Governance of Responsible Innovation

GREAT – 321480

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Executive Summary

The present report provides a description of both the dataset and also the survey instrument we will be considering in the GREAT project. A brief description of the complementary qualitative methodology is also included.

The goal of the work presented in this deliverable, DEL 4.1 hereinafter, is to present our work on the selection of empirical methodologies and the design of a survey instrument that can serve as a basis to accomplish three main goals in the GREAT project, namely, to:

i) provide an empirical foundation on which the theoretical work on Responsible Research and Innovation (RRI) in the GREAT project can be grounded;

ii) provide an empirical foundation and methodological framework based on which further work to be conducted within other work packages of the GREAT project can be undertaken; and

iii) generate empirical data that can provide actionable information to calibrate the agent-based model and simulation to be carried out as part of future work in Work Package 4 (WP4).

We begin our report by presenting the dataset used in the GREAT project. This dataset consists of 206 projects under the CIP ICT PSP programme, a policy support programme promoting the use of information and communications technologies. This policy support programme is currently being funded as part of the competitiveness and innovation programme funded by the European Commission under its Seventh Framework Programme.

We provide an overview of the projects in the CIP ICT PSP project pool and also describe some general information about the projects that are included in this dataset. Given the lack of information in this and other datasets describing primary data on research and innovation (RI) projects across the EU, we are not in a position to present here an in-depth social network analysis of the projects in this dataset nor is it the aim of DEL 4.1 to provide such.

Given our primary focus on mining the elements of RRI presented by the projects in the CIP ICT PSP pool, we motivate the need to raise secondary data regarding RRI in order for us to meet the objective of this DEL 4.1.Therefore, DEL 4.1 deals primarily with motivating the need for conducting empirical research in the GREAT project, describing the goals of the empirical research to be conducted, and presenting the methodologies and instruments needed to conduct the empirical research in the GREAT project.

The survey methodologies employed in the GREAT project will comprise both qualitative and quantitative empirical methodologies. The qualitative methodologies are mentioned but not described in this DEL 4.1 in any detail. A detailed description has been included in Deliverable 3.1 (Fieldwork methodology Approach including Interview and Observation Techniques; DEL 3.1 hereinafter), and further specifications will be given in Deliverable 3.4 (Context of RRI Report; DEL 3.4 hereinafter). DEL 3.4 will also give a full account of the findings from the qualitative approach. Moreover, first findings will be presented in Deliverable 4.2 (Case Study Report; DEL 4.2 hereinafter).

We also provide an introduction into the SKIN model as a way of motivating the need for calibrating the agent-based models in the GREAT project. These models will be based on SKIN (Simulation of Knowledge in Innovation Networks) and will be generated as part of future work within WP4. In this connection, we limit our exposition in this DEL 4.1 to a brief introduction to the SKIN model. The actual agent-based model will be presented Deliverable 4.3 (DEL 4.3 hereinafter) and

the results of the experiments and simulation will be presented in Deliverable 4.4 (DEL 4.4 hereinafter).

Most of this DEL 4.1 deals with the description of the quantitative methodology and the presentation of the survey instrument we will use in the GREAT project. Based on the findings of Work Package 2 (WP2), mainly Deliverable 2.1 (DEL 2.1 hereinafter) and more specifically Deliverable 2.2 (DEL 2.2 hereinafter), we designed an instrument that considers the RRI elements and parameters contained in the DEL 2.1 ad DEL 2.2 and includes additional RRI elements and parameters required for the calibration of the SKIN models.

Our choice of methodology and the design of the instrument for the quantitative survey were strongly influenced by the lack of a generally agreed-upon RRI construct and a RRI framework and governance methodology both in the RRI research and practitioners community. This is a consequence of the state of the art in this emerging research field. Though some RRI elements and parameters have been proposed in the literature, most of the questions raised by the GREAT project are still unresolved. This forces us to enter into unchartered territory when it comes to such important questions as to what are the RRI elements, what a RRI construct might look like, and what methodologies and governance frameworks should be applied by an agent conducting research and innovation RI in order for it to be considered “RRI compliant.”

In order to meet this challenge, the approach taken in WP4 builds upon the work presented in DEL 2.1 (Theoretical Landscape) and DEL 2.2 (Analytical Grid) and considers the additional RRI elements that are required in order to model an agent's behaviour in SKIN, including a characterisation of the agent archetypes, their RI (research and innovation) and RRI (responsible research and innovation) life cycles, and their behaviour during simulations using a generic RRI governance and management methodology. All this work is described in detail in this DEL 4.1.

Based on this work, we also provide in this DEL 4.1 a description of the survey methodology and instrument to be used in the GREAT project, focusing on the quantitative empirical research required to model and calibrate the SKIN models in the GREAT project. The other future deliverables of WP4 include DEL 4.3 (The Agent-Based Model Prototype) and DEL 4.4 (The Simulation Report).

Introduction

The present report provides a description of the dataset, the survey methodology and the survey instrument we will be using for the quantitative empirical research in the GREAT project. A brief description of the qualitative methodology (case studies) is also included.

The document is structured as follows. In Chapter 1, we provide an overview of the dataset used for the empirical work in the GREAT project. The dataset has been compiled from a group of projects funded by the Seventh Framework Programme of the European Commission under its CIP ICT PSP programme. This programme aims to stimulate the use of information and communications technologies (ICT) in the public and private sector and in society with the general objective of increasing innovation and global competitiveness across all member states in the European Union. This dataset has been chosen given its primary focus on innovation. In the context of the CIP ICT PSP calls, innovation is understood as a process undertaken by companies in the public and private sector and by organisations in society with the aim to create value for customers, citizens and society.

In Chapter 1, we indicate the motivations that identified the need for the survey in the GREAT project. A first motivation was the dataset itself. Indeed, the CIP ICT PSP dataset, as many other datasets compiling general information of projects funded under the Seventh Framework Programme, was not compiled with the goal of studying the emerging patterns of responsible research and innovation (RRI) of the projects funded by the CIP ICT PSP programme. The dataset itself allows for a very simple analysis of the composition of the project consortia in terms of the number and identification of the project partners in each project, the amount of the grant, and the duration of the project. An actual description of the projects and the project partners involved can only be obtained by contacting the

project partners directly and requesting this information from them. From an innovation standpoint, there is no information on the actual project outcomes. This information is of the essence in order to ascertain the RI (research and innovation) profiles of the projects in this dataset and will need to be generated as part of the survey. From a responsible research and innovation standpoint, we also lack information on the emerging framework for conducting responsible research and innovation in this dataset.

Based on these shortcomings, we need to extend this dataset with secondary data addressing the RRI-relevant questions in the GREAT project. This will be accomplished in the GREAT project through a quantitative survey and qualitative case studies. While the findings from the qualitative case studies will be reported in DEL 3.4 and DEL 4.2, the quantitative survey is reported in detail in this DEL 4.1.

A second motivation for the survey comes from the need to calibrate the SKIN model we will be using to run policy experiments using agent-based modeling and simulation. To this end, the types of agents in the dataset will need to be identified as well as the context in which the agents operate. This context does not only include ontologies of other agents and institutions in a potentially complex ecosystem of partners but also the composition of the innovation life cycle involved expressed in terms of phases and control mechanisms, as well as the tools and methodologies involved in managing processes of innovation.

In Chapter 2, we provide a brief introduction to the SKIN model in order to explain the need for this calibration process and we also introduce some of the questions we will be aiming to respond to through the use of agent-based simulation in the GREAT project. A description of the specific hypotheses pertaining to RRI and the experiments designed to test them using agent-simulation is not part of the scope of this DEL 4.1. This information will be reported in DEL 4.2 (The Agent-Based Model Prototype).

Chapter 3 provides an overview of the survey methodology and the qualitative methodology for the case studies available to us in order to cope with the specific challenges posed by the GREAT project in terms of empirical research. Rather than describing empirical methods in general, our aim in Chapter 3 is to provide the reader with a focused exposition of the actual empirical methods that will help us answer the relevant questions posed by the GREAT project. While we briefly mention the qualitative methodology we will be using to conduct case studies in the GREAT project, most of Chapter 3 is devoted to an exposition of the quantitative methodologies that can be applied to solve many of the empirical research questions posed. A detailed exposition of the qualitative empirical research methodology is included in DEL 3.1, and will also be part of DEL 3.4.

Chapter 4 is the main chapter of this document. This chapter presents the actual survey instrument we will be using to conduct the quantitative empirical research. As opposed to the qualitative empirical research that will be based on document-based case studies as well as in-depth case studies including semi-structured interviews, the quantitative survey will be conducted as an online survey. In Chapter 4, we introduce both the general and specific objectives of the survey as well as the taxonomy of archetypes of agents and their respective profiles to be used in order to classify the agents in the CIP ICT PSP pool. We also describe the design of the instrument including the agent profiles that correspond to the archetypes introduced in this chapter as well as the research and innovation (RI) and the responsible research and innovation (RRI) profiles of the agents involved. We also include in Chapter 4 a description of the normative framework and the complementor profiles we will be using in the survey instrument. The normative and complementor profiles will aim to elicit key elements of the RRI context in which the RRI processes take place, especially with regards to the current regulatory frameworks in the EU and the role of complementors, understood as actors that take part in the innovation process, either directly or indirectly. These complementors can encompass people, their

communities, their online communities, their organisations and interest groups, as well as other societal actors including civil society organisations (CSOs).

Chapter 5 presents the conclusions.

We also include in this DEL 4.1 three annexes containing the list of projects that are currently being considered for the qualitative empirical research as well as two schedules for semi-structured interviews that are used to conduct the in-depth interviews in the qualitative case studies.

Chapter 1 The Dataset

The purpose of this chapter is to provide a very brief description of the dataset we will be using for the survey in the GREAT project. In Section 1.1, we provide a brief overview of the projects in the dataset. In Section 1.2, we provide an analysis of the dataset.

1.1 The CIP ICT PSP Project Pool

The dataset used in the GREAT project consists of 206 ICT projects taken from the CIP ICT PSP programme, a policy support programme funded by the Seventh Framework Programme as part of the Competitiveness and Innovation Programme (CIP) of the European Commission. Funded under the Seventh Framework Programme (FP 7), the CIP programme aims to stimulate the use of information and communications technologies (ICT) in the public and private sectors and in society in order to foster innovation and increase the global competitiveness of the European Union. The projects in the CIP ICT PSP pool are being executed during the period from 2007 until 2016 and involve large consortia often comprised of more than 5 organisations as project partners.

Table 1 shows a summary of projects considered in this dataset.

Total Number of Projects	Total Number of Partners
206	3458

Table 1: Total Number of Projects and Partners in the Dataset

1.2 Analysis of the Dataset

The first part of the analysis of the dataset focused on eliciting the composition of the innovation network underlying the dataset in terms of the heterogeneity of actors involved in the CIP ICT PSP project pool.

Figure 1 illustrates the types of partners and coordinators in the CIP ICT PSP project pool for a random sample of project partners taken from the CIP ICT PSP project pool.

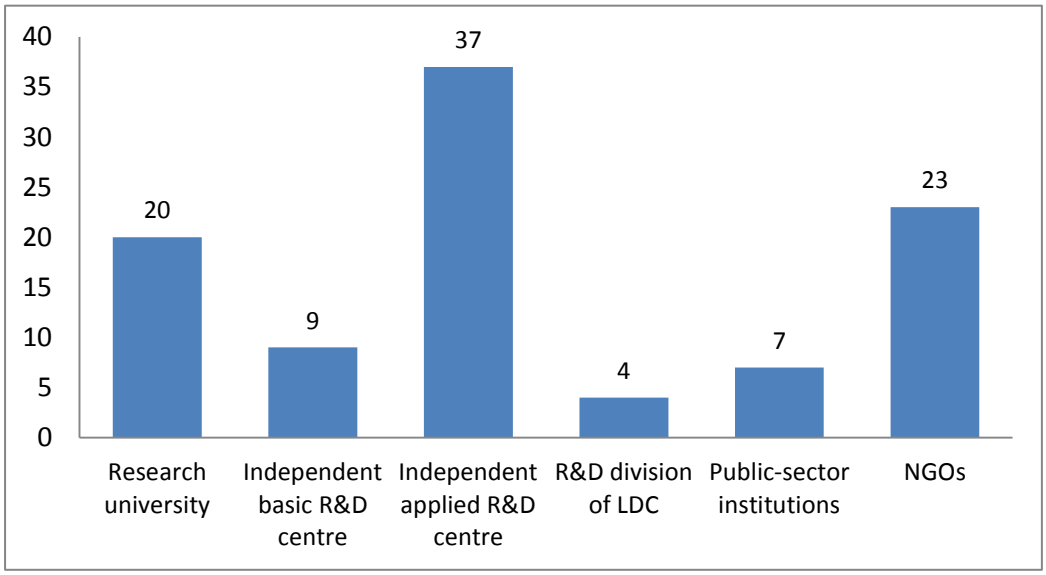

Figure 1: Type of Agents in the CIP ICT PSP project pool

The EU contribution ranged between 21% and 100%. Figure 2 shows the EU contribution across all projects in the dataset in four different bands.

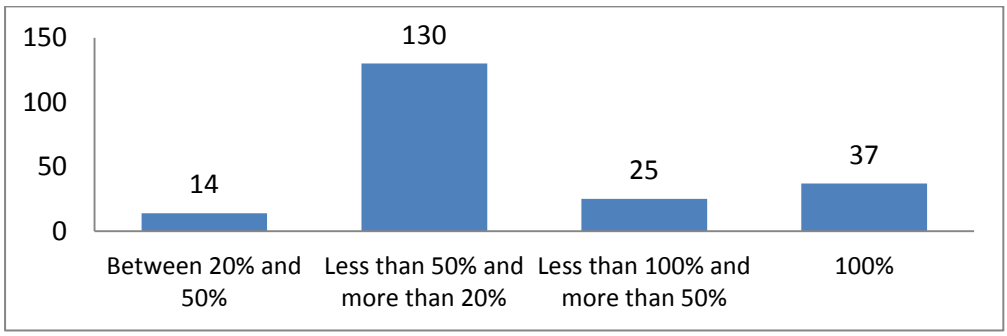

Figure 2: EU Contribution to the Project in the CIP ICT PSP project pool

The second part of the analysis of the dataset focused on eliciting the composition of the innovation network underlying the dataset in terms of the multiplexity of actors involved in the CIP ICT PSP project pool, that is, the different roles actors played in the network.

In this innovation network, an organisation could assume either the role of project partner or project coordinator. Project coordinators were by definition also project partners in the network.

Figure 3 shows some of the organisations in the dataset that acted as project coordinators in more than one project and had therefore a higher degree of multiplexity in this network.

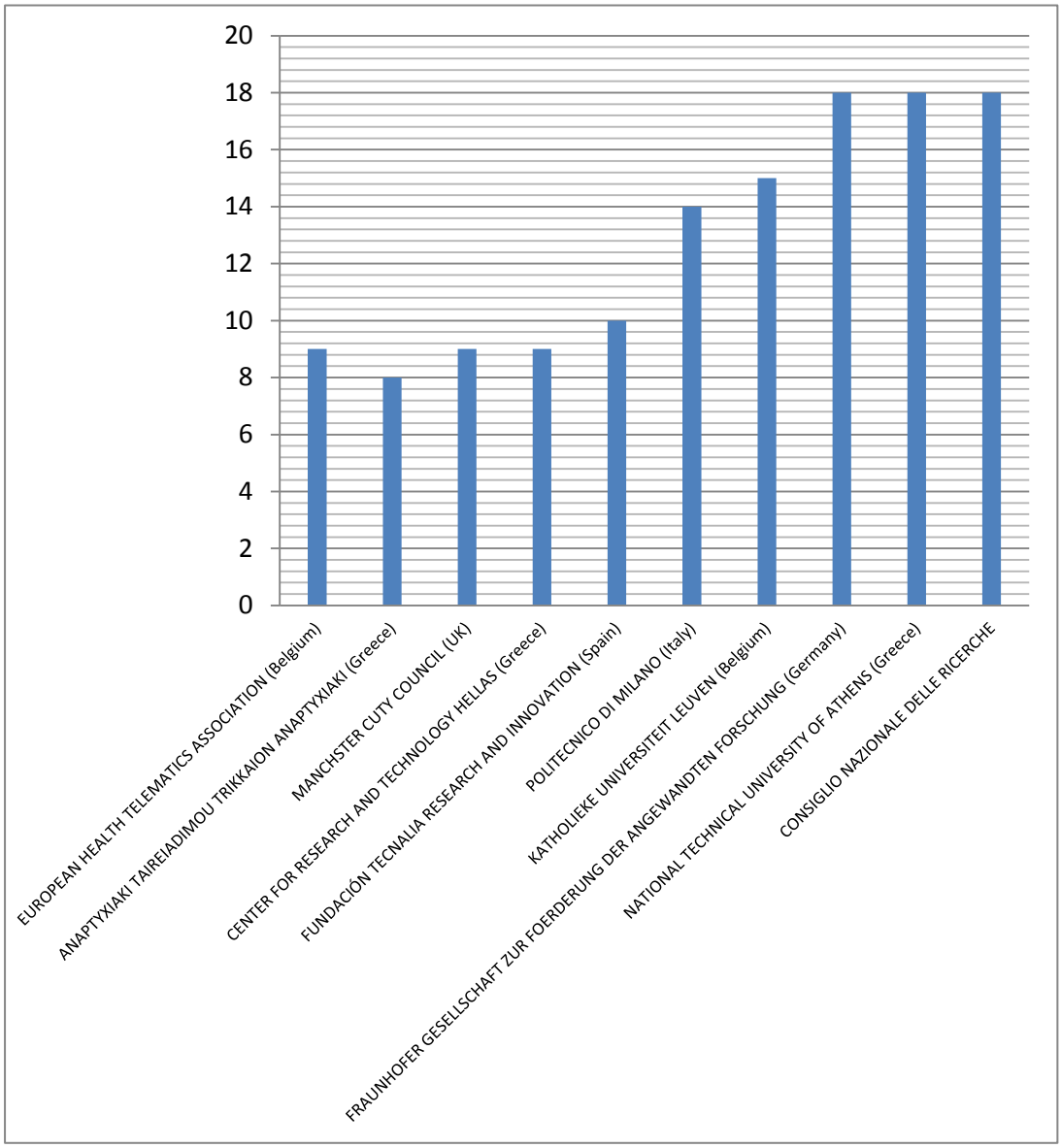

Figure 3: Number of Projects Coordinated per Project Partner

As we can gather from Figure 3, organisations that acted often as project coordinators in several projects in the dataset were a rather eclectic group comprised of consulting firms and applied research centres but also organisations from the public sector that do not conduct research. Research universities were also part of this group.

Figure 4 provides an overview of the number of partners and coordinators (per country) that participated in the projects compiled in our dataset.

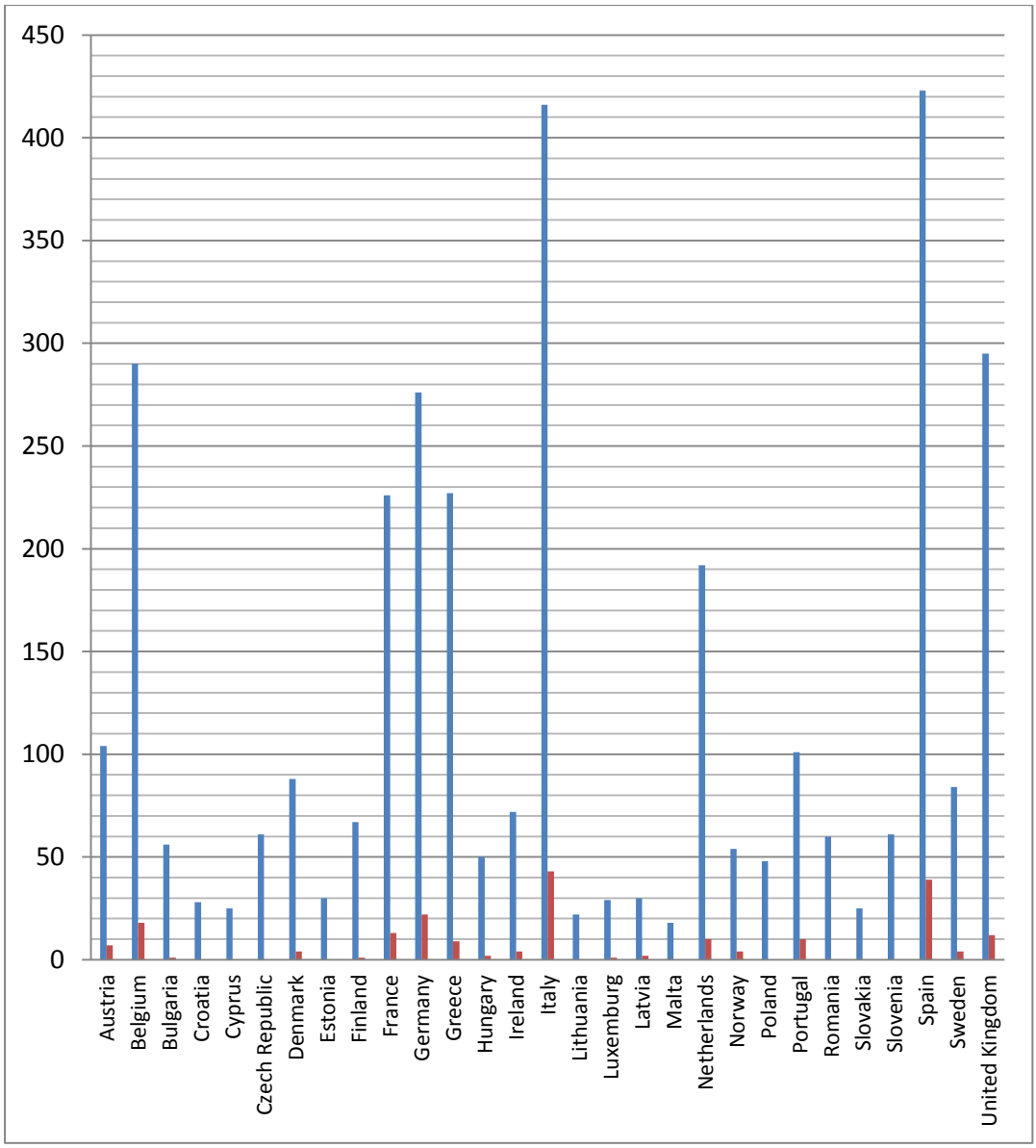

Figure 4: Number of Projects' Partners and Coordinators per EU country

A first group comprised of Italy and Spain has the highest number of project partners and coordinators in the CIP ICT PSP project pool analysed. They were followed by a second group comprised of Belgium, Germany and the UK. This second group was followed by a third group comprised of France, Greece and the Netherlands, by a fourth group comprised of Austria, Denmark, Portugal and Sweden, and by a fifth group comprised of Finland and Ireland. Eastern European countries were underrepresented both in terms of project partners and project coordinators in this dataset.

Chapter 2 Motivation

In this chapter, we indicate motivation for conducting the survey in the GREAT project.

In section 2.1, we elaborate on the reasons for conducting the survey as a result of the data contained in the dataset introduced in chapter 1. As mentioned in chapter 1, this dataset contains general information on projects funded by the Seventh Framework Programme of the European Commission under its CIP ICT PSP programme. Unfortunately, the dataset does not contain any data on RRI governance models, frameworks, methodologies or tools, some of which have been already discussed as RRI elements and parameters in DEL 2.2 (Theoretical Landscape) and in DEL 2.3 (Analytical Grid). The dataset does not contain any information on the project outcomes either. Therefore, we need to raise secondary data through a survey especially designed to uncover the emerging RRI elements and parameters discussed in DEL 2.2 (Theoretical Landscape) and DEL 2.3 (Analytical Grid) along with additional elements and parameters that will allow us to characterise the agents, their RI (research and innovation) profiles and their RRI (responsible research and innovation) profiles in the agent-based models using SKIN.

In section 2.2, we elaborate on the reasons for conducting the survey as a result of the need to calibrate the agent-based models we will be building in the GREAT project. In this section, we explain the role that empirical data plays in this calibration process and describe how agent-based models have been built for simulation purposes in the context of other projects that have been funded by European framework programmes in the past. Further elaboration on the elements and parameters presented thus far in DEL 2.2 (Theoretical Landscape) and DEL 3.3 (Analytical Grid) as well as additional elements and parameters presented in this DEL 4.1 are necessary in order for us to operationalise the

agent-based modeling and simulation tasks that will be conducted in the GREAT project, and which will be reported in DEL 4.3 and DEL 4.4, respectively.

As will be discussed at length in chapter 4, the survey will be conducted to uncover the underlying RI agent profiles, RI profiles, and RRI profiles contained in our dataset for calibration purposes.

2.1 Extending the CIP ICT PSP Dataset

One of the main challenges of the GREAT project from an empirical analysis standpoint is the lack of empirical data on RRI governance models, frameworks, methodologies, and tools.

As mentioned in Del 2.1 (Theoretical Landscape), RRI is still an emerging field not only within the scientific but also within the practitioners' community. In both of these communities, there is still an open debate on a number of fundamental terms and issues and a general lack of RRI governance models, methodologies and tools. To make things even more challenging, research-funding agencies have yet to compile comprehensive datasets about the projects they fund containing not only RI- but also RRI-relevant data.

Datasets covering RI projects in Europe and also elsewhere, including the dataset introduced in chapter 1, lack the necessary information to understand and model processes of RRI. This makes it necessary to extend this dataset with relevant data on the underlying RRI processes that took place *de facto* during the execution of the projects in the dataset chosen. This is indeed a challenging task as most of the RRI concepts and definitions covered in DEL 2.2 (Theoretical Landscape) and DEL 2.3 (Analytical Grid) and elsewhere in the RRI literature are still alien concepts to many researchers and practitioners both from industry and academia.

Important data we need to gather for the projects in our dataset pertains to such questions as, for example:

1. Were there any CSOs (civil society organisations) involved in the project and, if so, which CSOs were involved and what was their role in it?

2. Did the grantor organisation impose any form of RRI metrics as part of the project and, if so, which metrics were used and how were they measured?

3. Did the project team apply any RI management methodologies and tools above and beyond conventional project management tools and, if so, what tools were used?

4. Did the project team apply any RRI management methodologies and tools and, if so, what tools were used?

5. Was there an ethical review committee in place as part of the project and, if so, what was its role in the project, who were members of this committee and what powers were vested on its members?

6. Was the project in any way exposed to RRI issues raised by CSOs (Civil Society Organisations) or by communities and interests groups or by society at large and, if so, what governing, control and management mechanisms were used to deal with them?

7. Was the RI team bound by any responsible conduct of research (RCR) codes and, if so, what rules applied?

8. Was there a project steering committee in place and, if so, did the committee include any external stakeholders not directly involved in the

projects in a consultative or controlling capacity or otherwise and, if so, who were these external stakeholders?

9. Was there a governing board in place to resolve RRI issues and, if so, did the board include any external stakeholders not directly involved in the projects in a consultative or controlling capacity or otherwise and if so, who were these external stakeholders?

As elaborated upon in more detail in chapter 4, the purpose of the survey was to elicit information regarding these and other questions pertaining to the projects described in our dataset with the aim of revealing the emerging RRI elements, parameters and governance patterns shown by the projects in this dataset. This information will be used not only to understand these emerging RRI patterns but also to calibrate the agent-based models we are going to use as part of our work in WP4 of the GREAT project.

2.2 Calibration

Widely used and accepted in the natural and engineering sciences as a core research methodology, simulation opens up a wide range of new research possibilities for analysing future behaviour of complex systems in the social sciences as well.

Agent-based modeling and simulation has emerged as a scientific method in the social sciences, giving rise to the field of social simulation as a methodology to study complex systems, in general, and innovation networks, in particular (Gilbert et al., 2002). The underlying assumption behind this methodology is that computational models involving a potentially large number of agents can serve as the foundation to model and simulate the dynamic behaviour of complex social systems.

Models are abstractions of the real world and as such they are artifacts that create artificial worlds. To the extent that such models can reproduce past behaviour in complex social systems we say that the models are validated by empirical evidence. To the extent that such data is available for validation purposes, we might assume that models that emerge from past empirical data can either predict, within a certain degree of probability or plausibility, future behaviour.

In the field of agent-based modeling and simulation, we prefer to use the term calibration to denote processes of adjusting agent-based models in order to reproduce past behaviour. Calibrated agent-based models can then serve as a basis for modeling the dynamic behaviour of social systems. This, in turn, can be used for *ex ante* simulation of future behaviour of complex social systems. A special application of such agent-based models consists in simulating the behaviour of complex innovation networks (Gilbert et al., 2001).

Our past work in this area has included the study of UIRs (university-industry relationships) in knowledge-intensive industries such as the pharmaceutical industry as well as the *ex ante* evaluation of public policy in the area of innovation in the European Union (Gilbert et al., 2009).The GREAT project benefits from our past experience in these and other related projects involving the study of dynamic processes of knowledge diffusion and innovation using agent-based modeling and simulation.

In particular, we will apply the SKIN model, an agent-based modeling framework especially developed to model and simulate innovation networks, to test a number of RRI hypotheses. These hypotheses will be presented in DEL 4.3 (The Agent-Based Model Prototype). The results of testing them via experimental design using agent-based simulation will be presented in DEL 4.4 (The Simulation Report).

In section 2.3 and 2.4 we introduce the SKIN model. The contents of section 2.3 and section 2.4 borrow verbatim from (Ahrweiler, P., Gilbert, N. and Pyka, A., 2011; Ahrweiler, P., Schilperoord, M., Pyka, A. and Gilbert, N.; 2014, forthcoming; and Ahrweiler, P., Pyka, A. and Gilbert, N.; 2014, forthcoming).

2.3 The SKIN Model

2.3.1 Agents, Kenes, and Networks

Following the theoretical frameworks from Neo-Schumpeterian Economics and Economic Sociology, innovation is the creation of new, technologically feasible, commercially realisable products, processes and organisational structures (Schumpeter, 1911; Fagerberg, Mowery and Nelson, 2006). It results from the continuous interactions of innovative organisations such as universities, research institutes, firms such as multi-national corporations and small-to-medium-sized enterprises, government agencies, venture capitalists and others.

These organisations exchange and generate knowledge by drawing on networks of relationships (innovation networks) that are embedded in institutional frameworks at the local, regional, national, and international level.

2.3.2 Kenes

The first property agents would need to be endowed with is an individual knowledge base to model their most important resource: technological capital. Technological capital is defined by (Bourdieu 2005: 194) as “the portfolio of scientific resources (research potential) or technical resources (procedures, aptitudes, routines and unique and coherent know-how, capable of reducing expenditure in labour or capital or increasing its yield) that can be deployed in the design and manufacture of products“.

SKIN agents have a semi-structured knowledge space: a categorial system structuring the codified and explicit knowledge "portfolio," which is not only mentioned by Bourdieu, but which we can find in many literatures as disciplines, domains, fields, capabilities, procedures, aptitudes, routines and suchlike. Additionally, the knowledge representation of SKIN agents includes know-how and expertise, i.e. sometimes tacit and/or implicit knowledge features. Agents need to be able to explore and navigate their knowledge space, to connect to other agents' knowledge space as far as learning and cooperation goes, and to construct new knowledge.

The approach to knowledge representation used is similar to Toulmin's (1967) evolutionary model of knowledge production. This identified concepts, beliefs and interpretations as the "genes" of scientific/technological development evolving over time in processes of selection, variation and retention. Ackermann (1970) interpreted the works of Kuhn and Popper according to this perspective allowing for different selection systems.

In the SKIN model an analogical concept, the "kene" is used to represent the aggregate knowledge of an organisation (Gilbert, 1997).The individual knowledge base of a SKIN agent, its kene, contains a number of "units of knowledge". In the artificial space of a model, kenes could consist of arbitrary bit sequences of indefinite length. Each unit in a kene is represented as a triple consisting of an agent's capability C in a scientific, technological or business domain, its ability A to perform a certain application in this field, and the expertise level E the firm has achieved with respect to this ability.

As an example, the kene's capabilities C could correspond to the 3-digit IPC Codes, which represent broad technological fields, e.g. the code C07 stands for organic chemistry. One level below, on the 4-digit level, are the various occurrences within the capabilities domain, which correspond to the abilities A, e.g. the code C07K represents all technologies related to processes of preparation

of peptides. As every capability C has many (in principle infinite) occurrences (abilities A), each 3-digit IPC Code has several specifications on the 4-digit level, and these can be augmented if new, so far non-classified technologies become available. For almost every technological artifact or process, many capabilities, as well as different abilities within one capability domain, need to be applied (so-called combinatorial technologies, cf. Teece 1987). Therefore patents generally list several IPC codes. A firm's kene is a collection of C/A/E-triples, of variable number and representing its artificial knowledge space. The units of knowledge in the kene are used in a combinatorial way to produce innovations.

2.3.3 Doing Innovation

Agents in the model generate an "innovation hypothesis." They apply their knowledge to create innovation. "Most technology is specific, complex … (and) cumulative in its development. It is specific to firms where most technological activity is carried out, and it is specific to products and processes, since most of the expenditures is not on research but on development and production engineering, after which knowledge is also accumulated through experience in production and use on what has come to be known as "learning-by-doing" and "learning-by-using" (Pavitt, 1987: 9).

The special focus of an agent, its potential innovation, is called an innovation hypothesis. In the model, the innovation hypothesis (IH) is derived from a subset of the agent's kene units. The underlying idea for an innovation, modeled by the innovation hypothesis, is the source an agent uses for its attempts to make profits. Applying knowledge in its innovation hypothesis, an agent increases its expertise in this area.

This is the way that learning by doing/using is modeled. The expertise levels of the units in the innovation hypothesis are increased and the expertise levels of the other units are decremented. Expertise in unused units in the kene is

eventually lost and the units are then deleted from the kene; the corresponding abilities are “forgotten” or “dismissed” (e.g. Hedberg, 1981).

2.3.4 Learning

The learning features of the model are theoretically grounded in the body of literature known as “Organizational Learning” (OL). After John Dewey introduced the concept of experiential learning as a permanent activity cycle (Dewey, 1938) and started a discussion among educationalists about feedback learning and learning by doing, Donald Michael coined the term organisational learning (Michael, 1973).

Argyris and Schön’s influential monograph “Organizational Learning” (1978; newly edited with additional material as “Organizational Learning II”, 1996) proposed that a learning organisation is one that is permanently changing its interpretation of the environment. In doing so, the organisation learns new things and forgets old ones. Drawing on their background as action theorists, Argyris and Schön show how these interpretations are gained and how they are connected to different organisational behaviours. They distinguish between three types of learning, rooting them in an understanding of organisational agency that targets growth and effectiveness:

i. *Single-loop learning*: This is adjustment learning, referring to the rational use of one’s own means and instruments to adapt to environmental requirements, given a set of organisational goals, strategies and behaviours. It targets an improvement of the “theory in use” of an organisation using a simple action-outcome feedback and follows the heuristic “maximise gains and minimise loss.”

ii. *Double-loop learning*: This is turnover learning with respect to the meta-level of goals, strategies, and behaviours of an organisation, and aims to

adapt them to environmental requirements. The learning process includes un-learning of redundant knowledge to clear space for new behaviours. Furthermore, co-operation, including assumption and benefit sharing with collaborators, is seen as a vehicle for learning.

iii. *Deutero learning*: This is meta-level learning of the highest order where the organisation reflects on its own identity. Here, the learning process itself is the object of learning (”to learn how to learn”). The organisation’s norms and values are subject to critique and change.

Experiments concerning the effects of different combinations of learning activities on the agent population are reported in (Gilbert et. al., 2007). In the model, firms may engage in single- and double-loop learning activities.

Agents can use their capabilities (learning by doing/using) and learn to estimate their success via feedback (learning by feedback) and/or improve their own knowledge incrementally when the feedback is not satisfactory in order to adapt to changing technological and/or economic standards (adaptation learning, incremental learning).

If an agent’s previous innovation has been unsuccessful, it considers that it is time for change. If the agent still has enough capital, it will carry out “incremental” research (e.g. R&D in the firm’s labs). Performing incremental research (cf. Cohen and Levinthal, 1989) means that a firm tries to improve its product by altering one of the abilities chosen from the triples in its innovation hypothesis, while sticking to its focal capabilities. The ability in each triple is considered to be a point in the respective capability’s action space. To move in the action space means to go up or down by an increment, thus allowing for two possible “research directions.”

Alternatively, agents can radically change their capabilities (innovative learning, radical learning). An agent under serious pressure and in danger of going

bankrupt will turn to more radical measures by exploring a completely different area of opportunities. In the model, an agent under financial pressure turns to a new innovation hypothesis after first "inventing" a new capability for its kene. This is done by randomly replacing a capability in the kene with a new one and then generating a new innovation hypothesis.

According to the Organizational Learning theoretical framework, agents may be also active on the double-loop learning level of the model. They can (i) forget their capabilities (clean up their knowledge space); (ii) decide on their individual learning strategies themselves (e.g. incremental or radical learning), constructing and changing the strategies according to their past experience and current context; and (iii) engage in networking and partnerships to absorb and exploit external knowledge sources, to imitate and emulate, and to use synergy effects (participative learning).

2.3.5 Networks

An agent in the model may consider partnerships such as alliances and joint ventures in order to exploit external knowledge sources. The decision of whether and with whom to co-operate is based on the mutual observations of the agents, which estimate the chances and requirements coming from competitors, possible and past partners, and clients. This can be seen as a process of accumulating social capital, a concept defined in (Bourdieu, 2005: 194) as "the totality of resources activated through a more or less extended, more or less mobilisable network of relations which procures a competitive advantage by providing higher returns of investment."

Bolton, Katoka and Ockenfels (2005), writing from a theoretical viewpoint, and Mitchelet (1992), using empirical evidence, both show that greater mutual information where firms know their partner's history of co-operation improves the conditions for co-operation. Those capabilities not included in a firm's

innovation hypothesis and thus in its product are not necessarily visible externally and cannot be used to select the firm as a partner unless the firm "advertises" such capabilities. Such advertisement is then the basis for decisions by other firms to form or reject co-operative arrangements.

In experimenting with the model, we can choose between two different partner search strategies (Powell et. al., 2005), a conservative and a progressive strategy, both of which compare the agent's own capabilities as used in its innovation hypothesis and the possible partner's capabilities as seen in its advertisement. Applying the conservative strategy, an agent will be attracted to a partner that has similar capabilities; using a progressive strategy the attraction is based on the difference between the capability sets. Previously good experiences with former contacts generally augurs well for renewing a partnership. If there is a firm sufficiently attractive according to the chosen search strategy (i.e. with attractiveness above an "attractiveness threshold"), it will stop its search and offer a partnership. If the potential partner wishes to return the partnership offer, the partnership is set up.

The model assumes that partners learn only about the knowledge being actively used by the other agent to mirror the difficulty of integrating external knowledge as stated in empirical learning research (cf. Cohen and Levinthal, 1989; Cantner and Pyka, 1998). Once the knowledge transfer has been completed, each firm continues to produce its own product, possibly with greater expertise as a result of acquiring skills from its partner.

If the firm's last innovation was successful, i.e. the value of its profit in the previous round was above a threshold, and the firm has some partners at hand, it can initiate the formation of a network. This can increase its profits because the network will try to create innovations as an autonomous agent in addition to those created by its members and will distribute any rewards back to its members

who, in the meantime, can continue with their own attempts, thus providing a double chance for profits.

2.3.6 Getting Rich and Going Bankrupt

"Financial capital is the direct or indirect mastery of financial resources, which are the main condition (together with time) for the accumulation and conservation of all other kinds of capital" (Bourdieu 2005: 194). Of course, the agents of the model have individual capital stocks. They can prosper and they can go bankrupt. When it is set up, each agent has a stock of initial capital randomly assigned amount of starting capital (a few randomly chosen firms can be given extra capital). The capital is needed to do innovation and to improve its knowledge base. It can be increased by successful innovation. If a firms uses up all its capital without making any profits, it exits the population.

If a sector is successful, new firms will be attracted to it, representing Schumpeterian competition by imitation. This is modeled by adding a new firm to the population when any existing firm makes a substantial profit. The new firm is a clone of the successful firm, but with its kene units restricted to those in the successful firm's advertisement and these having a low expertise level. This models a new firm copying the characteristics of those seen to be successful in the market.

As with all firms, the kene may also be restricted because the initial capital of a start-up is limited and may not be sufficient to support the copying of the whole of the successful firm's innovation hypothesis.

2.3.7 Markets

The underlying idea for an innovation, modeled by the innovation hypothesis, is the source an agent uses for its attempts to make profits in the market. Because of the fundamental uncertainty of innovation (Knight, 1921), there is no simple

relationship between the innovation hypothesis and product development. To represent this uncertainty, we developed the following mechanism: the innovation hypothesis is transformed into a product through a mapping procedure where the capabilities of the innovation hypothesis are used to compute an index number that represents the product. The particular transformation procedure applied allows the same product to result from different kenes, which is not too far from reality where the production technologies of firms within a single industry can vary considerably (Winter, 1984).

A firm's product, P, is generated from its innovation hypothesis as:

$$P = \left(\sum_{IH} C_i \right) \bmod N \tag{1}$$

where N is a large constant and represents the notional total number of possible different products that could be present in the market.

A product has a certain quality, which is also computed from the innovation hypothesis in a similar way, by multiplying the abilities and the expertise levels for each triple in the innovation hypothesis and normalising the result. Whereas the abilities used to design a product can be used as a proxy for its product characteristics, the expertise of the applied abilities is an indicator of the potential product quality. In order to realise the product, the agent needs some materials. These can either come from outside the sector ("raw materials") or from other firms, which generated them as their products. Which materials are needed is again determined by the underlying innovation hypothesis: the kind of material required for an input is obtained by selecting subsets from the innovation hypotheses and applying the standard mapping function (equation 1).

These inputs are chosen so that each is different and differs from the firm's own product. In order to be able to engage in production, all the inputs need to be obtainable in the market, i.e. provided by other firms or available as raw materials. If the inputs are not available, the firm is not able to produce and has to give up this attempt to innovate. If there is more than one supplier for a certain input, the agent will choose the one at the cheapest price and, if there are several similar offers, the one with the highest quality.

If the firm can go into production, it has to find a price for its product, taking into account the input prices it is paying and a possible profit margin. While the simulation starts with product prices set at random, as the simulation proceeds a price adjustment mechanism following a standard mark-up pricing model increases the selling price if there is much demand, and reduces it (but no lower than the total cost of production) if there are no customers. Some products are considered to be destined for the "end user" and are sold to customers outside the sector: there is always a demand for such end-user products provided that they are offered at or below a fixed end-user price. A firm buys the requested inputs from its suppliers using its capital to do so, produces its output and puts it on the market for others to purchase. Using the price adjustment mechanism, agents are able to adapt their prices to demand and in doing so learn by feedback.

Thus, in trying to be successful on the market, firms are dependent on their innovation hypothesis, i.e. on their kene. If a product does not meet any demand, the firm has to adapt its knowledge in order to produce something else for which there are customers (cf. e.g. Duncan, 1974). Here, our learning and cooperation features are again connected.

2.4 Previous Applications of SKIN in European Framework Programmes

This SKIN application to FP-funded R&D networks already started in the EU project "Network Models, Governance and R&D Collaboration Networks" (NEMO, NEST, FP6; Scholz et al., 2010). In this project, we adapted the SKIN model to the study scope by developing new types of agent to represent research institutes, SMEs and big firms as required by the policies and scenarios to be modelled. The behaviours of the agents follow our empirical understanding of the processes of network formation and evolution in the Framework Programmes.

Agents are just R&D organisations (universities and research institutes), R&D departments in large diversified firms (LDFs) and small and medium-sized enterprises (SMEs). Each agent has a kene, which in this case is a "quadruple". A quadruple includes the following elements: **R**esearch **D**irection (RD) represented by an integer, **C**apabilities (C) represented by an integer, **A**bilities (A) represented by a real number and **E**xpertise (E) represented by an integer.

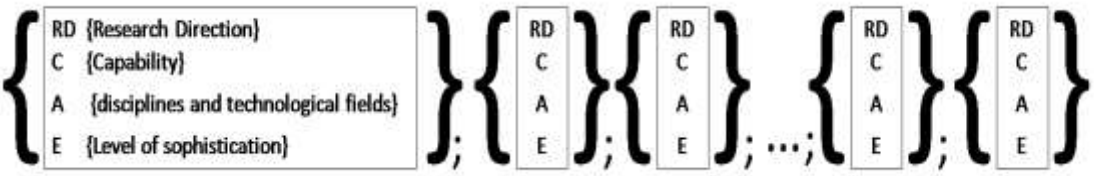

Figure 5: Kenes in the SKIN Model

The capabilities (C) represent different knowledge areas and technological disciplines, e.g. biochemistry, telecommunications or mechanical engineering. For modelling purposes the number of different capabilities has to be chosen to be large enough to cover all potential research areas that are encompassed in the European Framework Programmes. The knowledge space is structured: for

example 800 different capabilities are divided equally among each of eight themes.

The ability (A) represents the actors' specialisation in the capabilities' fields. In biochemistry, for instance, abilities are protein design, genomics, combinatorial chemistry, bioinformatics, filtering, and so on. The expertise (E) stands for the advancement of an actor's skills in the respective knowledge field.

There are three different types of agents: research institutions including universities (RES), large diversified firms (LDFs) and small and medium-sized enterprises (SMEs), as shown in Table 3.

Agent types	Contribution (indicated by length of kene)	Objectives	Research Direction	Capacity for partnerships
RES	Variety of knowledge	Publication and patents	Basic or applied	Large (>2)
LDFs	Variety of knowledge	Patents	Applied	Large (>2)
SMEs	Specialised knowledge	Patents and Publications	Applied	Small (1 or 2)

Table 2: Types of Agent in a SKIN Model

The general behaviours of the agents follow an empirical understanding of the phases in network formation and evolution of the Framework Programmes.

The EU provides funding for collaborative research. The rules are defined in the Framework Programmes (e.g. rules for project consortia, research topics, time span of the FP etc.). Actors (research institutes, firms etc.) want to apply for funding.

The Calls of the Commission specify:

i. The type of instrument (IP or STREP), which specifies the minimum number of partners in a consortium, the composition of partners, and the length of the project;

ii. The date of Call (to determine the deadline for submission);

iii. A range of capabilities, a sufficient number of which must appear in an eligible proposal (how many is sufficient depends on the type of instrument, e.g. lower for a narrowly focused STREP than for a IP with a broad scope);

iv. The funding available for this Call;

v. The number of projects that will be funded;

vi. The desired basic or applied orientation.

The actors form project consortia. Partner choice mechanisms apply. Firstly, the agent looks at the list of its previous partners. Secondly, previous partners that agreed to join the proposal can add previous partners from their list. Thirdly, new partners will be searched for. The search process is guided by the requirements outlined in the Call, a list of capabilities. The proposal is considered to be eligible only if a sufficient number of these capabilities appear. If no agent from the list of previous partners can contribute such a capability in the first iteration, then in the second iteration previous partners of those agents that agreed to join the proposal can ask their previous partners. If the required capability is still not found, the proposal consortium can search for the knowledge in the population of all actors. This is done on a random basis.

In each iteration, *n* agents can be asked whether they have the respective capability and whether they want to join the proposal consortium. The

possibilities to join a proposal consortium are determined by the same rules as for the determination of project initiations (see next step). The length of the kene determines whether the agent has free capacities for new activities. For example, an SME, whose kene is of minimum size (i.e. five quadruples) and which is already in a project or a proposal consortium has to reject the offer.

The agents in collaboration produce a proposal, representing the relevant knowledge of the partners. The consortium submits the proposal to the Commission. Each agent contributes one or more capabilities. The upper bound on how many capabilities an agent can contribute depends on the size of the agent's kene. If the agent has only one of the capabilities specified in the call, it contributes this capability. If the agent has none of the required capabilities, it declines to join. A proposal will be submitted if a sufficient number of capabilities appear.

The Commission evaluates the proposals according to a template that emphasises the contents (programme match), and the quality and architecture of the consortium (e.g. minimum number of members, industry involvement etc.). Proposals need to have sufficient partners with a sufficient number of capabilities as specified in the Call to be considered eligible. All proposals that fulfil the eligibility criteria are then ranked according to the average expertise level of the proposals (i.e. the expertise levels of the capabilities are summed and divided by the number of quadruples in the proposal). If some proposals turn out to have the same average expertise level, the tied proposals are ordered according to the number of the capabilities in the proposal that were specified in the Call. If, after the application of this rule, proposals are still ranked equally, one of them is selected at random. The number of proposals specified in the Call is then selected working down the ranked list. Proposal consortia that are not successful are dissolved. Those consortia that were selected start their projects.

The projects start to work on a "project hypothesis," i.e. they are involved in research and cooperative learning activities. They produce deliverables (e.g. a number of publications and patents). The research in the projects follows the ideas of SKEIN (Scholz et al., 2010).

Agents in project consortia are randomly allocated to sub-projects and combine their kenes. Every three months they produce an output (deliverable), which can be a publication or a patent. A transformation function for the project hypothesis produces: (i) a number between 0 and 1, which decides on the type of outcome and (ii) a figure describing the probability of success of the project hypothesis.

The potential outcome (publication or patent) depends on: (a) the research orientation of actors (i.e. an applied research orientation increases the probability of a patent whereas a basic research orientation decreases this probability) and (b) the variance in capabilities involved in a project hypothesis—the lower the variance, the lower the probability of a patent.

The research undertaken in projects is incremental (abilities are substituted, expertise levels are increased). The potential of a radical innovation is determined only when the proposal is put together in the sense that new capability combinations can appear in consortia. SMEs are important candidates for contributing new capabilities and their involvement increases the likelihood for radical innovation. New knowledge is injected into the system most often by new, small and sophisticated companies. In order to allow the SMEs to play their special role we define 10 capabilities per theme as "rare" capabilities and give these capabilities in the starting distribution exclusively to SMEs. The learning processes and knowledge sharing in the projects follow the SKEIN version. The expertise levels of the capabilities used for the deliverables increase at each iteration.

Capabilities of deliverables are exchanged among partners to model knowledge transfer in projects. At the end of the project all results are delivered to the Commission.

2.5 SKIN in the GREAT Project

While our previous applications of the SKIN model have focused on experiments dealing with innovation processes and university-industry relationships (UIRs), the GREAT project will lead us into unchartered territory in that we will need to simulate processes of responsible research and innovation.

We anticipate that the innovation hypothesis presented in equation (1) will need to be extended to take into account aspects of responsible innovation that have not yet been modelled, let alone simulated.

Of particular interest for the present application in the GREAT project is the modelling and simulation of university-complementor and industry-complementor relationships, UCRs and ICRs, respectively. In this connection, we will need to model and simulate the decision-making processes involving conflicting objectives. Agents will need to be endowed with the ability to make trade-offs involving multicriteria that will often be difficult to reconcile. Therefore, we will investigate to what extent the basic structure of kenes will need to be extended to allow for multicriteria decision algorithms to be implemented during the simulation.

2.6 The Survey in the GREAT Project

As far a calibration for the SKIN models in the GREAT project is concerned, we need to meet the following challenges.

2.6.1 Types of Agents

What are the types of agents that will be covered as part of the simulations? The choice of agents for the simulations will depend on the research questions we want to answer, on the one hand, and the availability of data for calibration on the other.

Below is a list of potential types of actors:

i) Research teams within departments at research universities;

ii) Research team within research centres at research universities;

iii) Independent research centres;

iv) Consulting firms;

v) R&D teams at small and medium-sized firms

vi) R&D team at large diversified companies

2.6.2 Focus on Research or Innovation

What is the primary focus of the project? Will it be basic or applied research whose output is measured in terms of publications in peer reviewed outlets and patents? Or will it be value created for end consumers and clients? Is there any corporate strategy in place? Is the project strategically aligned with that strategy? What is the current underlying governing and management framework used to drive the project and measure its success? How are decisions made by the agents in order to drive the project forward? What are their incentives and disincentives? What is the ultimate utility function underlying the decision-making processes made by the project team?

2.6.3 Responsible Research and Innovation

Is there any clearly stated notion of RRI proposed by the governing bodies of the firm or organisation that conducts the research and/or innovates? What are their guiding principles? What are the main implicit or explicit trade-offs involved made by that organisation as far as RRI is concerned? Is there any explicit RRI strategy in place? In the absence of such a RRI strategy on the part of the organisations that conducts research and/or innovates, what is the implicit strategy? Is the project strategically aligned with that RRI strategy? What are the current underlying RRI governing and management frameworks used to drive the project and measure its success as far as RRI compliance is concerned? What is the de facto RRI construct used by the organisation that conducts research and innovates?

2.6.4 Normative Framework

Is there any RRI normative framework in place either at the level of the organisation that conducts research and/or innovate or at a supra level? What are the norms set forth by that RRI normative framework? What are the guiding principles behind that RRI normative framework? Does the project comply with that RRI normative framework? What are the current underlying RRI governing and management frameworks used to drive the project and measure its success as far as RRI compliance with that normative framework is concerned? Was that methodology designed with a view to comply with that normative framework? Are the norms and regulations imposed on the project team detrimental to obtaining the research and innovation objectives of the project? If so, what are the conflicting objectives and how were or are they being resolved. What norms and regulations are desirable or undesirable as far as RRI compliance of this and future projects such as this are concerned?

2.6.5 Complementor Involvement

Where there any civil society organisations (CSOs) involved as complementors and, if so, who were they and what was their role in the project? Where there any complementors involved in the project to make sure the project increased the chances of being innovative? Where there any complementors involved in the project to make sure the project was RRI compliant? How did the RRI governing and management methodology was used by the project managers and other governing bodies in order the effect such RRI compliance and in what areas of RRI? Was it merely to anticipate and assess the potential negative impact of the project with on the external stakeholders involved or did the governing and management methodology extend into areas of project governance and strategic decision-making?

2.7 Using the Results of the Survey in the GREAT Project

We will model the SKIN models in the GREAT project based on the information about the type of agents and the RRI context in which they interact. This background information will be provided by the GREAT survey using the data set described in chapter 1. These models will include:

i) The type of agents to model in SKIN (Section 2.6.1);

ii) Their primary utility functions (research and/or innovation objectives and any governing and management procedures to reach the stated goals (Section 2.6.2);

iii) The RRI constraints (Section 2.6.3), which will correspond mostly to first-order reflexivity constraints, and the governing and management procedures to resolve them;

iv) The RRI constraints (Section 2.6.4), which will correspond mostly to second-order reflexivity constraints, and the governing and management procedures to resolve them;

v) The complementors involved and how the constraints they posed played a role in the governing and management of the RRI process (Section 2.6.5).

Utility functions and constraints will be used in SKIN to model the decision-making processes of actors during a simulation. Such decisions will be made sensitive to the RRI context identified through the GREAT survey.

With the models in place, we will design experiments to test the possible outcomes of public policy regarding RRI. Though these models will be strongly influenced by the information we gain through the GREAT survey, agents might need to be endowed with general-purpose functionality regarding processes of research and innovation as well with more specific features, as required by the experiment design and the technical constraints posed by the current state of development of the SKIN modelling framework and its underlying simulation platform and programming language.

In the next chapter, we introduce the survey methodology we will be using in the GREAT project.

Chapter 3 Survey Methodology

3.1 Motivation

What does it mean for an organisation to be conducting RRI?

This question poses one of the main challenges associated with the GREAT project, namely, the quest for the so-called "RRI construct."

An answer to this question should shed light on what the elements an organisation that conducts processes of research and innovation needs to comply with in order for actors in the public and private sector, including complementors, to consider it RRI compliant.

Arguably, different types of agents will have different views and ways of approaching RRI compliance issues, either from a normative perspective of legal and ethical compliance with internal and external governing bodies or from the perspective of their need to take into consideration and respond to the force of complementors, including societal actors such as CSOs (civil society organisations). Therefore, we are interested in finding out the actual profiles of both research and innovation (RI profiles) and also responsible research and innovation (RRI profiles) and ascertaining how different RI and RRI profiles lead to different responses, or trade-offs, when it comes to responding to the various opportunities—and threats—associated with processes of RRI.

The survey will helps us find out the profiles pertaining to RI and RRI in the dataset presented in chapter 1, which is comprised of innovation projects funded by the Seventh Framework Programme under the European Commission's CIP ICT PSP programme. As will be shown in chapter 4, the survey described in Section 4.5 of chapter 4 aims to find out not only the *de facto* RRI profiles but also the *preferred* RRI profiles in this dataset.

Mining these preferred RRI profiles is important given the need to model utility functions of the agents in the agent-based simulation. Finding out the preferred RRI profiles on multiple attributes corresponds to our overarching objective in the survey. Indeed, our task can be construed as the process of finding out RRI profiles that maximise the utility of agents that conduct RI in the dataset described in chapter 1.

Modelling the behaviour of RI agents to comply with RRI is a problem that raises a number of important strategic trade-offs not only for the actors conducting RI but also for the research-funding agencies that fund them and for the societal actors involved. To cope with this challenge, we have chosen both a qualitative and a quantitative approach to answering a variety of questions associated with the structure of preferences and values, that is, the trade-offs, that RI actors in the dataset have made in the process of conducting research and innovation. We also aim to elicit existing (informal) project practices and stakeholder perceptions of sensitive or difficult issues debated or dealt with throughout the life cycle of the projects.

In section 3.2, we introduce the qualitative methodology to be used for conducting the case studies in the GREAT project. In section 3.3, we introduce the quantitative methodology to be used for calibrating the agent-based models that will be applied for agent-based simulation in the GREAT project.

3.2 Qualitative Methodology

3.2.1 Introduction

The qualitative methodology includes two analytic orientations. The first is theoretical ("top-down") and informed by the "Analytical Grid" (DEL 2.3) developed in WP2 (Current Theory and Practice). The second is empirical

("bottom-up") and informed by grounded theory (Corbin and Strauss, 1990; Bryant and Charmaz, 2007).

A case study approach is followed (e.g. Yin, 2014) with eight case studies conducted altogether: five document-based, and three more comprehensive in-depth case studies that include semi-structured interviews. The basic method followed is thematic analysis (Guest, 2012). These and further relevant qualitative methods, and analytical orientations, have been explained in DEL 3.1 (Fieldwork Methodology Approach Including Interview and Observation Techniques).

The eight case studies will highlight RRI and governance issues in up to 17 past and current projects altogether. The following list provides an overview of the projects selected, as of end of May 2014. The CIP ICT PSP projects (4) and (5) will be identified by the end of June 2014; and the remaining projects – both CIP ICT PSP and others – cannot be named, as they are part of the in-depth interview based case studies which need to be completely anonymised (see section 3.2.3):

CIP ICT PSP projects:

(1) "CommonWell";
(2) "EnergyTIC";
(3) "SPOCS";
(4) a project from the domain "improving public services for citizens and businesses" (see section 3.2.2);
(5) another project from the domain "improving public services for citizens and businesses";
(6) a project from the domain "care for older people";
(7) another project from the domain "care for older people";
(8) another project from the domain "care for older people";
(9) another project from the domain "care for older people";
(10) another project from the domain "care for older people";

(11) a project from the domain “care for the environment”;

(12) another project from the domain “care for the environment”;

(13) another project from the domain “care for the environment”;

(14) another project from the domain “care for the environment”;

(15) another project from the domain “care for the environment”.

Non-CIP ICT PSP projects:

(16) EU project FP 7, Coordination;

(17) EUREKA project.

Bringing in two additional projects (from FP 7 Coordination and EUREKA) will assist in our understanding of the distinctive features of the CIP ICT PSP projects in comparison with international collaborative projects more generally.

Each case study focuses upon selected dimensions of the Analytical Grid. Together, all case studies are planned to provide a full account of all Analytical Grid dimensions, helping to assess and possibly amend it in order to develop final guidelines and models of RRI that are as practice-oriented as possible.

3.2.2 Domains Considered

The eight case studies assist in our understanding of a broad spectrum of societal concerns reflected in various CIP ICT PSP Work Programmes (WoPr). We distinguish four domains:

1. Care for older people (e.g. WoPr 2007: “ICT for ageing well”; WoPr 2011: “ICT solutions for fall prevention and detection and ICT and ageing network”);
2. Care for the environment (e.g. WoPr 2008: “ICT for energy efficiency in public building and spaces, including lighting”; WoPr 2012: “smart urban digital services for energy efficiency”);

3. improving public services for citizens and businesses (e.g. WoPr 2009: “enlargement of the e-procurement pilot PEPPOL”; WoPr 2012: “basic cross-sector services”);
4. automation (given the recent financial crises and its broader socio-economic repercussions, the empirical focus is automation in financial markets).

While the automation of services is a basic theme underlying all CIP ICT PSP work programmes, the three other domains (care for the environment, care for older people and improving public services for citizens and businesses) are more narrowly defined.

Annex 1 lists the projects identified under these three narrower themes. However, the classification is not absolute – sometimes a project could also have been classified differently. For instance, some of the listed projects relate to the overarching theme rather implicitly (e.g. the telemedicine projects MOMENTUM, PALANTE and SUSTAINS address the group of older people implicitly). Other projects reflect more than one theme. One such case is eEnviPer, which includes objectives related to both the improvement of public services and care for the environment. In such cases we listed the project under just one theme (in the case of eEnviPer under “Improving public services for citizens and businesses”). Our classification is based on the project descriptions available as of 08/05/2014 at:

http://ec.europa.eu/information_society/apps/projects/index.cfm?menu=secondary&prog_id=IPSP

These three thematic groups of projects (care for the environment, care for older people and improving public services for citizens and businesses), listed in Annex 1, are the pool of projects that our eight case studies draw upon. Our analysis considers three distinct domains, plus the cross-cutting theme of automation.

However, following a qualitative approach, in our eight case studies we focus on a selection of approximately 15 CIP ICT PSP projects. Out of these, five will be discussed through document-based case studies, as the next section explains. The other ten projects are analysed by conducting approximately ten semi-structured interviews with either the project coordinator or another participant of each of these projects. These interviews are part of our in-depth case studies. The rationale for this dual approach—document-based case studies versus in-depth (interview-based) case studies—and the criteria for selecting the 15 CIP ICT PSP projects from the three thematic groups of projects are explained in the next section.

3.2.3 Document-based and In-depth (Interview-based) Case Studies

The five document-based case studies are conducted relying on official CIP ICT PSP project documents such as deliverables and websites.

The projects (1) "CommonWell", (2) "EnergyTIC" and (3) "SPOCS" listed in the introduction have been chosen for the first three document-based case studies, as they seem to exemplify different governance models identified in the Analytical Grid (DEL 2.3). This working hypothesis is tested (DEL 4.2) and the actual results from the analysis will be used to confirm, amend or refine these and other dimensions of the Analytical Grid. The two remaining document-based studies will be chosen once this first round of analysis has been completed. They will be selected from the group of CIP ICT projects that address the theme "improving public services for citizens and businesses." These are the projects (4) and (5) listed in the introduction.

In doing so, all these five document-based case studies will have considered all the themes specified in section 3.2.2: CommonWell ("Common Platform Services for Ageing Well in Europe") relates to the theme "care for older people;" EnergyTIC ("Technology, Information and Communication Services for Engaging

Social Housing Residents in Energy and Water Efficiency") relates to the theme "care for the environment;" and SPOCS ("Simple Procedures Online for Cross-Border Services") as well as the two projects still to be selected relate to the theme "improving public services for citizens and businesses."

Moreover, all these five projects (CommonWell, EngeryTIC, SPOCS, and the two on public services) include different automated services. Thus, we also highlight governance and RRI issues related to our fourth theme ("automation") introduced in the last section.

Findings from these five project-centred studies will be included in DEL 4.2 (Case Study Report).

The three in-depth interview-based case studies relate to three out of the four themes introduced in the last section: care for older people, care for the environment, and automation (in financial markets). A variety of related technologies, services, stakeholder perceptions, practices, governance and RRI issues is considered, as interviews with different stakeholders from a number of different projects as well as from the wider context of the CIP ICT PSP projects are conducted. Thus, for each of these three themes, overarching patterns and relevant issues are identified, using a combination of grounded theory and thematic analysis. We also intend to identify general patterns and cross-cutting issues across all three themes. Up to 24 interviews are scheduled: nine related to the theme "care for older people," five related to the theme "care for the environment," and ten related to the theme "automation" (in financial markets). Two further interviews have already been conducted with non-CIP ICT PSP researchers (one with a researcher from another EU FP 7 project; one with a researcher from a EUREKA project). Apart from semi-structured interviews, the in-depth case studies draw on domain-specific documents and literature. Findings from these in-depth studies will be included in DEL 3.4 (Context of RRI Report).

Each “type” of case study has its advantages and disadvantages. By combining the two, their respective weaknesses and strengths are balanced to some degree. The advantage of a document-based case study is that a greater amount of specific project information that is included in publicly available documents can be integrated in the analysis. This includes important contextual information such as the precise research topic and related challenges. The disadvantages are, for instance, that actual (informal) practices and stakeholder perceptions of sensitive or difficult issues actually debated and/or dealt with during the project are often not mentioned in official project publications and will therefore remain hidden. Thus, the analysis lacks information related to important dimensions such as the full spectrum of governance and RRI issues in reality (e.g. not foreseen in the Analytical Grid), and practical limitations for conducting RRI. Moreover, stakeholders may have tried to act as responsibly as possible over the course of the actual project but may have struggled with different normative expectations. We assume that such normative dilemmas and other problems emerging in the course of a project are very common in practice. However, a discussion of these may often not be included in official project documents that tend to summarise decision-making processes and show results of work processes rather than the work processes themselves. In contrast to this, the in-depth interview-based case studies with different project participants can, to some extent, reveal such practices, perceptions, normative dilemmas and emerging issues that are part of the day-to-day activity that takes place in projects but is often not represented in official publications. Implicit existing forms of RRI may also be revealed. However, in order to obtain such information on existing implicit (informal) RRI practices, perceptions, and sensitive issues, full anonymisation of projects and interviewees is crucial to ensure the privacy and confidentiality of participants.

3.2.4 Interviews and Interview Schedules

Approximately ten interviews are conducted with project coordinators and other direct participants of CIP ICT PSP projects. The other interviews are conducted

with domain experts and stakeholders in order to better grasp the domain-specific context of the project work.

Regarding CIP ICT PSP project participants, the data-gathering process began in December 2013. A first interview schedule was prepared jointly by GREAT partners of WP3 and WP4. The aim was to put forth context- and practice-oriented questions involving relevant dimensions such as the nature of the innovation processes and the actors involved. We also included questions related to RRI, e.g. whether a project had an ethical review committee in place or not.

Annex 2 includes an excerpt of the comprehensive interview schedule developed for the first three interviews with project coordinators conducted in December 2013. The participants were interviewed for 1.5 hours on average. The semi-structured interview approach utilised meant that the questions asked over the course of an interview are adjusted to the interviewee's responses and needs as the interview unfolds in order to represent the domain and relevant issues adequately. Thus, each interviewee had an opportunity to elaborate on certain issues while omitting others. Not all questions originally included in the interview schedule were answered in all three interviews, as the semi-structured interview approach enables participants to also provide comprehensive accounts on unanticipated issues. Findings from these first interviews will be included in DEL 3.4 (Context of RRI Report).

Once the results from DEL 2.3 (Analytical Grid) were available in February 2014, we developed the initial interview schedule further taking into account the final version of DEL 2.3, and suggestions from our partners of WP 2. This revised schedule is shown in Annex 3. Approximately one quarter of the original schedule was altered based upon the list of parameters, and related explanations, in DEL 2.3 (the original interview schedule did not cover all of these). The revised schedule will be used for all the remaining interviews with both CIP ICT PSP

project coordinators and other project partners. These interviews will take place in 2014 (June through October).

Out of the ten interviews with further relevant stakeholders (non-CIP ICT PSP project participants) conducted so far, the first six interviews took place before the Analytical Grid was available. They were more exploratory and tailored to the characteristics of the domain of the interviewee. Once the Analytical Grid was available, the interview schedule for the next interviews was revised accordingly, also taking into account suggestions from WP 2 partners. A full overview of all interviews, and the findings of all eight case studies will be provided in DEL 3.4 (Context of RRI Report).

3.3 Quantitative Methodology

3.3.1 Introduction

From the point of view of the GREAT project, the overarching question we need to answer in terms of the quantitative survey is the following:

What is the utility that each of the potential elements of RRI contribute to an RI actor (a respondent) in the CIP ICT PSP project pool?

In other words, what is the relevance of such RRI elements and their potential values from the perspective of a respondent, which in our case we assume to be a project coordinator (or a project member) in the CIP ICT PSP project included in our dataset?

Answering the above question asks for a de-compositional model of quantitative analysis, as opposed to a compositional one.

Compositional multivariate models assume that an overall construct is already available and that respondents can provide the values associated with each

attribute in the construct. With such values in place, these models calculate the value of the dependent variable, that is, total utility of the construct, based on the values supplied by respondents for the independent variables in the construct, that is, the attributes and their respective values.

The lack of an agreed-upon RRI construct, that is, the set of attributes that make up RRI, on the one hand, and the lack of a set of values for the potential attributes, on the other, forces us to design experiments to elicit such construct and their associated values based on the overall utility perceived by respondents.

This is a de-compositional task in that respondents, when confronted with a set of potential RRI constructs, or RRI profiles as we will call them, will either rate or rank them, or will choose one of them from a given set of profiles, based on the *perceived overall utility of the profile*.

Our task will then consist in applying a de-compositional multivariate method in order to elicit the utility of each of the values for each one of the attributes in the construct. Such a de-compositional model would allow us to find out the relevant and irrelevant attributes and values. This de-compositional approach will, in turn, provide us with a quantitative multivariate methodology for eliciting the RRI profiles preferred by each of the respondents.

Based on the task at hand, we have chosen a hybrid family of multivariate de-compositional methods called Conjoint Analysis as the quantitative methodology to be used in the GREAT project.

We provide an overview of Conjoint Analysis in Section 3.3.2 through Section 3.3.8. Our description has been taken from one of the most comprehensive guides to Conjoint Analysis (Rao, 2010).

3.3.2 Conjoint Analysis

Conjoint Analysis is one of the most widely used quantitative multivariate methodologies since its inception in the early seventies (Green and Rao, 1971).

With the exception of the Self-Explicated Conjoint Analysis method to be introduced in section 3.3.6, Conjoint Analysis is one of the most important methods based on the *De-compositional Model*, a class of multivariate models that present respondents with a set of objects in order for the researcher to statistically infer the respondents' individual preferences.

Under this model, the respondent's preference representing his or her perceived value of the presented object, the so-called utility (the dependent variable), is decomposed into the actual utility contributed by each of the values for each of attributes in the profile (the independent variable). Conjoint Analysis has been developed to elicit respondents' preferences structure regarding objects, which in our case amounts to eliciting the attributes and values that will make up the RRI profiles in the CIP ICT PSP projects included in our dataset.

An object is described using *n* factors called *attributes* and each attribute can take *m* values ($m \geq 2$), usually called *levels*. While a particular instantiation of an object is called a *profile* (also called *treatment* or *stimulus*), a particular instantiation of levels for each one of the attributes of an object is called a *full profile*.

Conjoint Analysis differs from more traditional compositional techniques in that compositional techniques collect the rankings or ratings on many attributes directly from respondents to then compose a predictive model of total utility. When performing Conjoint Analysis, we are interested in the answer to the opposite question, that is, the researcher is interested in assessing how the attributes and levels of a profile determine the overall utility that a given profile provides to a respondent, which is expressed by the judgement on profiles

(expressed in terms of ranking or ratings) respondents provide or by the profiles they choose during an experiment.

Therefore, Conjoint Analysis is used to ascertain what attributes and levels determine utility for an individual respondent.

Collecting the preferences is performed in Conjoint Analysis using the so-called *Conjoint Task*, which is defined as the process of letting respondents communicate their judgements on each of the profiles in the so-called *Conjoint Design*. The Conjoint Design is defined as the set of conjoint profiles that are generated to perform the Conjoint Task.

There are two basic methods for designing the profiles that are going to be included in the Conjoint Design, factorial design and fractional factorial design. While factorial design generates all possible profiles as different combinations of levels for each of the attributes according to equation (2) below, fractional factorial design generates only a subset of them according to a predefined plan.

There are three basic methods for presenting profiles as part of the Conjoint Task, the *full profile method*, the *pairwise comparison method*, and the *trade-off method*.

The full profile method presents a full profile to respondents, that is, all of the attributes of an object along with a level for each one of the attributes are presented to respondents, who are then asked to rank or rate the full profiles presented. The pairwise comparison method presents a pair of profiles to respondents, who then select one profile as preferred. Under the trade-off method, attributes and their respective levels are presented two at a time, which forces a response by respondents expressed in terms of a trade-off.

3.3.3 Types of Conjoint Analysis

Conjoint Analysis is still an evolving methodology comprised of four methods:

1. The traditional method (CA);
2. The choice-based method (CBCA);
3. The self-explicated method; and
4. The adaptive conjoint method (ACA).

3.3.4 The Traditional Conjoint Analysis

The traditional conjoint analysis uses full profiles of the object. Full profiles are then presented to respondents, who are then asked to rank or rate all profiles in the conjoint task.

Based on the respondent's choices on multiple full profiles, the Traditional Conjoint Analysis method applies a de-compositional model to find out the preferences of respondents regarding an object described by way of a finite number of attributes and levels. Respondents are presented with these profiles using either the full profile or the pairwise comparison method and they have to rank or rate the profiles presented.

The Traditional Conjoint analysis method lets respondents evaluate a large number of profiles in order to then determine the respondent's preference structure. It differs from other multivariate techniques in that respondents are not asked to provide information on the relevance of specific attributes and levels. It is by a process of analysing the actual respondent's judgements on multiple profiles that the actual preference structure can be determined.

One of the problems of the traditional method is that, even for objects that can be described in terms of a relatively small set of attributes and levels, the number of profiles that need be presented to respondents can grow very quickly.

Equation (2) gives us the number of profiles for an object whose profile is fully described by *n* attributes and *m* levels for each attribute:

(2)

Presenting all full profiles requires conducting the so-called factorial design, that is, the n^m profiles need to be generated and rated or ranked by respondents. As we can see from equation (2), the number of profiles can grow very quickly, making the process of presenting all full profiles to respondents quite impractical in many cases. Even in cases where factorial design would lead to a still manageable number of profiles, respondents might be discouraged to participate if the surveys used require that they rank or rate a considerable amount of profiles.

The Traditional Conjoint Analysis method generally deals with this problem by applying the fractional factorial design introduced above. Fractional factorial design reduces the number of profiles in the conjoint task. Using this method, a subset of all possible profiles is presented to respondents using either the full profile or the pairwise comparison presentation method. The method then collects the preferences of respondents expressed in terms of ranking or ratings of profiles as usual.

An important task of the Traditional Conjoint Analysis method consists in calculating the so-called *part-worths*. Part-worths correspond to the actual utility contributed by a given level of a given attribute, for all the attributes that were considered to define the profiles in the conjoint design. Under the more generally

used *additive model*, the sum of the part-worths for all the attributes in the profile gives us the total utility or preference of that profile.

The Traditional Conjoint Analysis method uses multiple regression techniques to calculate these part-worths, which are calculated for each of the respondents separately. This method is therefore a de-compositional technique that can provide results on respondent's preference structure on an individual as opposed to an aggregate basis.

3.3.5 The Choice-Based Conjoint Analysis (CBCA)

As mentioned, the Traditional Conjoint Analysis method uses full profiles of the object and requires respondents to rank or rate all profiles in the conjoint task in order to elicit the preferences of respondents regarding an object described by way of a finite number of attributes and levels. Respondents are presented with these profiles using either the full profile or the pairwise comparison method whereby they have to rank or rate the profiles presented.

The Choice-Based Conjoint Analysis method (CBCA) differs from the traditional method in that it tries to mirror the actual settings respondents are embedded in when making choices in the real world. Under the CBCA method, respondents will be presented with a set of full profiles, the so-called *choice set*. Whilst the traditional method would ask respondents to rate or rank the profiles in the choice set (the respondent's *stated preference*), the CBCA method asks them to choose one of them from the choice set (the respondent's *stated choice*) or none of them (the "no choice" alternative in the choice set).

Calculating part-worths in the CBCA method differs from the traditional method in that the CBCA method calculates the probability of choosing a profile in a choice set. Under the CBCA method, the random utility of a profile in a given choice set for a given respondent is comprised of a deterministic and a random

component (McFadden, 1974). Several methods have been proposed to calculate the probability of choosing a profile in a given choice set. Chief among them is the multinomial logic model (MNL), which assumes an extreme value distribution for the error part of the random utility.

An advantage of the Choice-Based Conjoint Analysis method is that it allows for the detection of so-called *interaction effects* of two or more attributes in a profile (the independent variable) on the dependent variable (overall utility of the profile) as opposed to the traditional method that can only capture the main effects of each attribute on the dependent variable separately.

Another advantage of the Choice-Based Conjoint Analysis method is that it allows for the elimination of so-called *prohibited pairs*, that is, combinations of attributes and levels that are inconsistent and result from including all the possible combinations implicit in the traditional method. By designing the choice sets accordingly, the researcher can propose choice sets where such prohibited pairs of attributes and levels do not occur, thus *a priori* eliminating prohibited pairs from being considered.

Last but not least, the Choice-Based Conjoint Analysis method allows the researcher to explore specific questions that are not possible to be addressed using the traditional method. Researchers can let respondents deal with a particular question by designing choice sets accordingly in order to analyse the choices made by respondents when they are confronted with alternatives of seemingly comparable utility or when researchers are investigating potential interaction effects between attributes in the profile.

3.3.6 The Self-Explicated Conjoint Analysis

Real-life applications involving profiles with more than ten attributes will often lead to a large number of profiles in the conjoint task, even if a subset of all

profiles obtained through fractional factorial design is considered. In order to deal with these cases, a different method called the Self-Explicated Conjoint Analysis method has been introduced (Green and Srinivasan, 1990).

This method is a departure from the traditional and the choice-based methods, both of them also referred to as the part-worth conjoint analysis methods, in that it is a compositional method in which respondents are asked to rate both the levels of each attribute in a profile and also the relevance of the attribute in that profile.

The part-worths are then calculated using these two values. In other words, respondents are requested to self-explicate the utility perceived by each of the levels of an attribute, thereby providing their part-worths themselves, instead of providing their actual preferences on profiles.

3.3.7 The Adaptive Conjoint Analysis (ACA)

The Adaptive Conjoint Analysis method (ACA) has been introduced to also deal with conjoint analyses involving profiles with a large number of attributes, usually more than 10 and often involving 20 or more attributes in a profile(Green, 1984). This method combines the part-worth conjoint analysis methods with the self-explicated methods introduced above.

The Adaptive Conjoint Analysis method is often conducted online in order to adapt the profiles presented to the choices made by respondents as the survey unfolds. Given that the number of levels for a given attribute can be decomposed in sets of attributes, this method can also be used to structure the survey in several sections, each one of them dealing with a subset of attributes. The added flexibility of the Adaptive Conjoint Analysis method has contributed to its recent popularity (Huber et. al., 1993).

3.3.8 Software Tools

The following software tools are usually used to perform quantitative surveys and analysis based on Conjoint Analysis:

1. Sawtooth Software (http://www.sawtoothsoftware.com);
2. SAS (SAS Institute, 1999);
3. SPSS (http://www-01.ibm.com/software/cl/analytics/spss);
4. R (http://www.r-project.org);
5. MATLAB (www.mathworks.com/matlab);
6. LIMDEP (Greene, 2013).

Of all the software tools listed above, Sawtooth Software is today's most comprehensive software for performing Conjoint Analysis, including the CBCA, the ACA, and other hybrid methods.

Chapter 4 The Survey in the GREAT Project

In this chapter, we present the survey instrument we will be using in the GREAT project. In section 4.1, we present the general objective of the survey. In section 4.2, we present the list of specific objectives of the survey. In section 4.3, we present a list of archetypical RI agents that will be considered in the survey. These archetypical agents are important because we will model the agents in SKIN based on some of these archetypes. In section 4.4, we present the design of the survey instrument. In section 4.5, we present the survey instrument. In section 4.6, we present the hybrid conjoint methodology we have chosen to conduct the quantitative survey in the GREAT project.

4.1 General Objective

As already mentioned in chapter 3, our methodological choice for conducting the survey has been strongly influenced by the lack of what we might call the "RRI construct." This RRI construct can be construed as a series of agreed-upon elements and parameters that make up RRI. It cannot be the objective of our project to elicit such an RRI construct. Such an undertaking would require the analysis of large datasets covering a wide range of RI projects conducted in several industries and is certainly out of the scope of the GREAT project. Indeed, finding the RRI construct would require a long-term research programme such as the one undertaken by the entrepreneurial studies research community in order to find the so-called entrepreneurial construct (Lumpkin and Dess, 1996). Our objective with the survey will amount to eliciting the actual RI and RRI profiles emerging in the CIP ICT PSP projects included in our dataset. Therefore, we can state the general objective of the survey as follows.

General Objective

The general objective of the survey in the GREAT project is to elicit the RRI profiles shown by the RI agents represented in the CIP ICT PSP project pool.

In order to meet the challenge associated with this general objective, we needed to enter into uncharted territory. Using the findings of DEL 2.2 (Theoretical Landscape) and DEL 2.3 (Analytical Grid), we first put forth generic profiles for a series of archetypical RI agents. These agents correspond to generic RI organisations, which we will be presenting in more detail in section 4.3. Arguably, different archetypical agents will show different emerging RRI profiles and these profiles will, in turn, affect the RRI governance models these archetypical agents will prefer. Our ultimate goal is to elicit the prevalent RRI profiles of the agents found in our dataset. This will allow us to model *in silico* the RI agents accordingly. In other words, we will model the RI agents using the SKIN model based on the prevalent archetypical RI agents found in our dataset and their associated RRI profiles. In order to achieve this goal, a number of specific objectives need to be met.

4.2 Specific Objectives

In this section, we present the specific objectives of the survey in five different areas: RI agent profiles, RI life cycle profiles, RRI life cycle profiles, RRI normative profiles, and RRI context.

4.2.1 Eliciting the Profile of Agents

We will need to ascertain the types of agents that are present in the sample. To achieve this goal we did put together a taxonomy of archetypical agents that cover most of the RI organisations from both the public and private sector. This taxonomy is presented in Section 4.3.

4.2.2 Eliciting the Profiles of RI

We will also need to ascertain what elements or parameters were present in the sample from an RI (research and innovation), as opposed to an RRI (responsible research and innovation), governing standpoint. Examples of basic RI elements or

parameters are needed by the RI team to engage early on in the innovation process with so-called "lead customers," or through the use of innovation management methodologies that used stage-gating processes as a governing framework. As we will see in section 4.3, different archetypes will have different needs in terms of RI governance mechanisms and this, in turn, will affect the choice of RI governance elements involved.

4.2.3 Eliciting the Profiles of RRI

We will also need to ascertain what elements or parameters were present in the sample from a RRI governing standpoint. Examples of basic RRI elements or parameters are the need on the part of the RRI team to comply with RCR (responsible conduct of research) codes or the need to comply with rules imposed by an ethical review committee. As will become apparent when we introduce the archetypes in section 4.3, different archetypes will have different needs and preferences in terms of RRI governance mechanisms and this, in turn, will affect the choice of RRI governance elements involved.

4.2.4 Eliciting the profiles of the RRI normative framework

We will need to also elicit the RRI normative framework in terms of external governing bodies and institutions the projects in the dataset needed or need to account and respond to, from an RRI perspective.

4.2.5 Eliciting the Profiles of the RRI Context

The RRI context pertains to the ontology of actors, be they individuals, groups of individuals, communities, organisations, including potential beneficiaries or users of the expected project outcomes, civil society organisations (CSOs), and other societal actors that took part as external stakeholders in the RRI governance process, and the relationships between them.

4.3 The Archetypes

In this Section 4.3, we introduce the archetypical RI agents.

4.3.1 Archetype 1: Research University (Basic Research)

Table3 shows the elements that characterise Archetype 1.

	Research	Responsible Research
Output	Knowledge, IPs (publications and patents)	Corporate communications, outreach activities and knowledge generation and diffusion
Transfer model	Push model of technology transfer	Push model of communications and knowledge transfer
Governance model	Accountability to research grantor and to university	Standard or revised standard model (research team accountable to research community and complementors)
Principles	Freedom of research	Principles of the ethics review committee and RCR codes
Strategy	Loosely based on university and faculty research strategy	*Ex post ad hoc* community compliance and reputation
Management methodologies	No research and innovation (RI) management methodology	No responsible research and innovation (RRI) management methodology

Table 3: Research University (Basic Research)

In Table 3, the term complementor stands for external stakeholders that might get directly or indirectly involved in the RRI governance process, oftentimes in spontaneous ways that the RI team might not have even anticipated. Such complementors include, but are not limited to, civil society organisations (CSOs) and can include the following agents:

i. People;

ii. Their communities;

iii. Their online communities;

iv. Their organisations and interest groups;

v. Other societal actors posing a threat or an opportunity from a RRI standpoint, including civil society organisations (CSOs); and

vi. Society at large.

In what follows, each Archetype X will have its corresponding Archetype X*. Archetype X* will denote the archetype compliant with the criteria shown in its respective table but whose RRI governing model departs from the standard or revised standard RRI governance model and comply with the criteria set forth for the democratic-inclusive and co-constructive RRI governance models (see DEL. 2.2, Theoretical Landscape). In addition, this denotation will include agents that already have not only RI but also RRI management methodologies in place.

4.3.2 Archetype 2: Research University (Applied Research)

Table 4 shows the elements that characterise Archetype 2.

	Research	Responsible Research
Output	Knowledge, IPs (publications, patents and prototypes)	Corporate communications, outreach activities, knowledge generation and diffusion, PoCs (proofs of concept), prototypes, licensing deals, and spin offs
Transfer model	Push model of technology transfer	Push model of communications and knowledge transfer
Governance model	Accountability to research grantor and to university	Standard or revised standard model (research team accountable to research community and complementors)
Principles	Freedom of research	Principles of the ethics review committee and RCR codes
Strategy	Based on university research and faculty strategy, if there is one	*Ex post ad hoc* community compliance and reputation
Management methodologies	No RI management methodology	No RRI management methodology

Table 4: Research University (Applied Research)

4.3.3 Archetype 3: University-Linked R&D Centre (Basic Research)

Table5 shows the elements that characterise Archetype 3.

	Research	Responsible Research
Output	Knowledge, IPs (publications, patents and prototypes)	Corporate communications, outreach activities, knowledge generation and diffusion, PoCs (proofs of concept) , prototypes, licensing deals and spin offs
Transfer model	Push model of technology transfer	Push model of communications and knowledge transfer
Governance model	Accountability to research grantor and to university	Standard or revised standard model (research team accountable to research community and complementors)
Principles	Stated as part of corporation mission, vision and values	Principles of the ethics review committee and RCR codes
Strategy	Stated as part of corporation mission, vision and values and compliant with the university strategy	*Ex post ad hoc* community compliance and reputation
Management methodologies	No RI management methodology	No RRI management methodology

Table 5: University-Linked R&D Centre (Basic Research)

The term university-linked denotes an archetypical RI agent corresponding to a research centre, whether formed as a separate legal entity or not, where a university or group of universities have the controlling power in that entity. They differ from Archetype 1 and Archetype 2 in that these entities are typically formed with a more specific mission in a specific scientific field. In terms of their business models, Archetype 3 and Archetype 4 below rely mostly on "soft monies" contributed by research-funding agencies, although in some cases the universities might provide a basic endowment to fund their operation.

4.3.4 Archetype 4: University-Linked R&D Centre (Applied Research)

Table 6 shows the elements that characterise Archetype 4.

	Research	Responsible Research
Output	Knowledge, IPs (publications, patents, prototypes)	Corporate communications and outreach activities
Transfer model	Push model of technology transfer	Push model of communications and knowledge transfer
Governance model	Accountability to research grantors and to university	Standard or revised standard model (research team accountable to research community and complementors
Principles	Stated as part of corporation mission, vision and values	Principles of the ethics review committee, RCR codes
Strategy	Stated as part of corporation mission, vision and values and compliant with university strategy	*Ex post ad hoc* community compliance and reputation
Management methodologies	No RI management methodology	No RRI management methodology

Table 6: University-Linked R&D Centre (Basic Research)

4.3.5 Archetype 5: Independent R&D Centre (Public Sector)

Table 7 shows the elements that characterise Archetype 5.

	Research	Responsible Research
Output	Knowledge, IPs (publications and patents)	Corporate communications, outreach activities, knowledge generation and diffusion
Transfer model	Push model of technology transfer	Push model of communications and knowledge transfer
Governance model	Accountability to research grantors, board and funding public sector organisations	Standard or revised standard model (research team accountable to research community and complementors
Principles	Stated as part of corporation mission, vision and values	Principles of the ethics review committee and RCR codes
Strategy	Stated as part of corporation mission, vision and values	*Ex post ad hoc* community compliance and reputation
Management methodologies	No RI management methodology	No RRI management methodology

Table 7: University-Linked R&D Centre (Basic Research)

4.3.6 Archetype 6: Independent R&D Centre (Private Sector)

Table 8 shows the elements that characterise Archetype 6.

	Research	Responsible Research
Output	Knowledge, IPs (publications and patents)	Corporate communications, outreach activities and knowledge generation and diffusion
Transfer model	Push model of technology transfer	Push model of communications and knowledge transfer
Governance model	Accountability to research grantors, board and funding private sector organisations	Standard or revised standard model (research team accountable to research community and complementors
Principles	Stated as part of corporation mission, vision and values	Principles of the ethics review committee and RCR codes
Strategy	Stated as part of corporation mission, vision and values	*Ex post ad hoc* community compliance and reputation
Management methodologies	No RI management methodology	No RRI management methodology

Table 8: University-Linked R&D Centre (Applied Research)

4.3.7 Archetype 7: Contract R&D Centre (Public Sector)

Table 9 shows the elements that characterise Archetype 7.

	Research	Responsible Research
Output	Knowledge, IPs (publications, patents, prototypes, solutions)	Corporate communications, outreach activities, licensing, spin-offs, solutions
Transfer model	Pull model of technology transfer	Pull model of communications
Governance model	Accountability to clients, board and funding public sector organisations	Standard or revised standard model (actor accountable to clients and complementors)
Principles	Stated as part of corporation mission, vision and values	Principles of the ethics review committee, RCR codes
Strategy	Stated as part of corporation mission, vision and values	*Ex post ad hoc* community compliance and reputation
Management methodologies	RI management methodology	Custom RRI management methodology

Table 9: Contract R&D Centre (Public Sector)

4.3.8 Archetype 8: Contract R&D Centre (Private Sector)

Table 10 shows the elements that characterise Archetype 8.

	Research	Responsible Research
Output	Knowledge, IPs (publications, patents, prototypes, solutions)	Corporate communications, outreach activities, licensing, spin-offs, solutions
Transfer model	Pull model of technology transfer	Pull model of communications
Governance model	Accountability to clients, board and funding private sector organisations	Standard or revised standard model (actor accountable to clients and complementors)
Principles	Stated as part of corporation mission, vision and values	Principles of the ethics review committee, RCR codes
Strategy	Stated as part of corporation mission, vision and values	*Ex post ad hoc* community compliance and reputation
Management methodologies	RI management methodology	Custom RRI management methodology

Table 10: Contract R&D Centre (Private Sector)

4.3.9 Archetype 9: Consulting Organisation (Public Sector)

Table 11 shows the elements that characterise Archetype 9.

	Research	Responsible Research
Output	Knowledge, IPs (publications, patents, prototypes, solutions)	Corporate communications, outreach activities, licensing, spin-offs, solutions
Transfer model	Pull model of technology transfer	Pull model of communications
Governance model	Accountability to clients, board and funding public sector organisations	Standard or revised standard model (actor accountable to clients and complementors)
Principles	Stated as part of corporation mission, vision and values	Principles of the ethics review committee, RCR codes
Strategy	Stated as part of corporation mission, vision and values	*Ex post ad hoc* community compliance and reputation
Management methodologies	RI management methodology	Custom RRI management methodology

Table 11: Consulting Organisation Centre (Public Sector)

4.3.10 Archetype 10: Consulting Organisation (Private Sector)

Table 12 shows the elements that characterise Archetype 10.

	Research	Responsible Research
Output	Knowledge, IPs (publications, patents, prototypes, solutions)	Corporate communications, outreach activities, licensing, spin-offs, solutions
Transfer model	Pull model of technology transfer	Pull model of communications
Governance model	Accountability to clients, board and funding public sector organisations	Standard or revised standard model (actor accountable to clients and complementors)
Principles	Stated as part of corporation mission, vision and values	Principles of the ethics review committee, RCR codes
Strategy	Stated as part of corporation mission, vision and values	*Ex post ad hoc* community compliance and reputation
Management methodologies	RI management methodology	Custom RRI management methodology

Table 12: Consulting Organisation Centre (Private Sector)

4.3.11 Archetype 11: R&D Division of LDC

Table 13 shows the elements that characterise Archetype 11(Large Diversified Company)

	Research	Responsible Research
Output	Knowledge, IPs (publications, patents, prototypes, solutions)	Corporate communications, outreach activities, licensing, spin-offs, solutions
Transfer model	Pull model of technology transfer	Pull model of communications
Governance model	Accountability to clients and board	Standard or revised standard model (actor accountable to clients and complementors)
Principles	Stated as part of corporation mission, vision and values	Principles of the ethics review committee, RCR codes
Strategy	Stated as part of corporation mission, vision and values	*Ex post ad hoc* community compliance and reputation
Management methodologies	RI management methodology	Custom RRI management methodology

Table 13: R&D Division of Large Diversified Company

4.3.12 Archetype 12: R&D Division of SME

Table 14 shows the elements that characterise Archetype 12 (R&D Division of Small and Medium-Sized Enterprise)

	Research	Responsible Research
Output	Knowledge, IPs (publications, patents, prototypes, solutions)	Corporate communications, outreach activities, licensing, spin-offs, solutions
Transfer model	Pull model of technology transfer	Pull model of communications
Governance model	Accountability to clients and board	Standard or revised standard model (actor accountable to research community and complementors)
Principles	Stated as part of corporation mission, vision and values	Principles of the ethics review committee, RCR codes
Strategy	Stated as part of corporation mission, vision and values	*Ex post ad hoc* community compliance and reputation
Management methodologies	RI management methodology	Custom RRI management methodology

Table 14: R&D Division of Small and Medium-Sized Enterprise

4.3.13 Analysis of the Archetypes

Our approach to analysing the projects in the dataset will consist in ascertaining the type of archetype that more closely corresponds to the type of organisation serving as coordinator. As mentioned in chapter 1, each project consisted of a consortium involving a number of project partners, which taken together amounted to 3458 organisations from the public and private sector. While we might find all archetypes represented in the dataset, we expect that some of these archetypes will occur more frequently. The results we obtain will greatly influence the type of actors we will be modeling using SKIN in the GREAT project.

The project coordinators will be invited to take part in an online survey. As part of this survey they will be presented with a list of the 12 archetypical agents. The coordinators will be asked to select the archetype that corresponds to their

organisation. An additional type will be provided for cases in which respondents cannot identify any of the archetypes as one corresponding to their organisation, in which case they will need to enter a description of their type of organisation.

4.4 Designing the Instrument

We will consider that for an organisation to be considered RRI compliant, a process needs to be in place. This process, which we will term the RRI alignment process, presupposes the generation and application of an RRI strategy, on the one hand, and checking RRI strategic alignment throughout the entire responsible research and innovation life cycle, (RRI life cycle hereinafter), on the other. Such process of RRI strategic alignment is performed by the RI organisation with the participation of internal and external stakeholders.

4.4.1 The RI Life Cycle

The RI life cycle corresponds to the conventional innovation life cycle as used by a number of innovation management methodologies based on such framework methodologies as the Stage-Gate model (Cooper, 2008). The RI life cycle is usually comprised of four phases that deal with strategic alignment, incubation, development and exploitation. We do not elaborate on the RI life cycle here and refer the interested reader to (Gartner, 2012) for a compilation of the most widely used innovation management methodologies and the innovation life cycles they propose.

4.4.2 The RRI Life Cycle

As opposed to the RI life cycle, the RRI life cycle has not yet been proposed in industry or academia. The RRI life cycle we propose for the GREAT project is shown in Table 15.

Generating RRI Strategy
External Analysis (I)
Internal Analysis (II)
Strategic Diagnostic Analysis (III)
Strategic Design (IV)
Accounting and Responding (V)

Table 15: The RRI Life Cycle

The first phase of external analysis deals with assessing external variables in the environment surrounding the organisation that conducts research and innovation (the RI organisation). The variables pertain to the macro environment in which the organisation is embedded and include political, economic, social, technological, environmental and legal variables. External analysis also deals with the specific industrial sector in which the RI organisation is embedded. It includes actors in the ecosystem such as providers, customers, potential new market entrants, substitutes, competitors and the so-called complementors already introduced in Section 4.3.1.

A variety of analysis to analyse this microenvironment can be used, including the analysis of Porter's five forces, which in the particular case of RRI needs to be complemented by a sixth force, the so-called force of complementors. A key aspect during this phase is to ascertain the negotiating power of these six forces. These analyses of the macro- and microenvironment of the RI organisation serve the purpose of identifying potential threats or opportunities from an RRI standpoint.

The second phase consists of internal analysis. During this phase, the resources, capabilities and competences of the RI organisation are analysed and compared

with those considered as key resources, capabilities and competences for the success of the RI agenda. Internal analysis serves the purpose of identifying potential strengths and weaknesses of the RI organisation from an RRI standpoint.

The third phase consists of strategic diagnostic analysis. During this phase, a number of tools are applied for scenario analysis along four main strategic quadrants. The so-called SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis is commonly used in concert with other tools for scenario analysis with the aim of assessing the potential impact of the different scenarios, their probability of occurrence, and their expected time of occurrence.

The fourth phase consists in making the strategic choices from a RRI standpoint. It is at this phase that the RI organisation actually generates or revisits its RRI strategy and can therefore check RRI strategic alignment.

The fifth and final phase in this RRI life cycle is the actual process of accounting and responding. As mentioned, the RI organisation can only engage in a process of accounting and responding to internal and external stakeholders once its RRI strategy has been generated and, if needed, revisited or reformulated.

It is important to point out that all five phases of the cycle are active in parallel at any given point in time and that this process of generating RRI strategy generation and checking strategic alignment is an ongoing process during the entire responsible research and innovation life cycle (the RRI life cycle).

4.4.3 The RRI Strategy

The procedure outlined above corresponds to a process of quintessential strategic planning in the management sciences that has been extended and adapted to cope with the requirements of RRI.

The question now is how can we make the connection between them and the RRI governance process we are trying to measure with the survey?

In order to make this connection, we have taken the findings of DEL 2.2 (Theoretical Landscape) and DEL 2.3 (Analytical Grid), in particular the parameters that make up RRI process possible, to come up with the following characterisation of RRI compliance:

i. The project team and its internal and external stakeholders are bound by a RRI governance model with a set of governance processes in place;

ii. These processes are used not only to help produce new knowledge or an innovation but to do so making sure that all the potentially negative and positive societal effects have been identified through inclusion (involving transparency and participation),reflexivity and anticipation;

iii. These governing processes help the organisation make the necessary trade-offs (strategic decisions under uncertainty) in order to account and respond to internal and external stakeholders, including complementors, for the strategic trade-offs made (or revisit them throughout the RRI life cycle, if needed).

The survey should then be an instrument allowing us to ascertain not only how the project is being managed to deliver the "I" (the innovation) but also how the project is being governed to deliver the "RI" (responsible innovation). The latter amounts to ascertaining if and how the project is being governed from an RRI standpoint.

In other words, we need to find out not only the *de facto* governance model used by the RI organisation (standard model, revised standard model, inclusive democratic model, or co-constructive model) but also its underlying features.

To this end, we have integrated the elements of anticipation, inclusion, reflexivity and responsiveness compiled in DEL 2.2 (Theoretical Landscape) and DEL 2.3 (Analytical Grid) in the process of strategic planning outlined above.

Table 16 shows the results of this integration.

The RRI Life Cycle	RRI Elements
External analysis (I)	Inclusion (transparency and participation)
Internal analysis (II)	Reflexivity
Strategic diagnostic analysis (III)	Anticipation and responsiveness
Strategic Design (IV)	Strategy definition, that is, making our trade-offs in order to account and respond
Accounting and Responding (V)	A process of using the RRI strategy in order to account and respond to internal and external stakeholders

Table 16: RRI Strategy and RRI Elements

4.4.4 The RRI Elements in External Analysis

Table 17 provides a description of the RRI elements associated with the external analysis phase.

RRI Strategic Planning Phases and Alignment	RRI Elements
Phase I: External Analysis	The process of gathering information, from external forces and stakeholders, including complementors, in order to assess potential negative and positive effects (threats and opportunities) of the proposed RI agenda

Table 17: External Analysis and the RRI Elements

4.4.5 The RRI Elements in Internal Analysis

Table 18 provides a description of the RRI elements associated with the internal analysis phase.

RRI Strategic Planning Phases and Alignment	RRI Elements
Phase II: Internal Analysis	The process of gathering information from internal stakeholders in order to assess strengths and weaknesses

Table 18: Internal Analysis and the RRI Elements

Internal stakeholders include:

i. Members of the project steering committee;
ii. Members of the project governing council;
iii. Management and staff;
iv. Employees;
v. Consultants, advisors and subject matter experts;
vi. Jungle guides (guides and counsellors who assist the innovation team by shedding light on areas representing strategic uncertainty).

4.4.6 The RRI Elements in Strategic Diagnostic Analysis

Table 19 provides a description of the RRI elements associated with the strategic diagnostic analysis phase.

RRI Strategic Planning Phases and Alignment	RRI Elements
Phase III: Strategic Diagnostic Analysis	This phase is all about scenario analysis and has a lot to do with anticipating possible, likely, and unlikely outcomes (scenarios) and coming up with plans to respond to them

Table 19: Strategic Diagnostic Analysis and the RRI Elements

Strategic diagnostic analysis involves analysing the following four quadrants:

1. The first quadrant SO (Strengths and Opportunities) that deals with strategies to leverage current strengths in order to capitalise on current opportunities;

2. The second quadrant ST (Strengths and Threats) that deals with strategies to leverage current strengths in order to mitigate or eliminate current threats;
3. The third quadrant WO (Weaknesses and Opportunities) that deals with strategies to compensate for current weaknesses in order to capitalise on current opportunities;
4. The fourth quadrant WT (Weaknesses and Threats) that deals with strategies to compensate for current weaknesses in order to mitigate or eliminate current threats.

4.4.7 The RRI Elements in Strategic Design

Table 20 describes of the RRI elements associated with the strategic design phase.

RRI Strategic Planning Phases and Alignment	RRI Elements
Phase IV: Strategic Design	This phase is all about making our choices under strategic uncertainty and establishing the trade-offs we are willing and able to make, that is, establishing our RRI strategy

Table 20: Strategic Design and the RRI Elements

Strategic design aim is to produce the following outputs:

i. RRI vision and mission;
ii. RRI values and principles;
iii. RRI strategic general and specific objectives;
iv. RRI strategy;
v. RRI governing and management methodologies.

4.4.8 The RRI Elements in Accounting and Responding

Table 21 provides a description of the RRI elements associated with the fifth phase. This last phase deals with accounting and responding.

RRI Phase of Accounting and Responding	RRI Elements
Phase V: Accounting and Responding	This phase is all about accounting and responding to internal and external stakeholders, including complementors (the sixth force), applying the RRI strategy set forth in Phase 4 of the RRI life cycle

Table 21: Accounting and Responding and the RRI Elements

Accounting and responding is only possible for the RI organisation that innovates to the extent that the RRI strategy set forth in phase 4 complies with the so-called first- and second-order reflexivity criteria set forth during internal and external analysis. Given its general and specific objectives, we have decided to use a quantitative instrument for the survey, which we present in Section 4.5. This quantitative instrument will be complemented by qualitative research in the form of in-depth case studies to be developed as part of Work Package 3 and reported in DEL 4.2.

4.5 The Survey Instrument

In this Section 4.5, we provide a description of how we designed the quantitative instrument. The instrument is comprised of five sections dealing with the classification of the agents in the dataset, their RI profiles, their RRI profiles, their RRI normative profiles, and the profiles of the complementors involved, including CSOs. The survey will be conducted online with project coordinators taken from the list of CIP ICT PSP projects described in the dataset.

4.5.1 Section I: Agent Profiles

The project coordinators are required to select the archetype that corresponds to their organisation. To this end, the 12 archetypes already described in Section 4.3 will be used. Archetype 13 will be provided for cases in which respondents cannot identify any of the archetypes as one corresponding to their organisation, in which case a description of their organisation will be requested.

4.5.2 Section II: RI Profiles

The objective of the second part of the survey is to assess the RI profiles of the projects in the dataset. To this end, we put forth a set of RI profiles. The attributes in these profiles mirror the four phases of the RI life cycle, that is, the phases of (i) strategic alignment, (ii) incubation, (iii) development, and (iv) exploitation. They contain elements and parameters we have distilled from DEL 2.2 (Theoretical Landscape) and DEL 2.3 (Analytical Grid) along with other attributes needed for the calibration of the SKIN model to be developed in the GREAT project. The RI profiles proposed in Table 22 through Table 25 below are not intended to assess whether the process of research and innovation was managed according to a governance model of RRI. The aim of these RI profiles is to capture the attributes and levels needed to ascertain whether or not the projects in the dataset can be characterised as RI (research and innovation) projects and not whether the RI process was conducted "responsibly" from a RRI standpoint. The latter is the aim of the RRI profiles introduced in Section 4.5.3.

Phase 1: Strategic Alignment

Table 22 introduces the attributes and levels for Phase 1 of the RI life cycle.

Attributes	Levels
1. Prior to applying to this project, your organisation conducted a strategic analysis to ascertain whether the project was strategically aligned with the innovation strategy of your organization	1. No 2. Yes, but this analysis included only internal stakeholders 3. Yes, but this analysis included internal and external stakeholders without participation of potential customer and clients 4. Yes, the analysis included internal and external stakeholders with participation of potential clients 5. Yes, the analysis included internal and external stakeholders (including clients)and we are using tools to help us manage this process of strategic alignment such as, but not limited to, strategic choice framework, innovation journey assessments, innovation opportunity spaces, waterfall earnings charts, culture assessments

Table 22: Attributes and Levels for Phase 1 of the RI Life Cycle

Phase 2: Incubation

Table 23 introduces the attributes and levels for phase 2 of the RI life cycle.

Attributes	Levels
1. Did the project start from an important customer or market need?	1. No, we never validated whether the need was important or not from the point of view of any customers 2. No, but before commencing the project we had the project idea and its underlying value proposition validated by members of our team based on what we thought would be a good value proposition to potential customers and by the evaluators of the grantor organisation that funded the project 3. Yes, before commencing the project we had the project idea and underlying value proposition validated by our team and by a number of potential customers and users 4. Yes, before commencing the project we had the project idea and underlying value proposition validated by our team and by a number of potential customers and users and there was at least one lead customer contractually engaged in the project
2. Did you deliver the final prototype of the product, service or solution to the customer or user before proceeding to start developing it	1. No, after project approval we went straight into the development phase and did not develop or deliver any prototypes or proofs of concept 2. No, the project is still in the phase of ideation and prototyping 3. Yes, we finished the prototype of the product, service or solution but we never received the sign off from any customer or user and went straight to the development phase based on our own assessment of our prototype's functionality 4. Yes, we finished the final prototype of the product, service or solution and received the sign off from our customer or user in order to start the development phase
3. Are you using management tools for generating compelling value propositions, ideation and rapid prototyping	1. No, we did not use any management tools (such as those listed under point 4 below) and we did not check the value proposition with any customers or users or internally in our team 2. No, we did not use any management tools *per se* (such as those listed under point 4 below) but we did check the value proposition with members of our team and then generated ideas and rapid prototypes with the participation of internal stakeholders 3. No, we did not use any management tools (such as those listed under point 4 below) but did check the value proposition and generated ideas and rapid prototypes with members of our team and other internal and external stakeholders, including potential customers and users 4. Yes, we did use a number of tools for generating compelling value propositions, including: customer insight focus, marketing tools for analysing buying processes, segmentation, benefit ladder, idea management, discovery process, customer visits and rapid prototyping with direct involvement of users and customers

Table 23: Attributes and Levels for Phase 2 of the RI Life Cycle

Phase 3: Development

Phase 3 consists of a process of creation and delivery that concludes with the launching of the final product or service to the so-called launch market.

Table 24 describes the attributes and levels associated with this third phase.

Attributes	Levels
1. Are you using product marketing tools for the requirements specification of the product, service or solution	1. No, we are not using any product marketing tools and there are no potential customers or users engaged in the project 2. Yes, we are using diverse product marketing tools but there are no customers or users involved in the development process 3. Yes, we are using diverse product marketing tools and there are customers or users involved in the development as co-creators
2. Are you using tools for managing the times and materials involved in the project development, including tools allowing you to allocate staff to specific tasks	1. No, we are not using any project management tools (such as those listed under point 3 below) and we are dealing with some these tasks either manually 2. Yes, we are using basic tools for project management such as excel spreadsheets and MS project management in order to guide the development process according to our project plan but they do not include many of the tools listed under point 3 below 3. Yes, we are using advanced tools beyond conventional project management allowing us to manage this and other projects in our organisation such as gate reviews, risk frameworks, scope management and time management, cost management and risk management, quality assurance and benefits, project staffing, procurement, decision rights, communications management, portfolio management including roll out tracking, portfolio valuation and roll out timing, opportunity proposal, open Innovation (6Sigma), accelerated innovation, customer solution (value delivery), customer solutions (value sharing)
3. Did you deliver the product, service or solution to the customer or user	1. No, the project was aborted before finishing the development phase 2. No, the project is still under development 3. We did produce reports and peer-reviewed publications in scientific journals and conference only 4. Yes, we did finish the product, service or solution but we either never delivered it to any customers or users or, if delivered, the intended customer or user is not using it 4. Yes, we finished the product, service or solution, delivered it to customers and users, and they are using it

Table 24: Attributes and Levels for Phase 3 of the RI Life Cycle

The launch market is a segment of the target market that is comprised of so-called lead customers and early adopters. Both lead customers and early adopters are of strategic importance in the innovation process because they help cross the chasm usually referred to as “the valley of dead” and allow the innovation team to introduce the incremental improvements to the product, service or solution that are required to successfully deploy it at customers in the target market.

Phase 4: Exploitation

The fourth phase of exploitation aims to deliver value to both customers and the organisation that innovates.

Table 25 describes the attributes and levels associated with this phase.

Attributes	Levels
1. Do you have metrics in place to measure the success of the project for your company and for your customer in terms of value delivered	1. No, we only have financial metrics allowing us to measure success in terms of having delivered the project within budget and on time 2. Yes, we are using diverse metrics and key performance indicators above and beyond financial metrics but since no customers or users are actually using the solution or product we cannot measure the success of the project in terms of customer-oriented, value-based metrics 3. Yes, we are using diverse development tools with metrics that do not only allow us to measure the value delivered to our company but also the value delivered to our customers and users because they are actually exploiting the product or solution delivered
2. Did this project become a strategic customer or market win for your organisation	1. No, because we are still under development phase and therefore the intended customers or users are not yet exploiting it 2. No, because either the product or solution was never delivered to any customer or user or because the customer or user is not using it after the project outcomes were finished and even delivered 3. Although the intended product, service or solution was delivered successfully to customers and users and they are using it, we have not yet any metrics to ascertain the value created and delivered to them 4. Yes, the solution or project was delivered successfully to customers and users, they are using it, and we have metrics showing that the project created and delivered great value to them 5. Yes, the solution or project was delivered successfully to customers and users, they are using it already, we have actual metrics showing that the project created and delivered great value to them, and we wrote a success story, releasing it as a joint press release with some of them

Table 25: Attributes and Levels for Phase 4 of the RRI Life Cycle

An online questionnaire involving these attributes and levels will be sent out to project coordinators. They will have to select the levels for each of the attributes based on the RI process they followed.

4.5.3 Section III: RRI Profiles

The objective of the third section of the survey is to assess the RRI profiles of the projects. To this end, we used the elements and parameters pertaining to RRI compiled in DEL 2.2 (Theoretical Landscape) and DEL 2.3 (Analytical Grid) to put forth a correspondence between these elements and parameters, on the one hand, and the RRI life cycle phases shown in Section 4.4.2, on the other. Table 26 shows the RRI profile attributes and their correspondence with the RRI life cycle phases and the RRI elements.

Attributes	RRI Life Cycle Phase	RRI Elements
External forces, external stakeholders and complementor inclusion	External Analysis (8 attributes)	Inclusion and reflexivity
Ethical review committee	InternalAnalysis (5 attributes)	Inclusion and reflexivity
Project steering committee		
RRI governing board		
Stage-gating process in place		
Strategic diagnostic analysis (attributes I through III)	Strategic Diagnostic Analysis (3 attributes)	Anticipation and responsiveness
RRI mission and vision in place	Strategic Design (5 attributes)	Responsiveness
RRI principles and values in place		
RRI strategic objective and strategy in place		
RRI governing board		
RRI governance methodology		
Accounting and responding	Accounting and Responding (7 attributes)	Responsiveness

Table 26: Attributes and Levels of the RRI Life Cycle

An online questionnaire involving all these attributes and levels will be sent out to project coordinators in the CIP ICT PSP project pool. Project coordinators will have to select the levels for each of the attributes according to the RRI process they

followed during their respective projects. Coordinators will also have to select the levels for each of the attributes according to the RRI process they would have preferred to follow in the CIP ICT PSP project pool. While the first profile will correspond to the *de facto* profile, the second one will correspond to the *preferred* profiles. Table 27 through Table 31 show the attributes and levels for the RRI profiles.

Phase 1: External Analysis

Table 27 shows the attributes and levels proposed for phase 1 of the RRI life cycle. The RRI profiles pertaining to this phase of external analysis focus primarily on capturing information about how complementors, as defined in Section 4.3.1, are being or were included in the RRI process and what the scope of their involvement was, if any.

Attributes	Levels
1. Inclusion of external forces of the macro environment, including political, economic, sociocultural, technological, environmental, and legal forces	1. Yes 2. No
2. Inclusion of other external stakeholders such as providers, distributors, technology and channel partners, as well as competitors, new market entrants, and organisations providing substitute solutions	1. Yes 2. No
3. Inclusion of lead customers and users prior and during the project	1. Yes 2. No
4. Complementor inclusion	1. Yes 2. No
5. Complementors inclusion *ex post* after project completion	1. Yes 2. No
6. Complementors inclusion *ex ante* before project approval	1. Yes 2. No
7. Complementors feedback considered in the internal decision-making process throughout the entire RRI life cycle without granting them rights to vote and steer the project as external stakeholders	1. Yes 2. No
8. Complementors involved in the decision-making process as external stakeholders throughout the entire RRI life cycle with rights to vote and steer the project as external stakeholders participating in the project governance	1. Yes 2. No

Table 27: Attributes and Levels for Phase 1 of the RRI Life Cycle

Phase 2: Internal Analysis

Table 28 shows the attributes and levels for Phase 2 of the RRI life cycle.

Attributes	Levels
1. Strengths and weaknesses assessed	1. Yes 2. No
2. Ethical review committee in place	1. Yes 2. No
3. Project steering committee in place	1. Project steering committee with internal stakeholders only 2. Project steering committee with internal as well as external stakeholders not including complementors 3. Project steering committee with internal as well as external stakeholders including complementors
4. RRI governing board in place	1. RRI governing committee with internal stakeholders only 2. RRI governing committee with internal as well as external stakeholders not including complementors 3. RRI governing committee with internal as well as external stakeholders including complementors
5. Stage-gating innovation management process in place	1. No stage-gating process used 2. Stage-gating process used with internal gatekeepers only 3. Stage-gating process used with internal and external gatekeepers (partners, grantor) without complementors 4. Stage-gating process used with internal and external gatekeepers and complementors in a consultative capacity without rights to vote or take part in project-steering decisions 5. Stage-gating process used with internal and external gatekeepers, and complementors with rights to vote and and take part in project-steering decisions

Table 28: Attributes and Levels for Phase 2 of the RRI Life Cycle

In Table 28, we introduce the concept of RRI governing board. While the project steering committee deals with general issues pertaining to managing the RI project, the RRI governing board deals with RRI governance issues only.

Phase 3: Strategic Diagnostic Analysis

Table 29 shows the attributes and levels associated with the profiles that characterise phase 3 of the RRI life cycle. There are a number of tools that can be deployed to perform strategic diagnostic analysis. Chief among them is the so-called SWOT analysis of an organisation's strengths and weaknesses and the opportunities and threats presented by its environment. From a RRI standpoint, we include the opportunities—and threats—presented by complementors.

Attributes	Levels
1. Strategic diagnostic analyses, such as the SWOT analysis (Strengths, Weaknesses, Opportunities and Threats), was conducted in order to define the RRI strategy of our organisation, ascertain whether or not the project was aligned with that strategy, anticipate and respond to any potential RRI issues identified, and develop alternative response scenarios with **internal stakeholders only**	1. Yes 2. No
2. Strategic diagnostic analyses, such as the SWOT analysis (Strengths, Weaknesses, Opportunities and Threats), was conducted in order to define the RRI strategy of our organisation, ascertain whether or not the project was aligned with that strategy, anticipate and respond to any potential RRI issues identified, and develop alternative response scenarios with **internal and external stakeholders but without involving complementors**	1. Yes 2. No
3. Strategic diagnostic analyses, such as the SWOT analysis (Strengths, Weaknesses, Opportunities and Threats), was conducted in order to define the RRI strategy of our organisation, ascertain whether or not the project was aligned with that strategy, and anticipate and respond to any potential RRI issues identified and develop alternative response scenarios **with internal stakeholder and external stakeholders and involving complementors**	1. Yes 2. No

Table 29: Attributes and Levels for Phase 3 of the RRI Life Cycle

Phase 4: Strategic Design

Table 30 shows the attributes and levels for Phase 4 of the RRI life cycle.

Attributes	Levels
1. RRI mission and vision in place	1. Yes 2. No
2. RRI principles and values in place	1. Yes 2. No
3. RRI strategic objective and RRI strategy in place	1. Yes 2. No
4. RRI governing board in place	1. No 2. Yes, but only involving internal stakeholders 3. Yes, involving internal and external stakeholders and the grantor organisation but without involving complementors 4. Yes, involving internal and external stakeholders, the grantor organisation and complementors
5. Did the RRI governing board request that you use a governance methodology such as a stage-gating process	1. No, either no methodology was needed or used or we used our own *ad hoc* as opposed to a best-in-class custom methodology 2. Yes, we used a stage-gating process with internal stakeholders 3. Yes, we used a stage-gating process with internal and external stakeholders, the grantor organisation but no complementors 4. Yes, a stage-gating process involving internal and external stakeholder from industry and the grantor organisation, among others, including complementors

Table 30: Attributes and Levels for Phase 4 of the RRI Life Cycle

Strategic design consists in assessing, defining or redefining strategy in the light of constant changes in the internal and external environment of an organisation. From a RRI standpoint, we are particularly interested here in assessing the process of strategic design that led to the definition of RRI strategy, if any.

Phase 5: Accounting and Responding

Table 31 shows the attributes and levels for phase 5 of the RRI life cycle.

Attributes	Levels
1. Accounting and responding to grantor	1. Yes 2. No
2. Accounting and responding to project steering committee	1. Yes 2. No
3. Accounting and responding to ethical review committee	1. Yes 2. No
4. Accounting and responding to other members of the project consortium such as beneficiaries, owners, or those stakeholders intended to exploit the project results	1. Yes 2. No
5. Accounting and responding to the organisations that were part of the project consortium such as beneficiaries, users, owners, or those intended to exploit the project results, and to complementors in the project consortium	1. Yes 2. No
6. Accounting and responding to complementors that were not in the project consortium which we had to include at the request of either the grantor or other external organisations or governing bodies	1. Yes 2. No
7. Accounting and responding to complementors that were not part of the project consortium which we included of our own free will with the consensus of our organisation and the project partners in the consortium	1. Yes 2. No

Table 31: Attributes and Levels for Phase 5 of the RRI Life Cycle

4.5.4 Section IV: Normative Framework Profiles

The fourth section of the survey aims to assess normative framework profiles in the dataset. This normative framework is associated with norms and regulations imposed upon the RI agents by external organisations and governing bodies in the area of RRI in order for them to be considered as entities that conduct RRI. Table 32 through Table 36 provide the attributes and levels for this normative framework profile in five categories: (i) norms aimed at increasing broader impacts in terms of team diversity; (ii) norms aimed at increasing broader impacts

of RI in society; (iii) norms aimed at increasing reflexivity; (iv) norms aimed at increasing inclusion; and (v) norms aimed at increasing the use of management methodologies and frameworks.

Norms aimed at increasing the broader impacts of RI in terms of team diversity

1. Norms requesting your organisation to increase the number of women as members of the project's management and research staff	1. Yes 2. No
2. Norms requesting your organisation to increase the number of non-EU citizens as members of the project's management and research staff	1. Yes 2. No
3. Norms requesting your organisation to increase the number of citizens of the developing world as members of the project's management and research staff	1. Yes 2. No
4. Norms requesting your organisation to increase the number of racial minorities as members of the project's management and research staff	1. Yes 2. No
5. Norms requesting your organisation to increase the number of religious minorities as members of the project's management and research staff	1. Yes 2. No
6. Norms requesting increase the number of sexual minorities as members of the project's management and research staff	1. Yes 2. No
7. Norms requesting your organisation to increase the number of people with different disciplinary backgrounds as members of the project's management and research staff	1. Yes 2. No

Table 32: Profile of Broader Impacts of RI (Team Diversity)

Norms aimed at increasing broader impacts of RI in society

1. Norms requesting your project to contribute to increasing infrastructure and human capital in science, technology, engineering, and mathematics	1. Yes 2. No
2. Norms requesting your project to contribute to increasing the global competitiveness of the EU	1. Yes 2. No
3. Norms requesting your project to contribute to increasing the global competitiveness of the workforce in the EU	1. Yes 2. No
4. Norms requesting your project to contribute to increasing the literacy and knowledge in science, technology, engineering, and mathematics in the EU	1. Yes 2. No
5. Norms requesting your project to contribute to increasing homeland security across EU member states	1. Yes 2. No
6. Norms requesting your project to contribute to developing and furthering relationships with industry and academia in the EU	1. Yes 2. No
7. Norms requesting your project to contribute to developing and furthering relationships with NGOs, CSOs (civil society organisations), and society in the EU	1. Yes 2. No

Table 33: Profile for Broader Impact of RI in Society

Norms aimed at increasing reflexivity

Attributes	Levels
1. Norms requesting that your organisation, its research staff, and management comply with RCR (responsible conduct of research) codes including, but not limited to, norms for conducting experiments with animals or human beings	1. Yes 2. No
2. Norms requesting that your organisation respond to an ethical review committee comprised of only internal stakeholders	1. Yes 2. No
3. Norms requesting that your organisation respond to an ethical review committee comprised of internal and external stakeholders	1. Yes 2. No
4. Norms requesting that your organisation form and respond to an ethical review committee comprised of both internal and external stakeholders whose appointment needs to be approved by the grantor or other external bodies approved by the grantor, if there was not one already in place	1. Yes 2. No
5. Norms requesting that your organisation create an *ad hoc* ethical review committee for each project comprised of internal and external stakeholders whose appointment be approved by the grantor or by external bodies approved by the grantor, even if you had an ethical review committee already in place	1. Yes 2. No
6. Norms requesting that your organisation convoke ethical experts and analysts and societal issue panels	1. Yes 2. No

Table 34: Attributes and Levels for the Normative Framework

Norms aimed at increasing inclusion

Attributes	Levels
1. Norms requesting that your organisation demonstrate how the project involves complementors, including civil society organisations (CSOs), in the project as external stakeholders, either a beneficiaries of the project outcomes or otherwise, at least in a observing capacity (spectator)	1. Yes 2. No
2. Norms requesting that your organisation demonstrate how the project involves complementors, including civil society organisations (CSOs), in the project as external stakeholders, either a beneficiaries of the project outcomes or otherwise, at least in a consulting capacity (commentator)	1. Yes 2. No
3. Norms requesting that your organisation demonstrate how the project involves complementors, including civil society organisations (CSOs), in the project as external stakeholders, either a beneficiaries of the project outcomes or otherwise, at least in an influencing capacity (influencer)	1. Yes 2. No
4. Norms requesting that your organisation demonstrate how the project involves complementors, including civil society organisations (CSOs), in the project as external stakeholders, either a beneficiaries of the project outcomes or otherwise, at least in a co-constructive capacity (co-creator)	1. Yes 2. No
5. Norms requesting that your organisation demonstrate how the project involves complementors, including civil society organisations (CSOs), in the project as external stakeholders, either a beneficiaries of the project outcomes or otherwise, at least in controlling and supervisory capacity (legally binding)	1. Yes 2. No

Table 35: Attributes and Levels for the Normative Framework

Norms aimed at increasing the use of RRI governance and management methodologies

Attributes	Levels
1. Norms requesting that your organisation demonstrate that members of research staff and management appointed to the project have been trained in modern innovation management methodologies and that they are applying such methodologies in order to increase the positive outcomes of the project measured in terms of market wins with a number of clearly identifiable customers	1. Yes 2. No
2. Norms requesting that your organisation demonstrate that our organisation has a stated RRI mission and vision, a clear RRI objective and strategy in place, and that project research staff and managers are fully trained and follow a RRI methodology in order to make sure that the inclusion of complementors in the project is guaranteed, including civil society organisations (CSOs), so as to make societal actors active participants of the RI process that help us anticipate and respond to all potentially negative impact of the proposed RI agenda, even if this process of inclusion and anticipation leads to aborting or cancelling our project	1. Yes 2. No

Table 36: Attributes and Levels for the Normative Framework

4.5.5 Section V: Complementor Profiles

The objective of the fifth section of the survey is to assess additional RRI-relevant information, specifically the complementor profiles of the projects in the dataset.

Table 37 shows the attributes and levels for type of complementors involved.

Attributes	Levels
1. Complementors were involved as part of the project consortium because it was requested or suggested by the grantor organisation in order to approve and adjudicate the project	1. Yes 2. No
2. Complementors were involved in the project, either as part of the project consortium or as external members, not because the grantor organisation requested or suggested it but because the consortium decided to include them to assess potential threats or opportunities of the intended project	1. Yes 2. No

Table 37: Attributes and Levels for Types of Complementors

We will distinguish between complementors whose involvement was suggested by the grantor (or any other external) organisation to which the project team was accountable, and those whose involvement in the CIP ICT PSP pool was suggested internally and agreed-upon by the project partners in the consortia without the mediation or intervention of any external organisation, including the grantor.

We will also ascertain the role of civil society organisations (CSOs). CSOs are a special kind of complementor, one that is increasingly playing a role in monitoring and assessing the RRI qualities of a RI project and can pose a threat to RI agendas of different archetypical agents. We will assess what role CSOs played and will distinguish between two types of CSOs.

Table 38 shows the attributes and levels pertaining to the types of CSOs involved.

Attributes	Levels
1. CSOs were involved as part of the project consortium because it was requested by the grantor organisation in order to approve and adjudicate the project	1. Yes 2. No
2. CSOs were involved in the project, either as part of the project consortium or as external members, not because the grantor organisation requested it but because the consortium decided to include them	1. Yes 2. No

Table 38: Attributes and Levels for Types of CSOs

Table 39 shows the attributes and levels for CSOs potentially involved at the request of the grantor—or other external organisations or governing bodies.

Attributes	Levels
1. CSOs participated in producing research or innovation output as part of the research team (R&D activities)	1. Yes 2. No
2. CSOs participated as a potential user of the expected outcomes of the project (e.g. requirements specification, validation, testing)	1. Yes 2. No
3. CSOs participated as expected owners/beneficiaries of the project outcomes (entitled to own the IP generated or exploit it with future users and clients)	1. Yes 2. No
4. CSOs participated only to state the relevance in terms of the project's expected positive societal impacts, as required by the project tender submission process	1. Yes 2. No
5. CSOs participated only in a supervisory capacity with rights to intervene in the project decisions either at project team or steering committee level or beyond	1. Yes 2. No
6. CSOs participated only in consulting capacity without rights to intervene in the project decisions either at project team or steering committee level or beyond	1. Yes 2. No

Table 39: Attributes and Levels for CSO Profiles

Table 40 shows the attributes and levels for the CSOs in a second category of CSOs.

Attributes	Levels
1. CSOs participated in producing research or innovation output as part of the research team (R&D activities)	1. Yes 2. No
2. CSOs participated as a potential user of the expected outcomes of the project (e.g. requirements specification, validation, testing)	1. Yes 2. No
3. CSOs participated as expected owners/beneficiaries of the project outcomes (entitled to own the IP generated or exploit it with future users and clients)	1. Yes 2. No
4. CSOs participated only to state the relevance in terms of the project's expected positive societal impacts, as required by the project tender submission process	1. Yes 2. No
5. CSOs participated only in a supervisory capacity with rights to intervene in the project decisions either at project team or steering committee level or beyond	1. Yes 2. No
6. CSOs participated only in consulting capacity without rights to intervene in the project decisions either at project team or steering committee level or beyond	1. Yes 2. No

Table 40: Attributes and Levels for CSO Profiles

This second category corresponds to CSOs that were not official members of the project consortium but were considered at the request of some of the project partners or internal governing bodies.

Indeed, this second category of CSOs will correspond to organisations that, in the opinion of the project partners involved in the project consortium, along with its internal governing bodies, needed to be invited to participate in the project to account for processes of inclusiveness, with the associated gains not only in terms of participation and transparency but also to identify potential threats and opportunities associated with the project early on in the research and innovation process.

4.6 Conjoint Analysis in the GREAT Project

In this Section 4.6, we analyse the type of Conjoint Analysis selected for conducting the survey.

4.6.1 Section I and II: Agent Archetypes and RI Profiles

Section I and Section II of the survey will consist of a classification task not involving mining the actual preference of respondents so no conjoint analysis will be performed as we will not be mining the preference structure of respondent regarding attributes and levels. In both cases, the classification task will be performed online.

Project coordinators will be contacted to classify their organisation according to the archetypes described and they will have the “no option” alternative, in which case they will be asked to provide a description of the type of RI organisation they belong to. As far as the RI profiles are concerned, project coordinators will be presented with the full profiles of each of the four phases of the RI cycle. For each of the phases, respondents will be asked to choose one level for each attribute in the profile and a “no choice” alternative will be provided for each of the attributes in the profile.

The purpose of section I and section II of the survey will be to classify the agents involved and their associated RI profiles.

Section III through section V of the survey will involve conjoint analysis in order to elicit the preferences structure or respondents regarding three main areas, namely, RRI profiles, RRI normative frameworks, and complementor inclusion. These three sections of the survey will also be conducted online.

We describe the types of conjoint analyses involved for each of these three sections in Section 4.6.2 through Section 4.6.4.

4.6.2 Section III: RRI Profiles

In this section, we describe the types of conjoint analysis selected for eliciting the RRI Profiles. In doing so, we will separate the sections of the conjoint analysis according to the phases of the RRI cycle involved.

Phase 1: External Analysis

As shown in Table 27, the conjoint analysis for phase 1 involves 8 attributes and 2 levels for each attribute. In principle, this will create 256 different combinations of profiles that we would need to present to respondents as part of the conjoint task, with potential prohibited pairs in some of the profiles that will need to be eliminated. Given the number of attributes involved, we will use the ACA method for this section. In order to reduce the number of profiles from the conjoint task, we will adapt the profiles presented according to the choices made by respondents as the online survey unfolds. This will also allow us to eliminate prohibited pairs from the conjoint task.

Phase 2: Internal Analysis

As shown in Table 28, the conjoint analysis for phase 2 involves 5 attributes, the first and second attribute with 2 levels each, the third and fourth attribute with 3 levels each, and the last attribute with 5 levels. We will separate the conjoint task in three different conjoint tasks and will use the CBCA method involving full profiles in the conjoint sets for each one of them. Using this method, we will eliminate prohibited pairs from the resulting conjoint sets.

Phase 3: Strategic Diagnostic Analysis

As shown in Table 29, the conjoint analysis for phase 3 involves 3 attributes and 2 levels for each attribute. This will create 8 different combinations of profiles that we would need to present to respondents in the conjoint task, with potential prohibited pairs in some of the profiles that will need to be eliminated. Given the

number of attributes and levels involved, we will use the CBCA method for this section involving full profiles.

Phase 4: Strategic Design

As shown in Table 30, the conjoint analysis for phase 4 involves a first group of 3 attributes with 2 levels for each attribute. This will create 8 different combinations of profiles that we would need to present to respondents in the conjoint task, with potential prohibited pairs in some of the profiles that will need to be eliminated. We will use the CBCA method for this section involving full profiles. The selected choice sets will not include prohibited pairs.

The fourth and fifth attribute will be handled separately given their scope and meaning. They involve 4 levels each, thus giving rise to 16 profiles. We will use the CBCA method for this section involving full profiles. The selected choice sets will not include prohibited pairs.

Phase 5: Accounting and Responding

As shown in Table 31, the conjoint analysis for phase 5 involves a group of 7 attributes with 2 levels for each attribute. This will create 128 different combinations of profiles that we would need to present to respondents in the conjoint task, with potential prohibited pairs in some of the profiles that will need to be eliminated.

Given the high number of combinations involved, we will follow an ACA method for this section. In order to reduce the number of profiles from the conjoint task, we will adapt the profiles presented according to the choices made by respondents. This will also allow us to eliminate prohibited pairs from the conjoint task.

4.6.3 Section IV: Normative Framework Profiles

Norms aimed at increasing broader impacts of RI in terms of team diversity

As shown in Table 32, the conjoint analysis for assessing profiles relating to broader impacts in terms of team diversity involves a group of 7 attributes with 2 levels for each attribute. This will create 128 different combinations of profiles that we would need to present to respondents in the conjoint task, with potential prohibited pairs in some of the profiles that will need to be eliminated. Given the high number of combinations involved, we will follow the ACA method for this section. In order to reduce the number of profiles from the conjoint task, we will adapt the profiles presented according to the choices made by respondents as the online survey unfolds. This will also allow us to eliminate prohibited pairs from the conjoint task.

Norms aimed at increasing the broader impacts of RI in society

As shown in Table 33, the conjoint analysis for assessing profiles relating to broader impacts of RI in society involves a group of 7 attributes with 2 levels for each attribute. This will create 128 different combinations of profiles that we would need to present to respondents in the conjoint task, with some potential prohibited pairs in some of the profiles that will need to be eliminated. Given the high number of combinations involved, we will follow the ACA method for this section. In order to reduce the number of profiles from the conjoint task, we will adapt the profiles presented according to the choices made by respondents as the online survey unfolds. This will also allow us to eliminate prohibited pairs from the conjoint task.

Norms aimed at increasing reflexivity

As shown in Table 34, the conjoint analysis for assessing profiles relating to reflexivity involves a group of 6 attributes with 2 levels for each attribute. This will create 64 different combinations of profiles that we would need to present to

respondents in the conjoint task, with potential prohibited pairs in some of the profiles that will need to be eliminated. We will use the CBCA method for this section involving full profiles. The selected choice sets will not include prohibited pairs.

Norms aimed at increasing inclusion

As shown in Table 35, the conjoint analysis for assessing profiles relating to inclusion involves a group of 5 attributes with 2 levels for each attribute. This will create 32 different combinations of profiles that we would need to present to respondents in the conjoint task, with potential prohibited pairs in some of the profiles that will need to be eliminated. We will use the CBCA method for this section involving full profiles. The selected choice sets will not include prohibited pairs.

Norms aimed at increasing the use of RRI governance and management methodologies

As shown in Table 36, the conjoint analysis for assessing profiles relating to RRI governance and management methodologies involves a group of 2 attributes with 2 levels for each attribute. This will create 4 different combinations of profiles that we would need to present to respondents in the conjoint task. We will use the CBCA method for this section involving full profiles. The selected choice sets will not include prohibited pairs.

4.6.4 Section V: Complementor Profiles

As shown in Table 37, the conjoint analysis for assessing profiles relating to complementors profiles involves a group of 2 attributes with 2 levels for each attribute. This will create 4 different combinations of profiles that we would need to present to respondents in the conjoint task. We will use the CBCA method for

this section involving full profiles. The selected choice sets will not include prohibited pairs.

As shown in Table 38, the conjoint analysis for assessing profiles relating to CSO profiles involves a group of 2 attributes with 2 levels for each attribute. This will create 4 different combinations of profiles that we would need to present to respondents in the conjoint task. We will use the CBCA method for this section involving full profiles. The selected choice sets will not include prohibited pairs.

As shown in Table 39, the conjoint analysis for assessing profiles relating to CSO profiles in the first category involves a group of 6 attributes with 2 levels for each attribute. This will create 64 different combinations of profiles that we would need to present to respondents in the conjoint task. We will use the CBCA method for this section involving full profiles. The selected choice sets will not include prohibited pairs.

As shown in Table 40, the conjoint analysis for assessing profiles relating to CSO profiles in the second category involves a group of 6 attributes with 2 levels for each attribute. This will create 64 different combinations of profiles that we would need to present to respondents in the conjoint task. We will use the CBCA method for this section involving full profiles. The selected choice sets will not include prohibited pairs.

4.7 Executing the Online Survey in the GREAT Project

While the adaptive conjoint analysis method chosen provides a high degree of flexibility to accommodate a wide variety of attributes and levels as an online survey and adapt the questions presented to respondents as the survey unfolds, we still face a major challenge in the GREAT project in terms of securing the participation and engaging a number of project coordinators in the survey.

Indeed, securing this engagement and facilitating the participation in the survey of a relevant number of respondents may require the simplification of some sections of the instrument presented in this chapter, especially regarding the technical terms introduced in the survey and its length.

Whilst savvy innovation managers would have no trouble answering the online survey, we expect that most respondents, though familiar with project management methodologies in general, will be rather unfamiliar with innovation management as a discipline, with the basic innovation concepts presented, and with innovation methodologies in general. We therefore anticipate that some modifications to the original instrument may be necessary.

Chapter 5 Conclusions

Whilst qualitative empirical research in the area of RRI has been conducted in the past, mainly in the form of in-depth case studies such as the one reported by Stilgoe, Owen and Macnaghten (2013) in connection with the SPICE project (Stratospheric Particle Injection for Climate Engineering), quantitative empirical research has yet to be conducted in the emerging field of RRI.

To our knowledge, the quantitative analysis we will be conducting for the GREAT project to elicit the emerging RRI patterns in the European Union will be the first comprehensive quantitative survey ever conducted in this area not only in Europe but quite possibly in the rest of the world as well.

In this concluding chapter, we want to draw the attention of the reader to three main aspects of the quantitative empirical research agenda our survey entails.

5.1 Focus on Innovation

Although our quantitative analysis will not be broad in terms of industries and types of projects, we believe the dataset chosen provides a representative overview of RI projects funded by the European Commission under the Seventh Framework Programme.

In this connection, it is interesting to note that the CIP ICT PSP project pool has been chosen with an innovation focus in mind. Indeed, the various calls under this programme aimed to stimulate the use and application of ICT not only in organisations in the public and private sector but also in society at large.

From this perspective, the projects in the dataset we have chosen need to demonstrate from the outset their potential for generating value to customers and users, not only in the area of eldercare but also in a number of other

application areas as well. Delivering on the promise of value creation is of the essence for the projects in this dataset. Accordingly, the survey instrument has been designed with this focus on innovation rather than research in mind and we have also put forth RI profiles that elicit the innovation potential of the projects contained in the dataset.

This focus on innovation is also in line with the definition of RRI put forth by von Schomberg, a definition of RRI based on the requirement of value generation in the marketplace imposed on the organisations that innovate. This definition has also been put forth as the European definition of RRI, as opposed to the broader impacts definition of RRI that has been proposed and is currently being used in the U.S. by research-funding agencies such as the NSF.

5.2 The RRI Construct

The GREAT survey will aim to mine preferences on RRI profiles using the judgments of project coordinators and project partners who were members of project consortia in several of the CIP ICT PSP project calls.

Will our survey provide quantitative empirical evidence to suggest that such a RRI construct indeed exists?

If so, this important result of the GREAT project might kick off a very ambitious research agenda in the RRI community, namely, the search for what we might term here “the RRI construct.”

Such an outcome of the GREAT project might not be all that surprising if we consider similar research agendas. Indeed, a very similar agenda has dominated another research community for decades, namely, the entrepreneurial studies research community in its quest for the so-called entrepreneurial construct.

5.3 The RRI Trade-Offs

Arguably, the goals and objectives of research- and innovation-granting agencies such as the European Commission are not necessarily strategically aligned with the goals and objectives of the organisations they fund, in particular when it comes to RRI. Indeed, RRI seems to be a mine field of conflicting goals and objectives between RI agents, on the one hand, and the agencies that either fund or regulate them, on the other.

As a result, RRI is an area of strategic management *par excellence* where complex trade-offs need to be negotiated and made between actors conducting RI, on the one hand, and external stakeholders that are endowed with a formal or a *de facto* RRI governing mechanism, on the other.

Important questions in this area are for example to what extent increasing the red tape in terms of norms and regulations for RRI compliance will end up stiffening innovation and global competitiveness in the European Union in the long run.

This third aspect is embedded in our quantitative survey approach and is a direct result of the need to empower public policymakers in the European Union with quantitative tools for the *ex ante* simulation of public policy in the area of RRI.

As mentioned in chapter 5, we construe RRI strategic alignment and the associated RRI life cycle as a process of continually defining and making strategic RRI trade-offs under uncertainty. The results of the quantitative empirical research we are advocating in this document will serve as basis to model RI actors as SKIN models and calibrate them, that is, calibrate the way in which RI actors interact during a simulation, using the results of the quantitative survey. These models will, in turn, allow us to design and conduct experiments in order to test hypotheses such as the one mentioned above.

Through agent-based simulation, we will be able to provide a tool to test RRI hypotheses and provide policymakers in the European Union with an additional tool for the evaluation of public policy in the important area of RRI.

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ANNEX 1

CIP ICT PSP projects – theme “care for older people:”

(http://ec.europa.eu/information_society/apps/projects/index.cfm?menu=secondary&prog_id=IPSP)

- AgeingWell;
- ATIS4all;
- CAALYX-MV;
- Carer+;
- CLEAR;
- CommonWell;
- CROSS;
- DISCOVER;
- Dreaming;
- EASTIN-CL;
- E-NO FALLS;
- eHealth Innovation;
- ENGAGED;
- ETNA;
- FATE;

- HOME SWEET HOME;
- I-DONT-FALL;
- inCASA;
- INDEPENDENT;
- ISISEMD;
- LongLastingMemories;
- LIFE 2.0;
- MOMENTUM;
- NEXES;
- PALANTE;
- ProFouND;
- ReAAL;
- RENEWING HEALTH;
- SOCIABLE;
- SUSTAINS;
- T-SENIORITY;
- SEACW;
- SmartCare.

CIP ICT PSP projects – theme “care for the environment:”

(http://ec.europa.eu/information_society/apps/projects/index.cfm?menu=secondary&prog_id=IPSP)

- 3e-Houses;
- @qua;
- BECA;
- BEST Energy;
- BRISEIDE;
- Compass4D;
- COSMO;
- E3SoHo;
- EDISON;
- eENVplus;
- EnergyTIC;
- EPLACE;
- eSESH;
- EuroGeoSource;
- FREILOT;
- GREEN@Hospital;
- HABITATS;

- HosPilot;
- I-SCOPE;
- iCars Network;
- ICE-WISH;
- ICT 4 EVEU;
- ICT21EE;
- ICT4SMARTDG;
- ILLUMINATE;
- In-Time;
- LED 4 ART;
- LITES;
- MOBI.Europe;
- MobiCloud;
- MOLECULES;
- NESIS;
- PERIPHERIA;
- RADICAL;
- SAVE ENERGY;
- SEESGEN-ICT;

- SHOWE-IT;
- Smart Build;
- SMART CAMPUS;
- smartCEM;
- SMARTSPACES;
- SUNSHINE;
- TEDS4BEE;
- VERYSchool.

CIP ICT PSP projects – theme "improving public services for citizens and businesses:"

(http://ec.europa.eu/information_society/apps/projects/index.cfm?menu=secondary&prog_id=IPSP)

- ADD ME!;
- CEMSDI;
- DEN4DEK;
- DIEGO;
- e-CODEX;
- e-SENS;
- ECRN;

- eEnviPer;
- eGOS;
- EGOV4U;
- eGovMoNet;
- GEN6;
- ImmigrationPolicy2.0;
- InGeoCloudS;
- iSAC6+;
- LAPSI;
- LAPSI 2.0;
- NET-EUCEN;
- OASIS;
- Open-DAI;
- OurSpace;
- PARTERRE;
- PEP-NET;
- PEPPOL;
- Puzzled by Policy;
- Rural-Inclusion;

- SEED;
- SPOCS;
- SSEDIC;
- STORK;
- STORK 2.0.

ANNEX 2

Excerpt of the interview schedule used in the first semi-structured interviews with three project coordinators from the CIP ICT PSP Pool (23/11/2013; extended 29/11/2013).

A. *Understanding the type of organisation involved*

The interviewees were asked to classify their own organisation according to a list of suggested types shown in Table 41:

	Type of organization
1	Research University(Basic Research)
2	University Applied R & D Centre
3	Independent Applied R & D Centre from Public Sector
4	Independent Applied R & D Centre from Private Sector
5	Independent Contract R & D from Public Sector
6	Independent Contract R & D from Private Sector
7	R & D Division of LDC (Large Diversified Company)
8	R & D Division of SME (Small and Medium-Sized Enterprise)
9	Independent Consulting Firm Public Sector
	Other type:

Table 41: Attributes and Levels for CSO Profiles (Interview Schedule)

B. *Understanding the 'history' of the interviewee's participation in the project (may shed light on pre-existing 'innovation' networks, knowledge processes and responsibilities); understand his/her position and concrete daily work; understand the 'governance' structure within the project (e.g. hierarchies)*

1. You have worked/work for the EU project XYZ. Would you please explain to me how you got into this project?

2. Have you been, or are you involved in other similar projects?

3. What was your role, and what were your concrete tasks? Please give some examples.

4. How was this work of yours steered, who did you orient to? What/who were important drivers in your concrete work?

5. Did you have a say in other partner's and stakeholders work during the project – if yes, in which way? (And the other way around – others having a say in your work?)

6. General question: what are other relevant project participants? Their role? List of such other relevant actors (actor types):

    i. Project coordinator

    ii. Grantor (Funder)

    iii. Beneficiaries

    iv. Co-developers

    v. Complementary partners

    vi. Interested parties

    vii. Provider, supplier

    viii. RRI parties checking that project is conducted correctly

        - checking only occasionally: auditor/monitor
        - being directly involved as project partner

    ix. Any follow-up in this regard after the project?

C. *Understanding the existing legal, institutional and other governance structures, and how these influenced the project partner's work (including deliverables/milestones and the final innovative 'product') – as well as his collaboration with the other partners*

1. Would you please explain to me the conditions under which you do/did your work – like legal, institutional ones.

2. Is or was there any kind of formal body checking the ethical 'making'/running of the project (like ethical committee at university)?

3. And/or any such procedures (e.g. 'stage-gating')?

4. At what (organisational) level?

5. In R&D process (code of responsible research and development):

    i. Any rules and regulations that people were bound to follow?

    ii. Any relevant codes of conduct?

6. Has the grantor/funder installed any kind of (a) auditing/monitoring actor, or (b) procedures?

D. *Understanding how the funding structures (EU, but also other (existing) ones) have shaped the project partner's work (including deliverables/milestones and the final innovative 'product') – as well as his collaboration with others*

1. Would you please explain to me your relationship with the EU (as a funder) and other sources of funding?

2. Would you please specify the concrete ways in which, and when, you contacted/communicated with external funders (a) before the project, (b) during the project, (c) afterwards? (And vice versa, i.e. funders addressing you)

3. How have the funders, or funding structures, influenced the course of your work and/or the software tool?

4. Any funders apart from the EU?

5. Maybe for non-monetary assets?

6. If yes, what kind of role/function in the project?

7. If such additional monetary and non-monetary support existed – were there any mechanisms in place to manage these ('properly' - responsibility/ethical behaviour question)?

E. *Understanding the temporal and spatial structures of the project, and related communications/negotiations between partners, and how these shaped the final innovative 'product' (=responsibilities shaped by temporal and spatial conditions/constraints)*

1. Would you please describe your relationships with other project partners?

2. Were there any tasks divided between you and the others, or shared etc.? (Division of labour between partners). How was this coordinated?

3. Before, during and after the project: did/do you communicate with your different project partners – if yes, how, and how often? (e.g. e-mails, meetings, ...). About what, for example?

4. Did you have some kind of innovation management methodology in place? If yes, could you elaborate on that?

5. Was there any client or user in either of the following capacities:

   i. paying client

   ii. non-paying client

   iii. users engaged by a client

   iv. users engaged by a government body

   v. other users engaged by other project partners (e.g. older people)?

6. If yes, at which moment of the project were they brought in/participated, and how? (stakeholder and user engagement)

   i. Consulting function or more?

   ii. Degree of co-creation and participation in the creation process

F. *Understanding the (responsibility) relationships with primary and 'locally embedded' stakeholders (older people; existing staff in collaborating institutions); and other possible influences*

1. Have you been involved with any users of the new tools/products/services? If yes, in which ways? And at what stage(s) in the project?

2. Has this influenced your work in any way?

3. In your view, were there other important influences in the way you did your work over the course of the project?

G. *Understanding the outcomes and impacts of the project, if any; understanding problems, dilemmas*

1. Have you encountered any problems during or after the project?
2. How would you describe the effects of your project? (including benefits, disadvantages)
3. Are you still in any way in contact with the project site(s)?
4. Do you know whether and how the tool/product/service is still used?
5. Value creation/innovation management:
    i. Was the project finished in the time and with the money provided?
    ii. If yes, what were these project outcomes?
    iii. Has this been transferred (to the client)? Commercial solution? Or only 'proof of concept'? Any publications, patents?
    iv. Any wider dissemination, outreach activities, general public, how?
    v. Any capacities, skills, competences created? (Human resources, organisational factors/improvements)

H. *Questions related to the development of recommendations and guidelines in GREAT (WP 6)*

1. Was there anything difficult or problematic about this project?

2. In your view, is there anything that may have improved your work or the overall project?

3. Would you make any recommendations for future EU projects in this area? (This may concern all the different partners and stakeholders involved, and the funders)

ANNEX 3

Qualitative interview schedule CIP ICT PSP Pool, adapted after delivery of the Analytical Grid (DEL 2.3; end of February 2013); to be used for the remaining interviews in 2014.

The cursive comments in the brackets indicate the links to the Analytical Grid.

A. *Understanding the type of organisation involved*

Please describe and characterize your organization.

B. *Understanding the interviewee's position and concrete daily work; understanding the processes and products of the project; exploring part of the governance structure within the project.*

1. What is your role, and what are your concrete tasks? Please give some examples.

2. How is this work of yours steered, who do you orient to? What/who are important drivers in your concrete work?

3. How would you describe the products, outcomes or effects of your project? Are there any ethical implications that you or any other partner, or stakeholder, have raised? *('Product' in Analytical Grid)*

    i. How do or did you identify these issues?

    ii. Has there been any discussion of these issues with other project partners?

    iii. Did your discussion have an influence on the design of the product or the research (e.g. positively, by opening up new possibilities, or negatively, by inhibiting/slowing down the

development of some characteristics/properties or even products)?

4. Would you please describe the processes in place to achieve the project's goals? Who participates in these? Do these processes involve any form of reflexivity? *('Process' in Analytical Grid)*

5. Before, during and after the project: did/do you communicate with your different project partners – if yes, how, and how often? (e.g. e-mails, meetings, ...). About what, for example?

6. Are any assessment procedures in place? If yes, please describe these. *('Assessment' in Analytical Grid)*

7. In particular, are any risk assessment procedures in place? If yes, please describe these. *('Risk Assessment' in Analytical Grid)*

8. General question: what are other relevant project participants? Their role? List of such other relevant actors (actor types):

    i. Project coordinator

    ii. Grantor (Funder)

    iii. Beneficiaries

    iv. Co-developers

    v. Complementary partners

    vi. Interested parties

    vii. Provider, supplier

    viii. RRI parties checking that project is conducted correctly

        - checking only occasionally: auditor/monitor

- being directly involved as project partner

ix. Any follow-up in this regard after the project?

C. Understanding the existing legal, institutional and other governance structures, and how these influenced the project partner's work – including deliverables/milestones and the final innovative product – as well as his/her collaboration with the other partners.

1. Would you please explain to me the conditions under which you do/did your work – like legal, institutional ones. *('Norm/law relation' in Analytical Grid)*

2. Is or was there any kind of formal body checking the ethical 'making'/running of the project (like ethical committee at university)? *('Tools/epistemic tools' in Analytical Grid)*

3. And/or any such procedures (e.g. 'stage-gating')? *('Tools/epistemic tools' in Analytical Grid)*

4. At what (organisational) level?

5. In R&D process (code of responsible research and development):

    i. Any rules and regulations that people were bound to follow?

    ii. Any relevant codes of conduct?

6. Has the grantor/funder installed any kind of (a) auditing/monitoring actor, or (b) procedures?

(Combining the answers from B and C: Does the project's governance structure resemble one of the four models in the Analytical Grid – or how does it relate to these?)

D. *Understanding how the funding structures – EU and others – have shaped the project partner's work. This includes deliverables/milestones and the final innovative product, as well as his collaboration with others. This explores the dimension of 'norms' in the Analytical Grid parameter 'norm/law' relation.*

1. Would you please explain to me your relationship with the EU (as a funder) and other sources of funding?

2. How do the funders, or funding structures, influence the course of your work and/or the software tool, or have done so, in the past?

3. Any funders apart from the EU?

4. Maybe for non-monetary assets?

5. If yes, what kind of role/function in the project?

6. If such additional monetary and non-monetary support existed – were there any mechanisms in place to manage these ('properly' - responsibility/ethical behaviour question)?

E. *Understanding innovation management; relationships with primary and 'locally embedded' stakeholders; and possible elements of participatory approaches. ('Participatory approach' in Analytical Grid)*

1. Do or did you have any kind of innovation management methodology in place? If yes, could you elaborate on that?

2. Is or was any client or user active in your project, e.g. paying client, non-paying client, users engaged by a client, users engaged by a government body, other users engaged by other project partners?

3. If yes, at which moment of the project were they brought in/participated, and how? (stakeholder and user engagement)

    i. Consulting function or more?

    ii. How did you use the results of this consultation/ participation process?

    iii. Any kind of 'anticipatory work' being done together?

4. Where there any other important influences in the way you did your work over the course of the project?

F. *Understanding the outcomes and impacts of the project, if any; understanding problems, dilemmas. (This explores further the 'product' and 'process' dimensions in the Analytical Grid; and the parameter 'cultural differences')*

1. Have you encountered any problems during or after the project?

2. Has 'culture' mattered in your project – in any sense, in any way?

3. If the project has already been finished: Are you still in any way in contact with the project site(s)?

4. Do you know whether and how the tool/product/service is still used?

5. Value creation/innovation management:

    i. Was the project finished in the time and with the money provided?

    ii. If yes, what were these project outcomes?

iii. Has this been transferred (to the client)? Commercial solution? Or only 'proof of concept'? Any publications, patents?

iv. Any wider dissemination, outreach activities, general public, how?

v. Any capacities, skills, competences created? (Human resources, organisational factors/improvements)

G. *Questions related to the development of recommendations and guidelines in GREAT, WP 6*

1. Was there anything difficult or problematic about this project?

2. In your view, is there anything that may have improved your work or the overall project?

3. Would you make any recommendations for future EU projects in this area? (This may concern all the different partners and stakeholders involved, and the funders).