IJIS **2017**, 1(1), 20–36 http://www.ijis.org.cn/
doi: 10.3724/SP.J.1440.101003 http://engine.scichina.com/publisher/CSPM/journal/IJIS

Article

Politicizing Responsible Innovation: Responsibility as Inclusive Governance

Andoni Eizagirre [1,*], Hannot Rodríguez [2] and Andoni Ibarra [3]

[1] Department of Social Sciences, Faculty of Humanities and Education, Mondragon University, Dorleta auzoa z/g, 20540 Eskoriatza, Spain

[2] Department of Philosophy, Faculty of Arts, University of the Basque Country UPV/EHU, Paseo de la Universidad 5, 01006 Vitoria-Gasteiz, Spain; hannot.rodriguez@ehu.eus

[3] Department of Logic and Philosophy of Science, Faculty of Education, Philosophy and Anthropology, University of the Basque Country UPV/EHU, Tolosa Ave. 70, 20018 Donostia-San Sebastián, Spain; andoni.ibarra@ehu.eus

* Correspondence: aeizagirre@mondragon.edu; Tel.: +34-943-714-157, Fax: +34-943-715-220

Received: 2 August 2016; Accepted: 6 December 2016; Published: 17 February 2017

Abstract: This paper aims to provide the historical and conceptual bases underlying the inclusionary transition of European innovation policy, and critical analysis of the difficulties relating to the political nature of this transition. In the 50s and 60s of last century, linear innovation models operated on the basis of a clear division of roles among the different actors in innovation and fundamentally economistic-based strategies. The following decades saw innovation policies progressively recognize the multi-dimensional and complex nature of innovation and the need to make adjustments, but always in explicit response to the competitiveness imperative. More recent RRI (Responsible Research and Innovation) strategy within the European Union, in contrast, demands opening up the whole innovation process (including values and motivations) to collective decision, i.e., approaching responsible innovation as inclusive innovation. This paper appraises this important development primarily on the basis of in-depth analysis of the main policy literature on innovation, and also on the grounds of related academic literature. As a result, we conclude that the bid for collaboration models cohabits constitutively with another set of dynamics aimed at strengthening centralized and prescriptive forms of innovation. In other words, that inclusionary or political eagerness represented through RRI must grapple with the strategic imperative of competitiveness and economic development. Hence, fundamental tension exists, which should be elucidated in light of the objectives, demands and considerations that are integrated, and cease to be integrated, in innovation dynamics and trajectories.

Keywords: Inclusive innovation; Responsible Research and Innovation (RRI); Competitiveness; Institutional ecosystem

1. Introduction

Scientific and technological innovation systems all over the industrialized world have traditionally operated based on a number of fundamental assumptions. These include clear division of roles among the actors in innovation, subordination of innovation to macroeconomic demands, and identification of innovation with progress and well-being by default (OECD, 1972; Sarewitz, 1996).

However, these operative and ideological foundations of innovation have been progressively, and relatively, questioned in light of the institutional recognition that innovation should be conceived as a complex process. That is to say, innovation is reliant on the interaction of a wide variety of actors, considerations, demands, expectations and values. In response to this, policies addressing the constitution of "ecosystems" for innovation began to be developed in the 1990s. The policies addressed the design and implementation of programs, and strategies to promote entrepreneurial and collaborative attitudes among academic-business actors in innovation (Lundvall, 1992).

This trend toward integration of heterogeneity of aspects and actors, reflecting the complexity inherent to innovation processes, has led to more radical approaches throughout the course of the last decade. Integration is conceived as a platform for constituting the actual direction and objectives of innovation, thus reaching beyond inclusive strategies of an essentially economistic nature. Such is the case in European Union (EU), whose approach toward integration reflects the need for innovation dynamics to respond constitutively, or *inclusively*, to the plurality of social demands. This would include the integration of these demands and their actors in the innovation processes themselves. For example, in the view of Máire Geoghegan-Quinn, former European Commissioner for Research, Innovation and Science (2010–2014): *"Research and innovation must respond to the needs and ambitions of society, reflect its values, and be responsible. (...) The first key is to engage people and civil society organisations in the research and innovation process"* (Geoghegan-Quinn, 2012, p.1).

Understanding innovation as defined above, i.e., in terms of inclusivity, ultimately responds to the institutional recognition that it is insufficient to address the societal fit of innovation by formulating institutionally defined rules aimed at regulating the social and environmental impact of technological innovations. This is because the uncertainty and epistemological and regulatory complexity characterizing scientific and technological developments in our societies demand *inclusive* management of actual innovation processes, including their inception and direction (Irwin et al., 2013). This implies that innovation needs to be appraised as *inclusively contingent*—namely, as a reality that needs to be constituted heterogeneously in all its dimensions (i.e., not only concerning organizational or procedural aspects, but also normative aspects). A clear example of this can be seen from the experience of the regulatory failure linked to the development and commercialization of agrifood biotechnology in European territory (Thayyil, 2014).

In other words, this inclusive perspective demands that the issue of socially responsible innovation be focused on in essentially political terms. One can only be responsible if one is *inclusively responsible* by integrating, accommodating and institutionalizing the diversity of values, interests and knowledge dynamizing and constituting innovation. In other words, responsibility is politicized as a problem, and is directly related to the capabilities to decide collectively what kind of innovations we want as a society.

This paper aims to provide the historical and conceptual bases underlying the inclusionary transition of the European innovation policy, and critical analysis in light of the difficulties relating to the actual political

or transformative nature of this transition. In order to do so, we shall begin with a characterization of innovation as "exclusive innovation", prevalent in Research, Development and Innovation (R&D&I) systems until the 1990s. We shall then address the attempts to diversify innovation dynamics and trajectories throughout the past two decades in relation to the explicit integration of a wider variety of actors and demands in innovation systems. These attempts at integration and opening-up will also be relativized in light of the tensions deriving from economistic imperatives characteristically connected with such systems. Lastly, and through analysis of the contemporary European Responsible Research and Innovation (RRI) approach, integration in even more radical terms will be analyzed. That is, it will be analyzed in terms of *inclusion* based on the recognition of RRI demands to open up heterogeneous negotiation to the very principles, aspirations, objectives and assumptions forming the basis of innovation systems. Naturally, this analysis must continue to take the reality of the institutional context into account, largely articulated around the innovation imperative as the strategic driver of competitiveness and economic development.

2. The Innovation Imperative: Privilege and Exclusion

Innovation in the modern imagination has been closely associated with progress and well-being (Godin, 2015). However, while notions such as progress, innovation, or well-being impregnate modern societies, they also tend to be ambiguous and opaque and fail to establish the precise direction or specify the options, values and aspirations underlying such notions. Along with its interpretative flexibility, innovation has tended to occur whilst ignoring certain socio-technical dynamics and trajectories (Leach et al., 2005).

The picture of innovation became increasingly complex throughout the second half of the 20th century with the wide variety of technical, economic and social dimensions, calling into serious question the deterministic or the linear concept of innovation. Nevertheless, the prevailing model of innovation in the modern R&D&I policies maintained certain fundamental dynamics relating to the following aspects until well into the 1990s: a clear division of roles among actors in innovation, strong subordination of technological innovation to the demands of macroeconomics, and the de facto assumption that progress is inherently positive.

In order to understand the exclusive nature of innovation, attention may be turned to how innovation policies embody certain outlooks on progress, well-being, and future aspirations through which socio-technical trajectories are stabilized (Dickson, 1984; Sarewitz, 1996). In that sense, what may be a regulatory posture normally linked to power, has traditionally ended up adopting an ontologically inevitable character. In some respects, successive R&D&I models may be understood as different responses to the same question, which has in turn been conditioned by a privileged direction of understanding progress (Leach et al., 2010). Ultimately, every canonical model of R&D&I policy tends to integrate and represent a seemingly single objective and a neutral direction while the favored outlook excludes other directions and options for change.

A prime example can be found in the ideological and normative guidelines mentioned in the report *Science: The Endless Frontier*, written by Vannevar Bush (1945), in response to a request from the then US President Franklin D. Roosevelt who was aiming to pursue the development of science and technology in times of peace. In this report, linear sequencing can be identified, which adopts research as the driver of technological applications, for marketing novel products, and as the guarantor of job creation and economic growth. This triumphalist outlook insulates basic scientific research from public scrutiny, and gradually

stabilizes courses of action empowered and governed by technological innovation. Moreover, functional, institutional and moral demarcations of the phases in the innovation chain are stated. Such exclusiveness of tasks is hierarchic, centralized, and exclusionary.

Under this paradigm, for instance, scientists, who are the key drivers of innovation, are independent with regard to the technological applications of knowledge. Therefore, adopting a linear, positivist and triumphalist outlook also favored the autonomy of scientists to a large extent. Scientific autonomy, based on rules of scientific merit such as the degree of plausibility, scientific value, and originality (Polanyi, 1961), excluded the fulfillment of human needs and knowledge beneficial to society from its self-regulation (Ziman, 1998). Similarly, as stated by Hart (1998), even though the importance of science is accepted in relation to technology, industry and employment, at the time, the relationship of science and technology with the economy is non-existent or indirect. If the first national surveys on research and experimental development on the normalized methodology proposed in the first *Frascati Manual* (OECD, 1963) are adhered to, it can be seen that they refer solely to investments made (infrastructure and personal). Hence, the unpredictability of the outcomes justifies the stimulation of research based on anticipated benefits. Strange as it may seem, until very recently, the measurement and design of innovative activity failed to incorporate socio-economic outcomes and impacts (Godin, 2010). For instance, the shifts and transformations in the conception of innovation during the 1960s, when technological innovation began to be regarded as something that needed to be explained not only in terms of basic research and scientific excellence but also with respect to the broader societal context, took place in the normative grounds of the past (Greenberg, 1967).

On the one hand, the experience of the uneven outcome of two strategic projects (cancer research and space technology programs) funded in the 1950s and 60s subjected the lessons extracted from the Manhattan Project, the main source of reflection for Bush in his design for research policy, to debate and facilitated the empirical corroboration that successful outcomes in terms of product indicators (volume and quality of scientific research) do not guarantee the transfer of scientific knowledge to technological developments and productive systems. In other words, it was acknowledged that a science program's potential (its GDP size) does not necessarily explain the successes and failures of a nation's technological and productive capability. This scenario involved replacing knowledge push for market demand pull as the basis of innovation (Weinberg, 1967).

On the other hand, however, the decentralization of forms of innovation or importance of adapting changes to social interests found little practical support, at least at that time. Indeed, a few cases can later be found, such as Brooks' failed attempt, which formulated a *"new type of science policy"* (OECD, 1972, p.12) that was clearly aimed at satisfying the social demands and welfare of society and was vigilant with regard to environmental sustainability.

The paradigm shift, beginning in the 1960s, noted the need to abandon the *laissez-faire* policy arising from the report *Science: The Endless Frontier* and to orient science towards productive purposes, giving priority to investment utilization mechanisms and promoting strategic lines that ensure the transfer of knowledge to fields linked to the productive system (OECD, 1968 & 1971). However, whilst the applicative character of research gains in importance, changes in innovation policy are still proposed to increase the speed of innovation under the same linear and triumphalist sequencing. This is because a country's innovative character and the efficiency of its scientific-technological system are linked to impact and outcomes. This is how a distinction is made between scientific production indicators and technological

outcome indicators. Note that the latter set of patent and trademark-related indicators is especially oriented toward protecting and promoting research activity associated with technological creation by granting industrial property rights. It is presupposed that patents are the product of successful R&D activities as well as of the new stimuli motivating and driving innovation favored by the new laws during the projected course of action.

The deterministic assumptions comprising the linear outlook of innovation began to be called into question mostly during the late 1960s and 1970s, when the complex nature of innovation was increasingly being acknowledged. It started to be conceived as comprising contextual and institutional aspects such as sectorial realities (government, university, industry, non-profit organizations), economic and financial context, or international arena. This indicates that innovation, despite being represented as unequivocal and inevitable, acquires reality through a set of institutional and political measurements (OECD, 1980, 1988, 1991a & 1991b). In this respect, even though the complex nature of innovation has been gradually acknowledged, different manners of knowing, acting and assessing have rarely been discussed.

In the 1990s, theories on innovation and technological change were placed at the heart of economic policy (OECD, 1992). This period is highlighted by the fact that the measures aimed at feeding the flow of outcomes between the knowledge production system and the goods and services production systems clearly tipped the scales toward economic policy considerations. Even though innovation had already adopted a primarily economic nature during the 1980s, this dimension became the only one that mattered throughout the course of the 1990s. Innovation was oriented, at least initially, towards the technology and business sectors, and later diversified to other sectors under policy narratives on social innovation (OECD, 1996).

The normative vision of progress has therefore been rooted in a set of dominant values that interact with our manners of knowing, acting and assessing, to the extent that the direction of innovation has been largely taken for granted. Thus, the course of action comes to be seen as predetermined, and for this same reason, requires centralized forms of innovation governance. The capability to anticipate and adapt takes precedence, and is in keeping with a quasi-inevitable concept of progress (Pellizzoni and Ylönen, 2012). The ideology of progress, the latest fixation on sustainable development (OECD, 1997), or the analysis of any socio-technical system's trajectory (e.g., automobile, urban planning, food, electricity grid, household energy consumption) and the difficulties in varying the dynamics stabilizing it, clearly reflect this (Lockie et al., 2014).

What all this signals is that the innovation system has been subjected to important changes in organizational and budgetary strategies during the second half of the 20th century, with increasingly stronger and more stable collaboration between actors from academia, industry and policy making. In that sense, innovative capability, speed, and novelty may be discussed, but the meaning of innovation may not be, and even less so, innovation direction. The ontology of innovation being entrenched in a particular legal framework also makes it difficult to think of trajectories, directions, and different socio-technical configurations (Rip and Kemp, 1998). There is scarce innovation in many of the current ways to innovate. The aims of innovation are subsumed under competitiveness, and institutional and technical trajectories lack variety and robustness (i.e., they lack contextual sensitivity) (Voß et al., 2006). This is further compounded if a planetary outlook is adopted and the inequalities of power and diversity of ways of understanding society and its relationship with nature are included in the analysis (Arocena and Sutz, 2013; Bolay et al., 2012; Vessuri, 2012).

However, at the same time, the current century has also seen a deepening recognition of the constitutive complexity of innovation processes, increasingly understood in terms of interaction and feedback among a diversity of actors and their demands (Biegelbauer and Borrás, 2003). This is analyzed in greater detail in the next section.

3. Pluralizing Innovation: The Value of Complexity and Open Dynamics

The view of innovation focusing on structure has been partially displaced by a more dynamic and processual outlook during the 21st century, where the selection environment is not restricted to the productive environment. The innovation system pluralizes all the agents and increases its activities to practices as disparate as design, knowledge transfer, marketing, patent management, financial alliances, and so on (OECD, 1999).

Such change should not be underestimated, as the creation of networks and distributive innovation implies informal ways of cooperation in the construction of technological and industrial artifacts (OECD, 2001). Moreover, the traditional boundaries between science and society blur and fade away. The user, traditionally relegated to the final link in commercialization, takes on a strategic (and in some cases, an instrumental and opportunistic) role (Desouza et al., 2008; Verganti, 2009). The field of action expands (from industry to services) and it can be seen that innovation, owing to its role in productivity, progressively moves toward the core of competitiveness plans drawn up by governments and enterprises (Marklund et al., 2009).

There is also a growing interest in open innovation, indicating a gradual recognition of the distributed nature of knowledge and of collaboration between different organizations (private enterprise, public research agencies and user organizations), as well as the need to adapt to different contexts, environments and users (Chesbrough, 2003). Another case of distributed innovation, which is clearly rooted in the user, is open access tools (Goldman, 2012; Strauss, 2010). Together with linear models, which continue to be valid, and others clearly oriented to business profitability, these different versions suggest new ways of comprehending, stimulating and governing innovation (von Hippel, 2004). In short, this signals a new, more complex, and interactive division of labour, where different professionals and public interact and collaborate. In some cases, innovations are even induced by the user (e.g., patients, athletes, farmers) and are community-based, as a direct response to social needs and aspirations. To a certain extent, it could be suggested that these new systems and practices encourage greater inclusion of actors and demands, which directly affects governance and expected outcomes of innovation (Callon et al., 2009; Levidow and Oreszczyn, 2012).

However, this type of dynamics is not exclusive to the scientific-technological field of innovation. For example, within the field of education, comprehensive schools in Finland inquire about the nature of change and institutional learning and develop empowering services adapted to individual needs and skills (Miettinen, 2013). The quality of educational services here requires local experimentation processes (decentralization of service provision, municipal governance). This involves continuous co-learning between universities, research institutes, professionals and civic associations based on which standards and objectives are subject to constant redefinition.

Nevertheless, this should not lead us to ignore the fact that innovation dynamics tend to privilege certain relationships or partnerships to the detriment of others (OECD, 2005). This indicates that all

liberalizing transformations in technological innovation dynamics also require forms of organization, value chains and business structures in order to be renovated. Indeed, there seems to be a close correlation between innovation orientation and the variety of actors and demands converging in the configuration of a socio-technical artifact (Markus et al., 2009). Caution should therefore be exercised and attempts made to comprehend innovation within the spaces it materializes. Promoting plurality in innovation does not therefore imply that anything becomes possible or feasible (Jasanoff, 2004).

Innovation never develops in a social and political void. In the innovation process, the contextual factor (education system, productive model, tax policy, access to funding and credit, mutual guarantee companies, infrastructures projects) becomes the key (Aho, 2006). Technological innovation, in this respect, organizes society and models it. In other words, it needs an entrepreneurial society that takes risks and an innovation-friendly environment (European Commission (EC), 2010).

Coupled with all this is the gradual transformation of institutions in response to the needs imposed by innovation as the driver of competitiveness. An example can be found in the strategic plans of universities, where knowledge transfer is increasingly gaining key importance (Perkmann et al., 2013). Resource and activity-related indicators focus on contracts and agreements with firms, technology development, business incubators, exchanges of professionals, entrepreneurship, internships, and so on (Clarysse et al., 2005). Similarly, outcome and impact indicators largely aim to measure the creation of businesses, marketing, licenses, utility models, patents, spin-offs, start-ups and technology (Penfield et al., 2014). This suggests that innovation models also manage to reconfigure societies and their institutions.

In this respect, it is illustrative that innovation studies, with its huge amounts of stimulating literature as well as different government tools and investment schemes, has been preoccupied with the organization and operation of the R&D&I system, and its institutions and instruments (resource optimization; generated knowledge management). However, in doing so, debate on the scope and significance of innovation has been omitted (Boden et al., 2012; Smith et al., 2010), as acknowledged by top-level institutional actors such as the former US President Barack Obama (Obama, 2009), the Organisation for Economic Co-operation and Development (OECD, 2010) or the European Commission (EC, 2011 & 2013). This may explain that while the complex nature of innovation is acknowledged, the normative properties of the socio-technological trajectory in areas such as energy, transport, agriculture, health and food are decided according to a limited number of interests and socio-technical intentions (Ely et al., 2013; Scoones et al., 2015).

All of this forces recognition of the constitutively exclusionary nature of innovation systems, which tend to ignore, violate and reduce viable alternatives (van den Hove et al., 2012). Nonetheless, and although it may seem paradoxical, this exclusionary trend can debilitate innovation systems and their plans (Hommels et al., 2014). Just as societies rely heavily on technologies, a technologically viable innovation can be blocked socially, whether it is for lack of interest, profitability, or open opposition. Indeed, this circumstance determines the liberalizing role that governments are called to play upon. Whilst feeding the technological cycle of promises, they find themselves increasingly obliged to answer to an increasingly reflexive society with regard to scientific-technological dynamics (Bauer, 2015). The transformation of societies according to their economic, cultural and educational capabilities subjects innovation governance to the apparent paradox of the new social context of scientific-technological activity.

In any event, it is well worth remembering that despite the diversity of trajectories along which innovation can develop and progress, the emerging institutional trends toward the development of more

socially robust policies are not free from problems or difficulties. Hence, even though distributed and diverse innovations may be encouraged, it should be taken into account that innovations are reliant on the institutional and techno-economic ecosystem. This may favor governance and collaboration models or conversely, strengthen centralized forms of innovation. It would therefore appear that the various ways of comprehending innovation and its governance are to co-exist.

Be that as it may, the following section addresses the features of an emerging inclusionary-type regime within the EU, conceived in terms of greater, and institutionally more robustly articulated, involvement of actors throughout the entire innovation process and considerations typically excluded from this process.

4. Socio-Technical Integration and RRI: Towards Inclusive Innovation

European innovation policies have shown growing interest, notably from the beginning of the first decade of the 21st century, in integrating social demands in innovation processes (e.g., EC, 2001, 2002 & 2003). It is reasonable to argue that this European bid to promote more socially inclusive innovation dynamics can be explained in light of the regulatory failure associated with the development and marketing of agrifood biotechnology within the European territory. International, inter-institutional and social controversy and disharmony have predominated, and still do, regarding the true scale of the risks and benefits of genetically modified organisms (GMOs) applied to agriculture (Tosun, 2014; Wickson and Wynne, 2012).

This experience has revealed that traditional innovation promotion and regulation mechanisms, based on the development of expert knowledge aimed at fulfilling a series of technical or economic criteria and rules, are insufficient to anticipate and determine (Beck, 1995; Cranor, 2011; Shrader-Frechette, 2007) or normalize and stabilize (Kleinman et al., 2014; Vogel, 2012) the impacts and influence of innovations on our societies. Indeed, this should come as no surprise; rather, it should be interpreted as a direct consequence of the complex nature of our societies. A plurality of interests and policy preferences cohabit (Lassman, 2011) that are linked to, and strengthened by, a constant flow of information and growing availability of knowledge (Castells, 2012).

As a likely outcome of the "lessons learned" (David and Thompson, 2008) from the abovementioned biotechnology failure, in 2004, the European Commission (EC) prompted the need to address the then incipient innovations in nanoscience and nanotechnology from a more integrative or inclusive perspective. Socio-ethical and environmental health issues were considered a constitutive part of their development:

> Nanotechnology must be developed in a safe and responsible manner. Ethical principles must be adhered to and potential health, safety or environmental risks scientifically studied, also in order to prepare for possible regulation. Societal impacts need to be examined and taken into account. Dialogue with the public is essential … (EC, 2004, p.3).

Indeed, this inclusionary drive linked to nanotechnologies reflects a widespread demand applicable to all research and development areas sponsored by the EU. Moreover, it is formulated in rather radical narrative terms. This radicalness depends, in this case, on the level of integration being referred to. Therefore, for instance, European institutions state that the research expert dynamics promoted under the 6th (2002–2006) and 7th (2007–2013) R&D Framework Programmes should integrate socio-ethical considerations, as reflected in the following formulations:

> … consideration of the ethical, social, legal and wider cultural aspects of the research to be undertaken and its potential application … will, where relevant, form a part of the [6th Framework Programme] research activities … (Council of the European Union, 2002, p.7).
>
> The challenge today is to encourage actors in their own disciplines and fields to participate in developing Science in Society perspectives from the very beginning of the conception of their activities. This is in line with concepts developed in the field of governance, notably that of "co-operative research" …, i.e., a research process aiming as much at the harmonious societal integration of new scientific and technological knowledge as to achieving the specific objective of the research itself (EC, 2007, p.6).

This type of call for socio-technical integration (Fisher and Schuurbiers, 2013) or "co-operative research" in research processes began to emerge for integrating non-experts (i.e., the public as a whole) as well. Hence, for example, the then EC Deputy Director General for Scientific Advances, Zoran Stančič, in reference to the transition from the 6th to 7th Framework Programme, stated that *"[m]ore must be done (…) to find ways of actively engaging with civil society, stakeholder groups and the public at large in the preparation and execution of research"* (Stančič, 2007, p.1).

Nevertheless, the fact that these statements referring to inclusion have had to cohabit with other kinds of openly exclusive approaches reveals the difficulty facing all substantive attempts to modify the dynamics of innovation governance in terms of inclusiveness at an institutional or formal level. This is essentially due to the commitment of European innovation policy with knowledge production aimed at industrial exploitation and economic competitiveness. This leads to approaches that tend to seal off research expert dynamics concerning the potential incorporation of perspectives and values that may interfere in the path of techno-industrial progress. According to the EC: *"[f]or Europe to become the most advanced knowledge society in the world, it is imperative that legitimate societal concerns and needs concerning science and technology development are taken on board"* (EC, 2007, p.4). After all, and in the words of John Dalli, former European Commissioner for Health and Consumer Policy (2010–2012), *"it is important (…) to convince citizens of the benefits of (…) innovative products"* (Dalli, 2010, p.2).

Another expression of this tension, which would come to restrict the content and scope of responsible inclusionary innovation policy, is the way in which European institutions characterize science and its relationship with society in the Eurobarometers at the time. For example, the Eurobarometer 225 *Social Values, Science and Technology* (EC, 2005) addresses the issue of social reluctance to accept certain technological innovations in terms of a conflict between research freedom and moral values. In other words, it addresses the issue in terms of the basic demarcation between scientific and social aspects of research. Science is implicitly characterized here as an autonomous activity that is not open to public debate. Only the external impacts of science are considered (e.g., Eizagirre, 2013). This kind of approach is also particularly evident in the field of technological innovation risk governance where inclusive-type developments (e.g., Council of the European Union, 2014; Greiving, 2009) are formulated in terms of a fundamental demarcation between "objective" risks and inclusive management dynamics (Rodríguez, 2016).

As criticized in a report by experts commissioned by the EC itself, all of this indicates a marked institutional trend to consider responsible innovation dynamics based on approaches that only open the consequences of innovation to debate. The resistance of European responsible innovation policy to allow

critical scrutiny of the motivations, commitments and outlooks underlying innovation dynamics is also noted (Felt et al., 2007).

The EU seems to have echoed this diagnosis more explicitly when it recently acknowledged the need to adopt a broader and more complex or *political* focus regarding responsibility (Jacob et al., 2013), which is not centered on the management of technological innovation per se (assessed according to "objectively" delimited risks and problems and a number of assumptions relating to competitiveness, well-being and progress kept on the fringes of what is questionable), but on *"the whole innovation process"* (von Schomberg, 2015, p.2). The 8th R&D Framework Programme (2014-2020), also known as "Horizon 2020", openly calls for heterogeneously or inclusively constituted research and innovation according to its "Science with and for Society" strategy:

> 'Science with and for Society' will be instrumental in addressing the European societal challenges tackled by Horizon 2020, building capacities and developing innovative ways of connecting science to society. (…) It allows all societal actors (researchers, citizens, policy makers, business, third sector organizations etc.) to work together during the whole research and innovation process in order to better align both the process and its outcomes with the values, needs and expectations of European society. This approach to research and innovation is termed Responsible Research and Innovation (RRI) (EC, 2013, p.4).

This extract points to two closely-related issues in particular. On the one hand, at the beginning, it is noted that "Horizon 2020" defines and articulates R&D practices according to a *"challenge-based approach"* (EC, 2011, p.5). This approach underlines the value of research and innovation in order to solve pressing social and environmental problems. As stated by the EC at a "Horizon 2020" presentation:

> Smart investment, notably in research and innovation, is vital in order to maintain high standards of living while dealing with pressing societal challenges such as climate change, an ageing population, or the move towards a more resource-efficient society (EC, 2011, p.2).

On the other hand, and in relation to this, RRI is called for, which would involve the subversion of disciplinary and social boundaries in research. This is related to the fact that a research and innovation emphasis is placed on problems, rather than areas of knowledge, and their socio-technical complexity, which would force the collaboration or integration of heterogeneous research fields and social actors. In doing so, the social responsibility dimension of innovation dynamics seems to be taken on board in more deeply relational or systemic terms. The formulation of problems in itself and the expected benefits associated with their solutions or *right impacts* (von Schomberg, 2013) become subject of debate. Thus, the very principles, interests, outlooks and assumptions shaping the basis of institutional innovation systems ought to be susceptible to negotiation.

This RRI approach therefore calls for the phenomenon of innovation to be reformulated as *inclusively contingent*, namely, as something that demands to be constituted heterogeneously in all its dimensions (i.e., including normative issues, and not only organizational or procedural issues). Responsibility consequentially becomes a function of the degree to which it integrates, accommodates and institutionalizes the diversity of values, interests, and knowledge dynamizing and constituting innovations. In other words, responsibility is politicized as a problem, and relates directly to capabilities to decide collectively what kind

of innovations we want as a society:

> This, in turn, is challenging scientists, innovators, business partners, research funders and policy-makers to reflect on their own roles and responsibilities, acknowledging that the irresponsibility in innovation is a manifestation of the ecosystem of innovation and requires a collective, institutionalized response, if this is indeed possible (Owen et al., 2012, p.757).

The following formulation of RRI gives an even more explicit definition of the collective nature of responsible innovation, understood in terms of co-responsibility or mutual responsibility among a diversity of actors:

> Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society) (von Schomberg, 2013, p.63).

This "mutually responsive" element calls on the need for the diversity of social actors affected by innovations to make an effort, and have the capability and possibility to transcend their roles, and reflect and partially absorb the demands of other actors. This call for co-responsibility ultimately reflects what RRI theorists regard as the four fundamental principles of socially inclusive responsible innovation: anticipation, reflexivity, deliberation and responsiveness. These refer, respectively, to the intention and capability to: (i) conceive and consider a wide variety of possible scenarios relating to innovation; (ii) rethink and reconsider preferences, values and knowledge in light of having formulated these scenarios; (iii) open up these outlooks, preferences, values and knowledge to collective deliberation processes; and (iv) develop effective governance mechanisms that institutionalize the collective, or inclusive, constitution of innovation (Owen et al., 2013; Stilgoe et al., 2013).

Hence, this is a proposal for a constructive or co-responsible rupture from the traditional roles associated with actors involved in innovation (including critics). That is to say, a dynamic, circumstantial reconfiguration of the *division of moral labour* (Rip, 2014) is called for. Of course, the eminently transformative nature demonstrated by this inclusionary proposal for responsibility must, by its very nature, deal with the challenge of successfully overcoming the socio-institutional inertia and dynamics sustaining innovation systems (Levidow and Neubauer, 2014). It is oriented toward the future and therefore towards the actual heterogeneous constitution of innovations.

It would therefore be advisable to address the RRI approach's bid for inclusiveness with certain skepticism. For instance, it has been revealed that the potential influence that institutionally sponsored public engagement exercises on technological developments is severely constrained by the objectives, values and interests guiding the political and economic dynamics of innovation promotion and regulation (Davies and Horst, 2015; van Oudheusden, 2014). They remain impermeable to debate, oblivious to alternative normative points of view (Sykes and Macnaghten, 2013). In addition, in more general terms, it has been corroborated that the evolution of European science policy in the last two decades, characterized by a progressive radicalization of the narratives on inclusive innovation, has failed to be coupled with a proportional transformation in the design and demand of scientific-technological practices. These seem to be far more oriented toward fulfilling

the demands of a hyper-competitive, knowledge-based economy, and integrating industrial actors in research (Rodríguez et al., 2013).

Therefore, we should continue to be aware of potential inertia, power asymmetries and fundamental priorities that might constrain the constitution of more radically responsible socio-technical realities and futures, inasmuch as RRI aims to open up the objectives, goals and interests of innovation to public scrutiny. These tending to have been sealed off from the social context, which grants this outlook the virtue of making it possible to conceive more alternative outlooks and futures for science and its relation with society and nature. In any event, RRI and its mission to make innovation a more inclusively contingent process allow these dynamics and constraints to be explicated, which may be considered an important contribution in itself.

5. Conclusions

This paper focuses on the analysis of historical-conceptual dynamics linked to progress and the formulation of inclusive scientific-technological innovation policies within the EU. On the one hand, a clear trend has been identified on the part of the European policy, as in industrialized societies at large, to increasingly integrate socio-economic considerations in the design and execution of scientific-technological activities linked to innovation processes. On the other hand, however, it also highlights the manner in which this evolution toward forms of inclusively responsible innovation characteristically cohabits with imperative forms of innovation. This is where the instrumentalization of scientific knowledge at the service of economic growth and international competitiveness defines and guides institutional policy. In other words, it is not possible to address the issue of the meaning, scope and impact of inclusive innovation without considering the socio-economic context in which it is called upon to take place. Based on this, greater or lesser instrumentalization of inclusiveness is constituted at the service of a series of interests and objectives that remain impermeable to all potentially distorting external influence (Stirling, 2008).

In any event, inclusive-type European policies have become perspectives of radical inclusiveness, formulated on a highly transformative conceptual basis for understanding the relationship between science and society. The new European RRI approach illustrates this, based on an openly heterogeneous or relational perspective of knowledge and innovation. Indeed, RRI is not conceived as an exercise regulating a kind of science that is supposedly autonomous in its dynamism and that, nonetheless, must be accountable to a progressively demanding and reflexive society. It is formulated as a facilitator for the governance of innovation dynamics, whose constitutive complexity, variety and relationality are acknowledged as facts.

This approach unfailingly turns attention to the process and innovation dynamics themselves, which are now potentially susceptible to heterogeneous change and reformulation. Nonetheless, this politicization of responsible science also involves becoming aware of the difficulties associated with applying such a perspective to innovation processes. Its viability is reliant on the capability to subvert the principles, inertia, values, commitments and objectives underlying these processes to a greater or lesser degree, depending on the circumstances and singularity of each process.

Nevertheless, the objective of achieving inclusively more contingent innovation dynamics, together with diagnosis and analysis, serve to explicate these constraints. This may be considered an important contribution in itself, coupled with the fact that it allows light to be shed on the issue of inclusiveness, not in

absolute terms (i.e., inclusiveness, yes or no) but rather in terms of degree. Inclusiveness can have many edges (meanings, scope, demands, assessments etc.) according to the contexts in which it takes place.

Acknowledgements: This paper is based on research supported by the Basque Government's Department of Education, Language Policy and Culture under grant IT644-13, the Spanish Ministry of Economy and Competitiveness and the European Regional Development Fund under grant FFI2015-69792-R, and the University of the Basque Country UPV/EHU under grant EHUA15/13 (Rodríguez). The authors would like to thank anonymous reviewers for helpful feedback and constructive criticism of an earlier version. Any limitations and shortcomings of the work remain the responsibility of the authors.

Conflicts of Interest: The authors declare no conflict of interest.

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