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Good Practices in Responsible Innovation

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Innovation has the potential to drive economic growth, to promote sustainable development and to improve health, lifestyle and well-being. However, negative consequences of development, brought awareness that it is not only important to innovate, but also to innovate responsibly. Thus, during recent years, the concept of Responsible Innovation (RI) has gained increased attention and become embedded in the development endeavours of the European Union. As a result of this focused effort and attention on the topic, high quality theoretical knowledge is available accumulated in project documents, publications and policy recommendations. Despitethegrowing interest of responsible development models and findings of framework conditions and elements, limitations and obstacles persist in the application of the theoretical frame in practice. Thus, the practical application of RI is still an undiscovered area.

The goal of this study is to review and shortly systematize the most important points of theoretical knowledge regarding RI as a base for practical implementation and also to connect these findings with specific examples. Presenting projects, practices and endeavours which were designed for the conscious implementation and testing of RI will fill in the gap currently existing in the application of RI models. As a result, a comprehensive picture will be available about nature and the embedded potential of Responsible Innovation.

Keywords: Responsible Innovation, Mutual Responsibility

1. Introduction

The concept of Responsible Innovation (RI) and the need for responsible management of innovation have emerged over recent decades as a result of concerns (originated from the tendencies, change patterns and challenges in the innovation space) surrounding the products and purposes of innovation activity among scientists, politicians, the civil sector and the lay public. RI tries to exceed the traditional limits of innovation governance by making it adaptable to the new environment (WC 1987) and opening up the innovation process to build in new elements (such as stakeholder

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engagement or public dialogue). Also, it tries to underpin the concept with purposes and values. Although there is a vast literature of RI including the analysis of its main values, important elements and necessary framework conditions, the application of this knowledge in practice is absent in most European countries. From the appearance of the concept till its practical use, Responsible Innovation went through a long journey. During this journey milestone after milestone was reached continuously levelling up, approximating the application of RI in innovation practice. The aim of this study is to briefly sketch the theoretical principles of RI, present the most important milestones of the journey towards practical application and reveal some good practices in its implementation.

2. Definition, Elements and Framework Conditions of Responsible Innovation

Defining the purpose of innovation is truly a hard task, mostly because it varies depending on the perspective of the viewer. However, by finding the *basic values* on which we expect innovation to reflect, we will be able to sketch a picture about the purpose of innovation. RI is intended to serve society, by being responsibility-driven and assuring the *right impacts,* which are beneficial to society and guarantee a *good quality of life*. Defining these highlighted concepts is not easy. Nonetheless, in the context of the European Union, the normative anchor points of these concepts are described in relevant paragraphs in the Treaty of the European Union (EU 1992) as sustainable development; quality of life, high level of protection, human health and environment; competitive social market economy; promotion of scientific and technological advances and promotion of social justice, equality of women and men, solidarity and fundamental rights.

The chosen definition of RI aims to reflect on these basic values. As Rene Von Schomberg (2013, pp. 51-74) defined: *Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).*

The concept of RI covers a wide range of elements (von Schomberg 2013, pp. 51-74) some interconnected, some sector specific. Among them, we particularly focused on those that are of prime importance regarding the practical examples presented later. Thus the most important characteristics are the *dimensions of responsibility and main areas of interest* (von Schomberg 2013, pp. 51-74): RI shows a commitment towards the future by covering specific areas of interest – ethical, social and environmental aspects – during the innovation management of the present. The *environmental-conscious* or, in other words, sustainable approach is the most popular dimension among all the participants, which is reflected also on a certain

level in the regulatory and policy principles. It is suggested as a key expectation to modern development and innovation as a result of the peak-availability of the natural resources and destruction of the natural environment by human activity.

The *social aspect* of responsibility represented by RI is complex. It can be easily understood by taking a look at the contradictory relationship between technological development and employment. The tendency shows that the development of technology and innovation is accompanied by a decrease in the number of workplaces. So the technological and innovation advances bring about unwanted social effects. The key aspect here is to find and maintain the balance between the benefits of development and social disadvantages. Therefore, the main goal of RI undertakes the responsibility to ensure that our quality of life does not compromise the chance for future generations to enjoy – at least – a comparable quality of life.

The most controversial aspect is *ethical responsibility*, which is based on the common and traditional value set of every society. Every once in a while new technological and innovation advances come to a point where scientists and innovators see the necessity of transgressing and re-evaluating the traditional value set in the name of development and possible advantages. Experience shows that the importance of the ethical aspect varies according to the level of development of the territorial context. In less developed areas satisfying basic needs draws more attention rather than concerns about the ethical aspects of development. During RI management, the ethical responsibility is undertaken in a way that assures that the satisfaction of the basic needs is guaranteed in every territory. Moreover, ethical concerns of the sector-specific or controversial science and innovation areas are revealed and brought to discussion among RI participants.

As we approach the practical implementation, corner stones should be defined for the *practical framework* around the two future-oriented dimensions of responsibility, which allow us to reflect on the emerged concerns. A framework built on the dimensions of *care* and *responsiveness* urge us to answer 2 important questions (Owen et al. 2013b):

1. What do we want innovation to do? This question seeks to understand what areas of public value can be achieved, what challenges can be faced and how the future can be shaped with innovation. It will help the participants to find the value and the benefits in RI.
2. What are the risks? The second question tries to answer what the risks of achieving this future are and how the effects of innovation can be foreseen, managed and controlled. So this area aims at reducing the unpredictability and strengthening the responsibility dimensions.

Therefore, the first task is to enhance the capacity to make the RI framework *reflective, deliberative, anticipatory* and *responsive* (Owen et al. 2013a).

Reflective: Acting reflectively means reflecting on the underlying purposes, motivations and exploring the assessed effects and impacts of RI and also discovering the underlying ones.

The main goal of the actors and stakeholders belonging to the RI framework is to help the participants of the RI space to find out what sort of agendas RI needs to bring to achieve responsible development. Their role is to integrate the EU principles with national, regional and local realities as a basis for discussion about the values, agendas and benefits of RI. Through the constructive discussion, the goal is to define which unique values RI is built around and to create a basis, which is able to reflect on the grand challenges of the regions and countries implementing RI. It is essential to consider the questions and dilemmas, assumptions and areas of ignorance, which are expected to emerge.

Deliberative: *Inclusively opening up visions, purposes, questions and dilemmas to broad, collective deliberation through processes of dialogue, engagement and debate, inviting and listening to wider perspectives from the public and diverse stakeholders.*

RI is a complex phenomenon with ethical, social, economic and even political aspects. To understand the concept of RI and to be able to develop it constantly, collective deliberation should be assured. This deliberation should happen through the interaction and engagement of the public and diverse stakeholders to open discussions, raise dilemmas and also provide an open-space to find answers and create solutions. Moreover, public and stakeholder involvement can represent the social needs of society and assure the embedding of the fundamental values and rights (e.g. privacy, safety, etc.). In an RI process the stakeholders' necessary satisfaction and engagement can be achieved when they are used as co-creators of innovation. RI challenges each actor in the innovation process to play their part and it explores when and how best to involve the stakeholders appropriately and effectively in their particular part of the process.

Anticipatory: Being anticipatory means describing and analysing those intended and potentially unintended impacts that might arise, be these economic, social, environmental or otherwise.

To cope with the concerns about unpredictability and negative side effects of innovation, there is a need for a policy environment that seeks to deeply understand the effects of innovation with technology assessment, foresight and scenario development. Moreover, enhancing and rewarding the use of the anticipatory approach beyond regulatory expectations is a key factor to achieve the attitude change in the RI process. So there is a double role. First, the key is to embed the anticipatory approach to the policy principles and, secondly, to encourage the participants of the RI space to interactively use, develop and embed its tools to their innovation activity.

Responsive: Using this collective process of reflexivity to both set the direction and influence the subsequent trajectory and pace of innovation. This should be an iterative, inclusive and open process of adaptive learning, with dynamic capability.

Making the framework of RI reflective, deliberative and anticipatory is essential but these conditions are not enough to drive the change if their conclusions, findings and results are not taken into consideration and are not applied during the decision and policy making processes. So there is an urge to build up a dynamic capacity (Teece et al. 1997) that is able to continuously collect and build the obtained inputs into the policy principles of innovation, the activity of the RI participants and into the mentality of the public.

3. From Concept to Practice

Various theories have spread about the concept of Responsible Innovation, which have coincided in the main values and goals of the new, more responsible approach required in innovation management and science. Based on these theoretical roots, *public discussion* has evolved concentrating on dilemmas and concerns raised by the enhanced responsibility dimension in innovation. The forms of public deliberation were conferences, interactive workshops and round table talks involving innovation experts, policy makers, scientists and also representatives of the business sector and the lay public. The *EISRI (European Intersectoral Summit on Research and Innovation)* initiative clearly reflects the process and purpose of the dialogue. EISRI is a European meeting organised by the Atomium Culture every eighteen months dedicated to research and innovation. It aims to create a platform for intersectoral and interdisciplinary discussions between the key stakeholders and to address RI related concern, future agendas and assessment measures. The two most important general goals are the following:

- define the role of research and innovation in the development of a strong and competitive knowledge society;
- discuss the relationship between science and society.

Highlighting elements of Responsible Research and Innovation, the various EISRI editions focus on specific areas on every event. In 2013, the influence of communication and media on Responsible Research and Innovation and the design to create a unique opportunity for intersectoral and interdisciplinary discussions appeared as the main topic of the conference. The EISRI conferences bring together all different kinds of stakeholders involving key representatives of research institutions, businesses, the media, NGOs, policy makers and professional science communicators and also present high-level speakers including former heads of state and key representatives of the European institutions and national governments as well as

leaders from leading research institutions, businesses and the media. The tools to address and discuss the issues are workshops dedicated to reflect the key issues in this area and to promote "out of the box" thinking and participatory processes. As Responsible Innovation aims at closing the gap between society and innovation to make the social factor relevant in the innovation process, the involvement of the societal actors in the innovation decisions and the proper information transfer to these actors are essential.

Following this line, the conference addressed 6 key elements, which support Responsible Innovation: Engagement – "Choose together"; Gender equality – "Unlock the full potential"; Science Education – "Creative learning fresh ideas"; Open Access – "Share results to advance"; Ethics – "Do the right "think" and do it right", Governance – "Design science for and with society".

Other successful initiatives to engage the public with the topic of RI was the series of events that went under the title of *L'Innovazione Responsabile* (Responsible Innovation). In 2011, in cooperation with the Fondazione della Cassa dei Risparmi di Forlì (bank foundation), the Romagna Creative District and a number of local authorities, including the two local scientific and training hubs of the University of Bologna, the Chamber of Commerce of Forlì-Cesena launched this event. The first event was held on September 09th and 10th 2011, and the second took place on May 17th and 18th 2013. The format of the event included conferences, seminars, workshops, exhibitions and shows. The idea was to resort to a variety of events to disseminate the concept/s and practices of responsible innovation to a wide audience, including all relevant stakeholders – enterprises of all sizes, citizens of all ages, public authorities, associations, schools and universities, etc. Discussion within the different events varied from philosophical to hands-on, with craft-workshops. Each event included, in the two-day main event, addressing RI as a comprehensive concept or approaching it from a specific point of view (e.g. social or environmental, business or consumer, etc.). For two days and one night the city of Forlì hosted – on both occasions – some 50 events, with about 950 people taking part in the events and about 20,000 visiting the city centre to enjoy the open-air events (pop-up organic restaurants, gigs in abandoned public spaces, music concert powered by people riding their bikes, etc.).

As a result of public discussion and focused attention from the European Union, the basics of practical application were designed in the form of *practical tools* to assess the implementation conditions and to develop measures and methods of practical RI principle use. The *KARIM (Knowledge Acceleration and Responsible Innovation Meta-network)* project aimed at facilitating knowledge transfer across North West Europe (NWE). The theoretical background of the project was the economic growth potential embedded into innovation, which requires turning research into new and better services and products. The target audience were small and medium sized enterprises and the goal was to make them capable of accessing high value innovation support and technology. The first goal of the project was to take down

the obstacles experienced by SMEs and to make the technology and innovation support available to them. The second goal was to create a transnational model aimed at broadening technology transfer opportunities of universities and SMEs. The third goal of the project was to make SMEs capable of coping with Responsible Innovation principles and of getting access to technology and innovation support on a transnational level. This 5-actioned activity included the development of a Responsible Innovation Diagnostic Tool which is of prime importance from our perspective. The Responsible Innovation Diagnostic Tools aim at monitoring the step by step implementation of RI principles into the life of organizations.

Table 1. Multi-criteria set of RI Flash Diagnostic

Environmental	**Social**	**Economic**	**Approach**
Water management	Health *(Prevention, Screening, Treatment, Toxicity)*	Development of territory / field / sector	Stakeholders management
Materials management	Safety of employees, users and residents	Employment	Anticipation *(legal requirements, market, tendencies, technologies)*
Energy management	Well-being and comfort in life and at work	Public services efficiency / public interest	Project risk management
Pollution (water / air / land)	Social cohesion / Solidarity	Economical performance and consequences on the market	Development of a sustainable value chain
Greenhouse gas	(In)formation / Skills / Culture	Economical consequences for the user, the citizen	Transparency of offer / communication
Biodiversity			Global approach in the design of responsible products / services
Waste management			Sustainable development strategy in the organization

Source: KARIM webpage

The second analysis has a more sector specific approach focusing on ICT features. The flash diagnostic tool has multi-criteria analysis methodology based on questioning. The set of criteria is visible in the following table (Table 1).

The first responsibility dimension to appear in this best practice is the anticipatory ones. It is visible in the activities of the RI Diagnostic Tool and the implementation of RI principles in the research activity. These measures support the creation of indicators to measure RI performance and also serve to minimise the embedded risks into the activity and achieve a more sustainable and safe activity. The reflective dimension appears in the importance of the social, moral and environmental factors. Improving research activities at the universities and finding new ways to

make the research more focused to the need of society to boost life quality is truly an example to follow. The embedded RI principles also cover the concept of moral responsibility and they also include the efforts to make innovation financing an ethical system. The environmental factor is represented by the most efficient and sustainable usage of resources. The project also considers the importance of involving every possible participant of the innovation environment to create the final output. Expert support is gained by universities and enterprises and decision makers are also involved to approximate the policy environment and the practice from the beginning.

The example of the *Socio-Technical Integration Research (STIR)* project also shows how the principles of responsibility can be applied in science and innovation. The reason behind the project's existence is the fact that science and technology policies around the world are placing new pressures on laboratories to address the broader societal dimensions of the work. Despite longstanding collaborative initiatives between natural and human scientists to reach this goal, neither the capacity of laboratories nor the important role of interdisciplinary collaborations has been well understood or supported on an empirical base. Thus, it was of prime importance to overcome these limitations for designing, implementing and assessing effective programs aimed at responsible innovation. In the framework of the STIR program a coordinated set of 20 laboratory engagement studies was conducted to assess and compare the varying pressures on – and capacities for – laboratories to integrate broader societal considerations into their work. During the project a core group of ten doctoral students each conducted two paired laboratory studies. During these studies the doctoral students tried to engage researchers in semi-structured interactions designed to enhance reflection upon research decisions in light of broader considerations. During the assessment studies a protocol was used developed by Pi Fisher. So the most important results of the project were a set of techniques which are publicly available for use in designing, conducting and assessing effective collaborations with scientists and engineers that are aimed at responsible innovation.

As the concept of RI started to embed into the scientific and innovation environment, there was a need to transfer the accumulated and existing knowledge to scientists in different forms of *education and training.* There are several universities worldwide where RI is part of the curriculum or is included among the research principles of the institution. This is the case at the 3TU Federation in which three universities of technology (TU Delft, Eindhoven University of Technology and the University of Twente) from the Netherlands work jointly to embed RI principles in research. At Arizona State University students can even obtain a Certificate in Responsible Innovation in Science, Engineering and Society. This certificate is designed for scientists, engineers, research managers, technology officers, public administrators, and policy officials to confirm their RI knowledge and through that obtain benefits on the job market. But there is no need to look for foreign examples as at the University of Szeged, RI is also included in the curriculum in the form of a project modelling course.

4. Good practices

As seen, the different theoretical concepts, the evolved public discussion, the practical tools and the integration of RI into education paved the way for practical implementation. There are several initiatives within Europe, which reflect the enhanced responsibility dimension of the RI concept. However, in the following section we will analyse a Good Practice outside of Europe. This example was chosen as it includes all the responsibility dimensions and the main characteristics of the necessary approach towards RI.

Both examples have their roots in Grameen Bank (GB). GB developed an unconventional banking practice by removing the need for collateral. It also placed its banking system on new, special characteristics which are mutual trust, accountability, participation and creativity. The target audience of the bank is the poor layer of the rural areas of Bangladesh. The banking system and the credit which can be granted through it is seen as effective means against poverty and unlimited potential to achieve overall social and economic development of the local population. Muhammad Yunus is the founder of the GB banking system who won Nobel Peace Prize for his activity and the innovativeness of his theory. The coverage in the traditional banking system focuses on people with huge amounts of accumulated financial resources. However, based on the new approach the financial resources should be made available to the poor as well, by changing the conditions of banking to fit the needs of the neediest. The application of the new approach brought about remarkable success. In October of 2011 GB has 8.349 million borrowers (97 percent of whom are women) and 2,565 branches; their services were available in 81,379 villages (covering more than 97 percent of the total villages in Bangladesh). Grameen Bank's positive impact on the affected parties has been documented in many independent studies carried out by external agencies (e.g. World Bank, the International Food Research Policy Institute, the Bangladesh Institute of Development Studies).

The generally used financial approach is completed with social and moral considerations aiming to achieve an attitude change of the borrowers focused on responsibility. The so called “16 decisions” is a program which underpins the whole system indicating the 16 main principles that the borrowers should follow in order to improve their financial and social situation. Also, every year GB staff evaluates their work and check whether the socio-economic situation of GB members is improving. GB evaluates the poverty level of the borrowers using ten indicators. The most important element is the credit delivery system.

So the credit delivery system completely differs from traditional ones and has some special features that shall be presented below.

GB focuses special *attention on the people most in need.* This means that in the selection of the clientele they establish clear eligibility criteria and try to adopt

practical measures to screen out the people who do not meet those. Also, regarding the financial situation of borrowers, they take into consideration gender issues.

Most of the credits are assigned to women, the group that enjoys fewer privileges traditionally. Besides the selection, credit delivery is also tailored to meet the diverse socio-economic conditions of the target audience.

The *borrowers of GB are organized into small, homogeneous groups* to facilitate the integration of the members based on group solidarity and participatory interaction. The GP system operates in a way that it is coordinated by centres, which include the smaller groups. The aim of this system is to organisationally strengthen the integration of members as well as improve their capacity to plan and implement development decisions at micro level. The Centres are linked to GB on a functional level, the workers of GB regularly attend meetings at the centres.

There are *special loan conditions*, which provide the basis to the whole banking system. The loans are given in small amounts without any collateral and their repayment is in weekly instalments. The granting of subsequent loan depends on the repayment of the first loan. The supervision activities of credit are delivered by the group of borrowers and the banks staff as well. The transparency is also important element which is ensured mostly by centre meetings. Finally, there are special safeguards as compulsory and voluntary savings to minimise the risks.

Besides taking into consideration the indicators included in the traditional banking systems, there is special focus on the *social development agenda addressing the basic needs of borrowers*. This is the "sixteen decisions" framework, which serves as a guideline, which borrowers should follow in their everyday life. The aim of this element is to pay focused attention on women of the poor households as they are key players in the development of the family. It also contributes to the strengthened monitoring activities of social and physical infrastructure projects (education, family planning, housing, etc.). The enhancement of social and political consciousness of the groups is also essential aspect.

GB aims at continuously designing and *developing the organizational and management systems* capable of delivering programme resources. The system has evolved gradually through a structured learning process that involved trials, errors and continuous adjustments. A major requirement to operationalize the system is the special training needed for the development of a highly motivated staff. In this way decision making and operational authority is gradually decentralized and administrative functions are delegated at the zonal levels downwards.

Also, its loan *portfolio is extended* compared to the traditional banking system. The general credit program serves as an introduction where the borrowers can get familiar with the rules of the system. Later on, other loan programmes are introduced to satisfy growing social and economic development needs of the clientele. Such programmes include credits for building sanitary latrines, for installation of

tubewells, for seasonal cultivation to buy agricultural inputs and for leasing equipment (i.e. cell phones).

The example of the Grameen Bank showed it is not an impossible proposition to lend money to the people with scarce financial resources; on the contrary, it is a responsible financial innovation which can set an example for European countries too.

The second example also appeared in a rural context of Bangladesh. The source of the problem is that about 70% of the population in Bangladesh does not have access to electricity. Grameen Shakti (Green Economy Coalition webpage), grants small loans that enables poor households to buy solar power system. The average price of the system is about $135, but villagers usually pay in instalments as they don't have enough financial resources. The role of solar power systems is to help to reduce the biological footprint of the households by replacing polluting kerosene-fuelled lanterns and enhancing the reduction of deforestation. Local jobs and income opportunities are also created related to the activities. The innovation has beneficial impacts as some women have doubled their income and become energy distributors as a result of electricity. About 10,000 new household solar energy systems are being constructed every month. Currently about 2.5 million people can benefit from the energy systems the organization plans to reach a lot more in the future.

5. Summary

Responsible Innovation appeared as a possible answer to the emerging challenges of the changed innovation context characterized by risk, uncertainty and ignorance. With the enhanced innovation dimensions focusing on the social, ethical and environmental aspects of the outputs and process of innovation, it will be able to express commitment towards the future with appropriate stewardship of innovation management in the present.

The accumulated theoretical knowledge paved the way for RI to be implemented in practice applying a dynamic capacity which is reflective, deliberative, anticipatory and reflexive, thus is be able to adapt to the continuously changing features of innovation space.

The first milestone leading towards broad practical application was embedding RI into public discussion. The open platforms, conferences, workshops and training session enabled the actors of innovation space to improve their RI knowledge and form their own perspective regarding the topic. This included the questions and dilemmas about RI becoming an integrated part of present-day innovation management. New initiatives were undertaken assessing the initial conditions and the possible integration of RI principals (KARIM, STIR) into day-to-day innovation management. The results were a set of indicators and new approaches; tools

which will put in practice RI principles. New forms of educational and training activities also emerged concentrating on the elements of RI to satisfy the need of providing human resources with high-quality RI knowledge. Scientific institutions are on the way to integrate RI into the research and innovation initiatives and practices, as well as integrating RI knowledge into their curriculum.

This focused attention made the appearance of projects and initiatives possible, which were created and delivered fully adapting to and capitalizing on the main values of RI (Grameen Bank, Grameen Shakti). From these initiatives it is clearly visible that RI has immense opportunities to overcome the present challenges related to innovation and development. However, the broad application of RI in science, innovation and everyday life requires a change in attitude from the actors of the innovation space and the lay public. The goal should be to reveal the benefits of RI taking into consideration that RI related measures will bring about positive changes in the future, but require sacrifices in the present.

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