Characteristics of RRI in the projects

- What main purpose does the concept of RRI have for this project? / Where do you see is the main objective of RRI for this project?

- The RRI dimensions defined by the European Commission are *Science Education, Public Engagement, Open Access, Gender Equality, Ethics and Governance.* How are these dimensions covered within the project? / Which of these RRI dimensions do you see largely covered within the project?

- Working in this project and with different stakeholders, what RRI dimensions do you estimate to be the most complicated to realize? Why?
    - *Which are the easiest ones to implement?*

- How are the stakeholders (by this I mean project partners as well as external stakeholders) made aware of RRI in this project?
    - *How could they be made more aware? / Why is it difficult to make them aware of RRI?*

- What personal lesson do you think can stakeholders learn from applied RRI principles? Why?

B) Knowledge transfers and how RRI can be excepted to influence them

- Looking at this particular project, what are the most important activities/tools/actions to make knowledge exchange possible between the project's stakeholders?
  - *How important is (each of the) RRI (dimensions) for these Knowledge Exchange and Transfer? Why? / What role does RRI play in enabling them in communicating?*

- In MARINA/COLUMBUS, what different kinds of knowledge are exchanged and transferred? / How would you define the knowledge that's being exchanged?

- What is the main goal of the knowledge transfer and exchange that is happening? / What other goal, besides […], could RRI have in this project?
  - *Between which stakeholders is a knowledge exchange taking place?*

- What are the main factors that determine whether a knowledge exchange works well or doesn't work well (in the projects, otherwise from your experience)?
  - Where do you see RRI's biggest impact on the knowledge transfer and knowledge exchange processes?

C) RRI, sustainability and environment

- A very important topic throughout H2020 is "sustainability". Looking at the MARINA/COLUMBUS project, in what way do you think will the outcomes of this particular project be sustainable? Why?
  - How do you think can especially RRI principles significantly support this sustainability in the long term? Why?
- In what way can the outcomes of the MARINA/COLUMBUS project be relevant for the environment (directly or even indirectly)?

- Where do you see RRI's biggest potential to cause environmental changes? Why?

- How does the fact that RRI doesn't impose any mandatory guidelines influence your work with this concept? / What do you think about the fact there are no mandatory RRI requirements?

- In an ideal world, how would you want a concept like RRI to change people's conception/attitude towards our environment?

- So, we have come to the end of our talk, I asked you all my questions and I really want to thank you for taking your time and giving me some precious insights in the work with RRI. Is there something left that you want to say about RRI that we haven't talked about yet?

Appendix B: Survey questionnaire

The survey can be found online at: https://docs.google.com/forms/d/e/1FAIpQLSfPbL9-H3zhwtdZi3nQC2k0NPF7KuBYv1_LKVx1uEvmNkXQVg/viewform (01.12.2017).

- o Indicates a Multiple Choice question (only one option)
- ▪ Indicates a Multiple Response question (multiple options)
- × Indicates mandatory questions

For practical reasons, the questions are numbered consecutively.

Responsible Research and Innovation in MARINA and COLUMBUS

Dear Madam, Dear Sir,

I am pleased you found your way to this online survey.

My name is Viktoria Brunner, I am writing my master thesis about Responsible Research and Innovation in two EC-funded projects: MARINA and COLUMBUS. Therefore, I would like to study the opinions of all the stakeholders (project partners as well as external stakeholders) who were engaged in one of these projects (short or long activities, e.g. by sharing information, participating in workshops and conferences, being active on the project's online platforms...). The goal is to find out how you perceived the project and the work within it.

The survey doesn't request any explicit knowledge about the projects themselves but will ask about your personal experience!

Please note that the survey's results will form an essential part of my research work but be assured that your anonymity will be guarded at all instances.

Please take your time to answer all the questions genuinely.

The survey will take about 15 min.

I thank you very much in advance for your time!

If you have any further questions, please don't hesitate to contact me:
Viktoria Brunner - viktoria.brunner@students.boku.ac.at
Master programme: Environment and Bio-Resources Management
at the University of Natural Resources and Life Sciences, Vienna

1. Which project do/did you participate in? (Even if you participated in both MARINA and COLUMBUS, please choose the one you predominantly worked on) ×
   - o COLUMBUS
   - o MARINA

Your stakeholder role

2. What is/was your role in the project's activities? (Check all the boxes that apply) ×
   - ▪ Policy Maker

- Civil Society Organisation
- Business and Industry
- Researcher
- Educator
- Citizen
- Journalist
- Project partner

3. What domains are you professionally working in? (short open question)

Activities

4. What was your personal aim of your participation in the activities of the project? (activities = workshops, platforms, conferences,...) (Check all the boxes that apply) ×
   - To contribute by introducing a product/service/methodology/knowledge/...
   - To benefit by learning about a product/service/methodology/knowledge/...
   - To get engaged with different participants/stakeholders
   - To learn about a marine/maritime domain of interest
   - To learn about the applied methodology (Knowledge transfer methodology/workshop methodology, ...)
   - Other: ___

5. During your engagement in the project, do/did you have the opportunity... (Check all the boxes that apply) ×
   - ... to access freely available data (documents, publications, research findings,...)
   - ... to learn about a new scientific topic and this topic was explained to you in a way that you can understand it and explain it to others
   - ... to engage with a wide range of different people from society (who have different jobs, different interests,...)
   - ... to work on research questions that can solve societal and economic problems
   - ... to produce results that follow ethical principles
   - ... to support equality between women and men
   - ... to change decision-making in policies
   - ... to anticipate future opportunities, weaknesses, challenges, risks of a given subject
   - ... to speak your mind and to influence decision-making in Research and Innovation
   - ... to have insight in the project's processes
   - ... to work on the concept of sustainable development
   - ... to learn about needs of others that are involved in this project
   - None of the before mentioned opportunities were given
   - Other: ___

6. Which stakeholders would you have wished to be more involved in the project's activities? (Check all the boxes that apply) ×
   - Policy Makers
   - Civil Society Organisations
   - Business and Industry
   - Researchers
   - Educators
   - Citizens
   - Journalists
   - None

7. What stakeholders do you think are/were influencing the activities in which you participated the most? (Please rank according to influence) ×

Policy Makers	○	○	○	○	○	○
Civil Society Organisations	○	○	○	○	○	○
Business and Industry	○	○	○	○	○	○
Researchers	○	○	○	○	○	○
Educators	○	○	○	○	○	○
Citizens	○	○	○	○	○	○
Journalists	○	○	○	○	○	○

Your interests

8. What environmental issues were you most interested in within the project's activities? (short open question)

9. What environmental would you have liked to talk about more in the project's activities? (short open question)

Knowledge in the project

10. What activities within the project help/helped you to exchange (to receive and to give) knowledge with other participants/stakeholders? (Check all the boxes that apply) ×
    - ▪ Conferences
    - ▪ Workshops
    - ▪ Social media sites (platform, LinkedIn, Facebook, Twitter,...)
    - ▪ Brokerage events
    - ▪ Marine/maritime events
    - ▪ Direct meetings with project partners of the consortium
    - ▪ None

11. How satisfied or dissatisfied were you with the relations you had with people in the project? ×
    - ○ Very satisfied
    - ○ Satisfied
    - ○ Somewhat satisfied
    - ○ Neutral
    - ○ Somewhat Dissatisfied
    - ○ Dissatisfied
    - ○ Very dissatisfied

12. Will you continue to use methods you learned or knowledge you acquired in the project's activities for your private or professional life? ×
    - ○ Yes, definitely

- Yes, very likely
- Undecided
- Not very likely
- Definitely not

13. How will you use the experiences you made in the project's activities for your private or professional life? (Please give some short examples) (short open question)

---

14. What are/were the barriers in knowledge exchange in the project's activities? (Check all the boxes that apply) ×
    - The methodology was too complicated
    - Project partners and/or participants were unavailable
    - The participants' objectives were conflicting
    - Different use of scientific/technical language lead to misunderstandings
    - Different use of English (or other National language) lead to misunderstandings
    - The chosen communication tools were ineffective
    - None
    - Other: ___

15. What new knowledge do you take from this project? (Check all the boxes that apply) ×
    - Knowledge about a product/service/methodology/...
    - Knowledge about different people/stakeholders and their preferences/interests/worries...
    - Knowledge about societal issues
    - Knowledge about environmental issues other than marine/maritime issues
    - Knowledge about economic issues
    - Knowledge about a marine/maritime domain of interest
    - Knowledge about the applied methodology (Knowledge transfer methodology/workshop methodology, ...)
    - Knowledge about policies
    - None
    - Other: ___

Engagement

16. How often do/did you get engaged in the project's activities? ×
    - I am still engaged on a regular basis (multiple times per month)
    - I am still engaged on a less regular basis (multiple times per year)
    - I was engaged more than 20 times and I am not engaged anymore
    - I was engaged more than 20 times and I will continue my engagement
    - I was engaged between 10-20 times and I am not engaged anymore
    - I was engaged between 10-20 times and I will continue my engagement
    - I was engaged less than 10 times and I am not engaged anymore
    - I was engaged less than 10 times and I will continue my engagement
    - I was engaged once and I am not engaged anymore
    - I was engaged once and I will continue my engagement

17. How satisfied or dissatisfied are you with the opportunities you were given to express your opinions on topics/in discussions...? ×
    - Very satisfied
    - Satisfied
    - Somewhat satisfied
    - Neutral
    - Somewhat Dissatisfied
    - Dissatisfied
    - Very dissatisfied

18. How satisfied or dissatisfied are you with the value that was given to your input/contribution in the project? ×
    - Very satisfied
    - Satisfied
    - Somewhat satisfied
    - Neutral
    - Somewhat Dissatisfied
    - Dissatisfied
    - Very dissatisfied

19. How satisfied or dissatisfied are you with the new knowledge you received from the project? ×
    - Very satisfied
    - Satisfied
    - Somewhat satisfied
    - Neutral
    - Somewhat Dissatisfied
    - Dissatisfied
    - Very dissatisfied

Research & innovation
For the following questions, please give answers based on your personal preferences and interests!

20. How interested are you in Research and Innovation? ×
    - Extremely interested
    - Very interested
    - Moderately interested
    - Slightly interested
    - Not at all interested

21. How important is it to you to have the possibility to get engaged with other people in finding solutions to urgent societal, economic and environmental issues? ×
    - Highly important
    - Important
    - Neutral
    - Less important
    - Not at all important

22. How important is it to you to learn about Research and Innovation issues and to acquire scientific competences? ×
    - Highly important
    - Important
    - Neutral
    - Less important
    - Not at all important

23. How important is it to you that gender equality is supported throughout Research and Innovation processes? ×
    - Highly important
    - Important
    - Neutral
    - Less important
    - Not at all important

24. How important is it to you that Research and Innovation anticipates future opportunities, challenges and risks for the next generations? ×
    - Highly important
    - Important

- Neutral
- Less important
- Not at all important

25. How important is it to you that scientific publications and data are made publicly available? ×
    - Highly important
    - Important
    - Neutral
    - Less important
    - Not at all important

26. How important is it to you that Research and Innovation respect ethical principles? ×
    - Highly important
    - Important
    - Neutral
    - Less important
    - Not at all important

27. How important is it to you that Research and Innovation solve economic concerns? ×
    - Highly important
    - Important
    - Neutral
    - Less important
    - Not at all important

28. How important is it to you that Research and Innovation respect the environment and natural resources? ×
    - Highly important
    - Important
    - Neutral
    - Less important
    - Not at all important

29. How important is it to you to that politics support society-centred Research and Innovation programmes? ×
    - Highly important
    - Important
    - Neutral
    - Less important
    - Not at all important

30. Your gender: ___ (short open response)
31. Your age: ___ (short open response)
32. Your nationality: ___ (short open response)

Appendix C: Sociodemographic data of interviewees

Pretest interview

Company	**Name**	**Nationality**
Nausicaa – Centre national de la mer	Iwona Gin	French and Polish
Country of Employment	**Educational background**	**Current job position**
France	Business manager, teacher of English, interpreter	Project manager
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**
French and English	About a year	No

COLUMBUS

Interview partners listed in chronological order

Company	**Name**	**Nationality**
Nausicaa – Centre national de la mer	Florence Huron	French
Country of Employment	**Educational background**	**Current job position**
France	Fisheries and aquaculture engineering	Head of international projects
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**
French and English	About a year	Yes

Company	**Name**	**Nationality**
Eurocean – Fundacao Eurocean	Edward Dwyer	Irish
Country of Employment	**Educational background**	**Current job position**
Portugal	B.A.I. – Electronic Engineering; MSc. PhD Remote Sensing	Executive-Director
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**
English	About two years	No

Company	**Name**	**Nationality**
CETMAR - Centro Tecnológico del Mar	Rosa Fernandez	Spanish
Country of Employment	**Educational background**	**Current job position**
Spain	Yes	Head of department
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**

Spanish and English	More than three years	Yes

Company	**Name**	**Nationality**
AquaTT	Cliona NÍ Cheallacháin	Irish
Country of Employment	**Educational background**	**Current job position**
Ireland	Yes	Senior project manager
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**
English	More than three years	Yes

MARINA

Interview partners listed in chronological order

Company	**Name**	**Nationality**
CNR - Consiglio Nazionale delle Ricerche	Fernando Ferri	Italian
Country of Employment	**Educational background**	**Current job position**
Italy	PhD in medical informatics	Senior researcher
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**
Italian	More than three years	Yes

Company	**Name**	**Nationality**
APRE – Agency of Promotion of European Research	Margot Bezzi	Italian
Country of Employment	**Educational background**	**Current job position**
Italy	Communication sciences	Project manager/policy analyst
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**
Italian and English	More than three years	No

Company	**Name**	**Nationality**
APRE – Agency of Promotion of European Research	Chiara Buongiovanni	Italian
Country of Employment	**Educational background**	**Current job position**
Italy	Communication/public sciences	H2020 communication officer
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**
Italian and English	About a year	Yes

Company	**Name**	**Nationality**
CIC nanoGUNE – Associacion centro de investigacion cooperativa en nanociencias	Nagore Ibarra Gonzalez	Spanish
Country of Employment	**Educational background**	**Current job position**
Spain	Nanomaterials	Post Doc
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**
Spanish, English and Basque	About a year	No

Company	**Name**	**Nationality**
ISPRA - Istituto superiore per la protezione e la ricerca ambientale	Sasa Raicevich	Italian
Country of Employment	**Educational background**	**Current job position**
Italy	PhD	Researcher
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**
Italian	More than three years	Yes

Company	**Name**	**Nationality**
Aalborg Universitet - AAU	Jesper Rohr Hansen	Danish
Country of Employment	**Educational background**	**Current job position**
Denmark	MSc. Sociology, PhD	Researcher
Language at work place	**Number of years working with RRI**	**Regularly working with RRI in other projects**
Danish and English	About a year	No

Appendix D: Example of thematic comparison coding

The following interview passages were assembled to form the thematic comparison code:
RRI is not novel but some interviewees think that the RRI concept allows packaging and conceptualising of known R&I elements that can address problems and that together can have more strength than considered alone.

R. Fernandez (COLUMBUS):
She felt that, from her long experience with knowledge transfer activities, it is good to "package this concept around one kind of title". She thinks it's good to transmit the RRI approach but she also states that some things "behind RRI have been happening for many years". People who work in innovation and relay centers (like CETMAR) have mostly been implementing RRI when connecting people and institutions around research and innovation. Connections between them should make it possible to fulfill their needs and increase knowledge transfer opportunities and benefits that go from research to society for the benefit of society (be it through the economy, policy, education).

R. Fernandez states that the ideas underlining RRI have existed for a long time. She suggests putting things into practice. She claims that the RRI concept is "right" but not "novel".

N. Dwyer (COLUMBUS):
N. Dwyer states that RRI or some of its dimensions have already been taken into account throughout research up until now. RRI is just a new term. Stakeholder engagement has been done for years. He thinks that the research side may have been more successful in implementing public engagement because the stakes are lower than in other sectors (e.g. implementation of innovations). In Europe, ethical requirements have always been made throughout research. Governance has been addressed on the marine side in various governance approaches. RRI dimensions are "pretty much all being addressed to either a greater or lesser extent, in different ways, but obviously with different strengths, depending on the project type". RRI is not new but brings together concepts that previously haven't been considered together.

J. Hansen (MARINA):
J. Hansen feels that the novelty of RRI lies in its ambition to create a conceptual approach in research and innovation. He claims that the combination of the RRI dimensions has cutting

edge and is “quite intriguing” compared to the way things are done at a national level. He says it’s a demanding concept. He states that RRI is a radical process tool (he mentions the RRI Tools project). He claims that if universities that are interested in forming collaborations with private sector parties deployed these process tools then this would be a game changer and challenge. The citizen involvement would not only be used as a tokenism but the citizens could be part of the design phase and have a say in the project’s development and the impact of the dimensions. He mentions that RRI is novel as a conceptual package.

Moreover, J. Hansen states that in [Y], people feel their country is already a well-structured democracy that does not face corruption or gender-based repression, meaning that a lot of the RRI dimensions are already being realized, “perhaps not as good as we could, but […] it’s not like it's a brand new kind of thing”. J. Hansen states that, in [Y], a little bit more could be done about including citizens in innovation processes but most of the RRI dimensions are already well-covered in this country.

S. Raicevich (MARINA):
S. Raicevich states that RRI represents “good principles and aims laid down by the Commission”. RRI can be fully applied throughout some parts of research and the calls for projects and there are elements of it present in normal policies. But it was not before now that these elements are known “under the umbrella of RRI”. Regarding RRI, S. Raicevich states that the whole is more than the sum of its parts. He claims that one RRI dimension doesn’t have the same “strength” as all of the RRI dimensions all together. He thinks that in the engagement processes, RRI is new to the people even though people might know some if its elements. He states that it is difficult to consider the RRI dimensions explicitly in policies.

S. Raicevich thinks that for some MARINA partners RRI was completely new, mostly for those who have not been working in participatory projects. He states that RRI’s definition and its dimensions are new but have a long background in Europe. S. Raicevich states he has been working on GAP1 and GAP2 (Science with and for Society), applying participatory approaches throughout these processes (Public Engagement).

S. Raicevich states that engagement entails Science Education, Open Access, Governance and Ethics. He feels that in Europe for several decades there has been an issue of increasing public engagement and participation in consideration with Governance, Ethics, etc. He claims “that the Commission tried to structure all these elements under the same umbrella […] and try to make it relevant, in particular for research and innovation.”

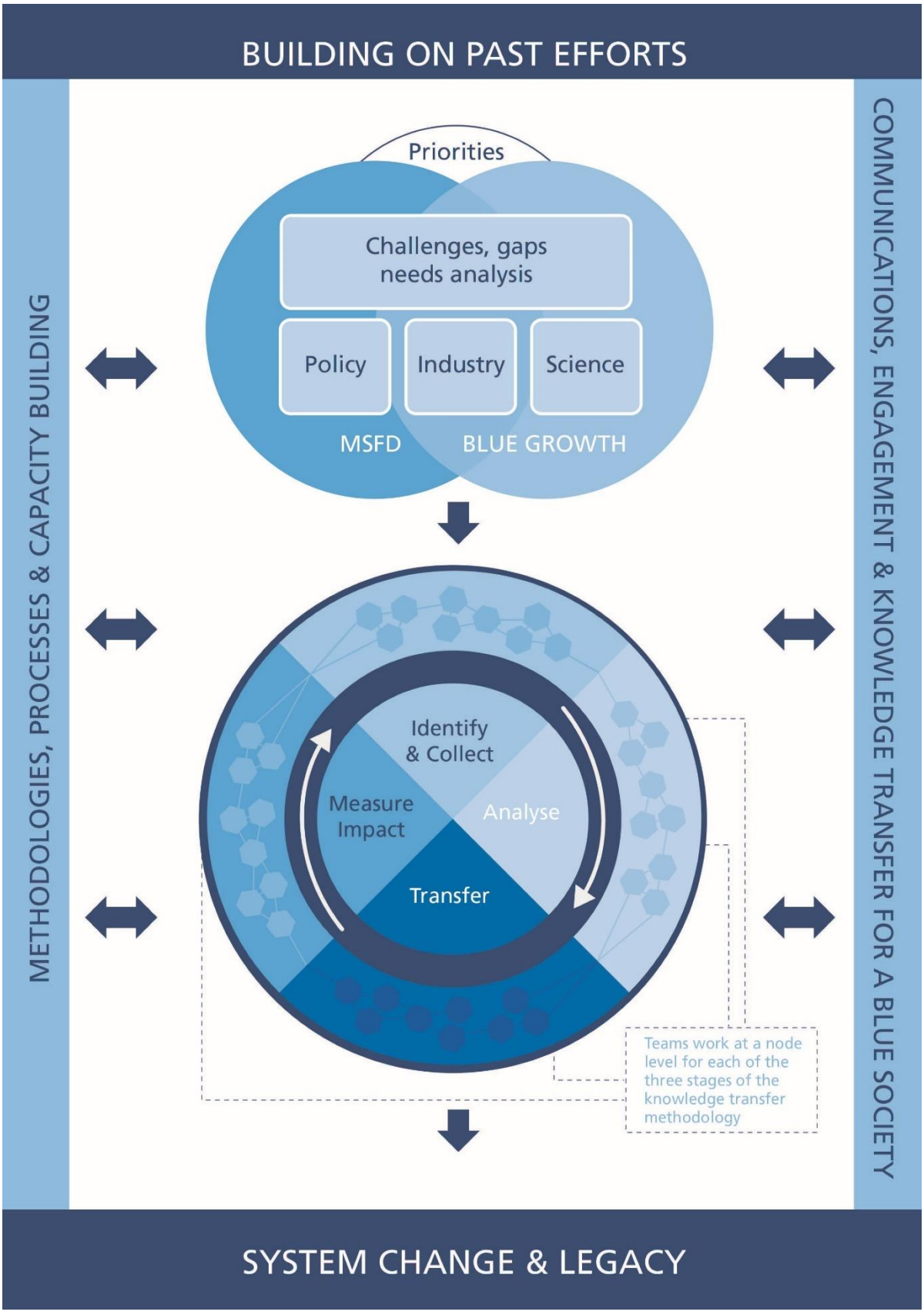
Appendix E: Figures and tables

Appendix F: List of abbreviations

cf.	Compare
e.g.	for example
EC	European Commission
ERA	European Research Area
etc.	Etcetera
EU	European Union
FP7	Seventh Framework Programme for Research and Innovation
GE	Gender Equality
GSC	Grand Societal Challenges
H2020	Horizon 2020 EU Framework Programme for Research and Innovation
i.e.	that is
ibid.	in the same place (ebd.)
KT	Knowledge transfer
LS	Likert scale
MC	Multiple Choice
MML	Mobilisation and Mutual Learning
MR	Multiple Response
OA	Open Access
PE	Public Engagement
R&I	Research and Innovation
RRI	Responsible Research and Innovation
SDG	Sustainable Development Goals
SE	Science Education
SME	Small and medium enterprises
SwafS	Science with and for Society
TA	Thematic Analysis
WKSP	Web Knowledge Sharing Platform
WP	Work Package

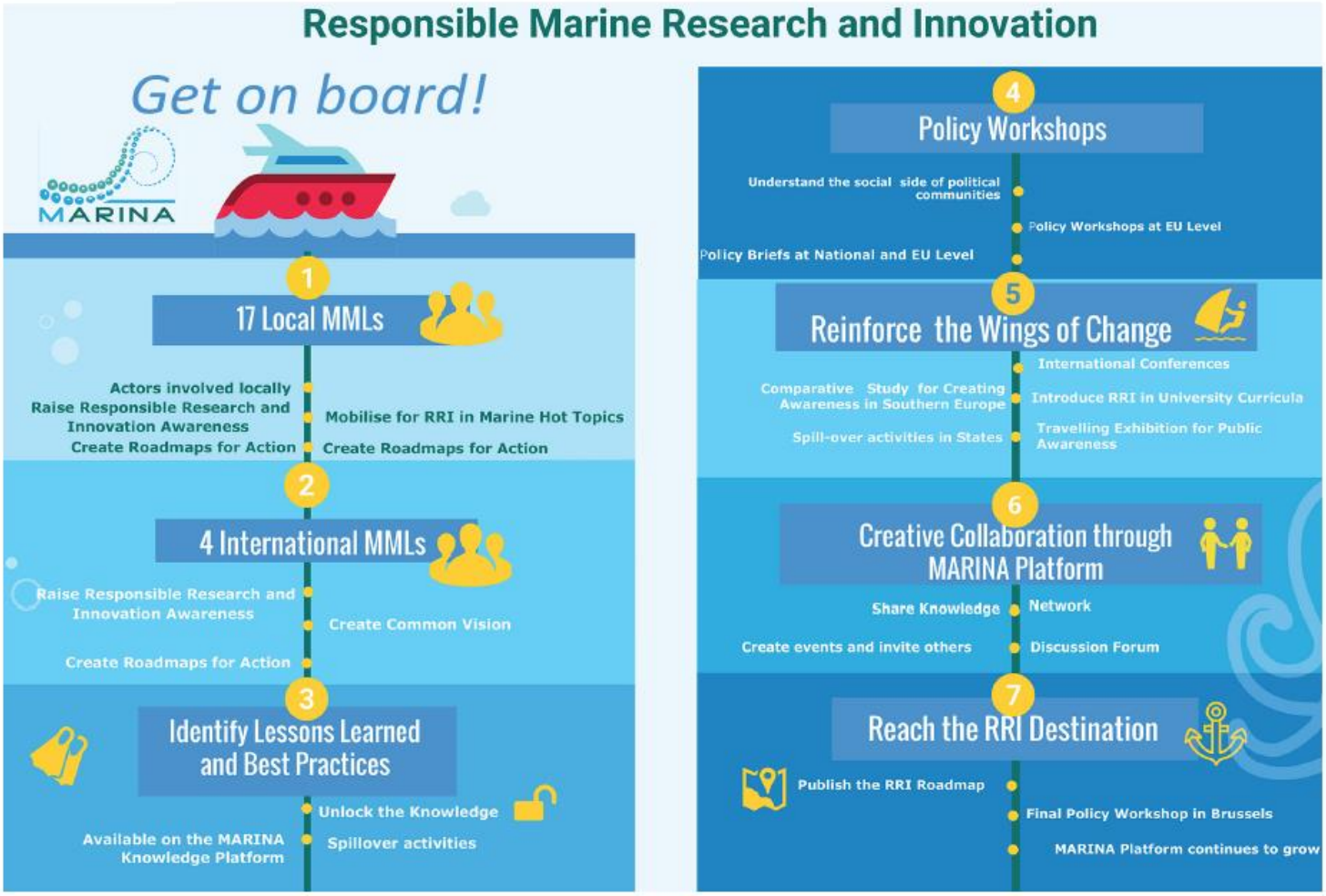
Appendix G: COLUMBUS project structure

To be found at: http://www.columbusproject.eu/links?id=1342 [Accessed 01.02.2018].



Appendix H: MARINA project structure

To be found at: MARINAZINE (2017), at:
http://www.apre.it/media/454916/01_marinazine_2017.pdf [01.02.2018].



Appendix I: Used deliverables for analysis

COLUMBUS public deliverables

Deliverable D2.1 (2015): Internal Project Management System, Lead parties for Deliverable: AQUATT

Deliverable D2.2 (2015): Guidelines on carrying out COLUMBUS Knowledge Transfer and Impact Measurement, Lead parties for Deliverable: AQUATT

Deliverable D3.1 (2016): Report on knowledge gaps and needs in different focus areas, Lead parties for Deliverable: JUELICH

Deliverable D3.2 (2016): Assignation of Knowledge needs to Competence Nodes, Lead parties for Deliverable: JUELICH

Deliverable D3.3 (2016): Mapping Report of possible inter-relationships, inter-linkages and dependencies of prioritized knowledge gaps and needs of the focus areas combined, Lead parties for Deliverable: JUELICH

Deliverable D4.1 (2016): Inventory of Relevant Projects by Priority Focus Area, Lead parties for Deliverable: EUROCEAN FOUNDATION

Deliverable D4.2 (2016): Portals and Repositories and their role in Knowledge Transfer to support Blue Growth, Lead parties for Deliverable: SEASCAPE CONSULTANTS

Deliverable D4.3 (2016): Report on KO's identification, Lead parties for Deliverable: EUROCEAN FOUNDATION

Deliverable D5.2 (2016): Progression of Knowledge Outputs To Knowledge Transfer, Lead parties for Deliverable: CETMAR

Deliverable D7.1 (2015): Dissemination and Exploitation Plan, including website. Lead parties for Deliverable: AQUATT

Deliverable D7.5 (2016): Blue Society Award Rules, Lead parties for Deliverable: AQUATT

Deliverable D8.1 (2016): Report on current metrics for research performance, Lead parties for Deliverable: UPMC

Deliverable D8.2 (2016): Report on existing knowledge transfer initiatives including their positive and negative attributes from an end user point of view, Lead parties for Deliverable: NERC-NOC

N.N. (2016): COLUMBUS 1st Annual Conference Minutes

MARINA public deliverables

Deliverable D1.2 (2016): H – Requirement, Main author: GRIFONI, P.

Deliverable D2.1 (2016): Criteria for Identifying, Collecting, and Extracting Information from Sources – Taxonomy, Main author: SCHNEIDER, X.

Deliverable D3.1 (2016): MML Workshop Methodology Approach and Actor Inclusion Criteria, Main author: GIN, I.

Deliverable D7.1 (2016): Definition of Dissemination and Communication Strategy, Main authors: EMANUELA DANÉ and MARA GUALANDI

Deliverable D7.2 (2016): MARINA Website, Main author: DANÉ, E.

Deliverable D7.3 (2016): Promotional Kit, Main author: DANÉ, E.

Deliverable D7.8 (2016): Exploitation Plan, Main author: KNEZ, M.

RAICEVICH, S. (2017): Making EU Research and Innovation responsible - MARINA Project Position Paper on H2020 interim consultation