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Looking Back at Ten Years of RRI: Review of R. von Schomberg and J. Hankins (eds): *International Handbook on Responsible Innovation: A global resource*
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This year marks the 10th anniversary of a workshop hosted by the EC Directorate-General for Research and Innovation, which brought together policymakers and scholars in constructive technology assessment, applied ethics and public engagement with science (among other antecedent endeavours) to begin the work of reconfiguring publicly-funded research and innovation systems to incorporate 'responsibility' as something beyond risk mitigation (EC, 2011). With the mainstreaming of the European Commission's (EC) Responsible Research and Innovation (RRI) framework into the launch of Horizon Europe in 2021, there has also been some concern that much of RRI's global impetus, derived through its funding as a cross-cutting issue in Horizon 2020, may be lost (Gerber et al., 2020). The **International Handbook on Responsible Innovation** creates a reflective opportunity to consider what has been achieved so far.

For those familiar with the various epistemic communities now engaging with RRI (and RI more broadly) there are many well-known and well-qualified names among the contributors, as well as a selection of promising newcomers to the field. As co-editor, Rene von Schomberg is uniquely qualified as one of the originators of this 'vision' of responsible innovation (von Schomberg, 2013) which he has shaped both as a member of the European Commission, and as an academic scholar in his own right, holding PhDs in both science and technology studies and philosophy. Complimenting this more policy-oriented expertise, his colleague Jonathan Hankins is a researcher at the Fondazione Giannino Bassetti, which has been promoting its own form of responsible innovation since 1999, and works closely with innovators and RI scholars in Italy and abroad.

Neither the question of what RI should be, nor how it should be done, is settled by this Handbook -- which, even at 550 pages, is not exhaustive. Nor are such questions meant to be. The Handbook instead seeks to provide both retrospective and prospective views, and to be of interest not only to scholars in science, technology and innovation studies (as well as to scientists and engineers) but also to policymakers, entrepreneurs and industrial actors with an interest in using the innovation system to solve real-world problems. The book is divided into five parts which address the field's span from the theoretical to the practical, and from the project to the policymaker's desk. With sixty-four authors contributing to thirty-six chapters, a comprehensive discussion of each section is not possible here, but certain contributions do stand out.

As has often been noted, RI is both an outcome and a process (Sutcliffe, 2011) and the book seeks to explore both. In terms of process, the book begins with Concepts Underpinning RI where Owen & Pansera lead the discussion of responsibility and ethics with a much-needed reminder that innovation cannot stand apart from the political economy in which it takes place, yet the field of RI has largely failed to address the all-important question of *what kind of future do we want all this innovation to create*? Given the policy discussions currently circulating, which assume a post-Covid future that will somehow be different from what we thought the future might look like in 2019, but do not interrogate *how* we expect the pandemic to lead us somewhere better (let alone what 'better' entails) this chapter could not be more timely. Part I continues with several largely theoretical chapters which delve more deeply into the antecedents of RI, ethics as applied to

emergent technology and the practical realities of interdisciplinary collaboration between the natural/technical sciences and social sciences/humanities, which RI calls for but gives no guidance towards accomplishing. Considering the challenges of governance brings an equally necessary critique of the assumption that innovation always brings economic benefits in two chapters by Soete and Lukovis et. al. before moving towards a series of detailed explorations of how RI has been deployed as a policy objective within innovation. The final section looks more closely at how RI might be deployed in organisations, including a finely-tuned discussion by Blok of the difficulties of implementing a non-reductive approach to multi-stakeholder engagement.

The book then moves to the question of Becoming Responsive to the Global Societal Challenges, a key rationale for RI as a response to problems which are both global and intractable, and cannot therefore by solved by one single entity, even one as expansive and heterogeneous as the EU. For those interested in the genesis of RI itself, Stilgoe's chapter is notable for its discussion of the Stratospheric Particle Injection for Climate Engineering (SPICE) project, his work on which strongly contributed to the UK Engineering and Physical Science Research Council's formulation and integration of RI into its funding requirements (Stilgoe, Owen, & Macnaghten, 2013). Considering RI as an outcome also moves the discussion away from its European/North American roots to other parts of the world. Macnaghten draws from case studies of attempts to regulate transgenic genetically modified (GM) crops in Brazil, India and Mexico to examine how the mismatch between a policy focus on safety and the wider public's focus on social and ethical issues arising from the context of GM (such as field contamination, loss of local crop diversity and and corporate control over staple foods), have contributed to an intractable global resistance to GM technology. RI often frames itself as an attempt to avoid 'another GM', therefore it is pertinent that this and the subsequent chapter by Schroeder & Kaplan in fact suggest that stakeholder engagement should be broader than usually conceived, and that RI-inflected practices should directly aim to benefit the poor and poorer countries by including marginalised groups in both problem definition and solution design, particularly in the context of challenges which are considered to be of global concern.

In Part III, Embedding RI in Emerging Technological Practices, we return to what is likely to be more familiar territory to this journal's readers, beginning with another key question in the field – how are we to understand 'responsibility' in fields where there is not enough knowledge to determine potential consequences because the technology does not yet exist? Grunwald suggests exploring the narratives developing around new and emerging science and technology (NEST) in an hermeneutic (i.e. interpretative) mode which can be informed by responsibility assessments of similar existing practices and technologies. This could enable a reflective analysis of what such 'techno-visionary futures' expect to achieve, and the values and visions embedded within them, which can then provide some orientation for RI even in conditions of profound uncertainty. The subsequent chapters then delve deeper into attempts to engage with RRI in a range of NEST fields: synthetic biology, nanotechnology, ICT and robotics . Again considering RI as both process and outcome, of particular note is the chapter by Rainey, et al. on the Human Brain Project (HBP), a hugely complex multi-national and multi-disciplinary research project in which a subgroup tasked with embedding RRI developed a reflexive idea of 'meta-responsibility' – responsibility for others' responsibility -- as a way of navigating the difficulties of ethics management.

Part IV opens these discussions up to Regional Practices, considering perspectives and empirical examples from countries with very different innovation systems and traditions of public engagement. Of particular note here is the chapter by Srinivas & Pandey which offers a rethinking of frugal, or resource-constrained, innovation practices in rural India by filtering a set of historical examples through the lens of RRI, a paradoxically important contribution to the oft-avoided topic of

innovation in the conditions of austerity imposed on many developed economies by successive governments since 2008, particularly in Europe. It is followed by an excellent examination by Buzás & Lukovics of the introduction of RRI concepts in the transitional economies in south-eastern Europe, which have not benefited from either the research investment or traditions of public engagement more prevalent in the countries whose policymakers and academics contributed to the development of RRI in the EU ten years ago. The final part of the book consists of interviews presented as guided conversations with Piero Bassetti, President of Fondazione Giannino Bassetti; Robert Madelin, a former Director General and Advisor on Innovation for the EC; and Dr Rob van Leen, Chief Innovation Officer and Head of the DSM Innovation Center, all of which provide a fascinating glimpse of what RRI looks like from a leadership perspective.

Overall, the discussion is as wide-ranging as one would expect after the intensive research which was enabled by national funders (albeit largely in the US and EU) over the last seven years. As would be expected from RRI practitioners, it is reflective of both the aspirations and the difficulties of trying to shift global innovation systems towards more publicly-engaged frameworks (albeit mainly for research targeting high-tech, potentially lucrative markets). The Handbook covers an impressive range of topics and approaches, and its more theoretical aspects help to situate 'responsibility' as an approach to practical ethics in technological development, without codifying it into a solid object or tick box formula; above all the Handbook demonstrates the complicated, contextual nature of RRI/RI. Of particular value are the several chapters in Part I which attempt to grapple with the form, purpose and economic demands placed on 'innovation' as a policy objective. Scientists and engineers are also likely to find the case studies in Part III of great interest, as these deal directly with the application of RI principles to emergent fields such as synthetic biology, nanotechnology, ICT and robotics. The chapters are relatively short and generally written in language accessible to those who may not be familiar with the more specialised terminology of science and technology studies, and thus they also provide (but are not limited to) an overview of critical arguments set forth by that group of scholars. This should prove particularly useful for STEM researchers wishing to explore ways of working with the humanities and social sciences to embed RI more comprehensively into their research projects.

One of the strengths of the Handbook is that many of the authors do question dominant assumptions about the purpose and benefit of innovation, and how the term has been coupled with increasing economic growth in the various policy framings of RI. The focus on 'marketable products' in Von Schomberg's oft-quoted definition on page 2 corresponds to the business-oriented definition of innovation as solely taking place within the market (Gerber, 2020). However, as von Schomberg and Hankins note in their short introduction, the market is not designed to maximise societal benefit over profit. The section on regional practices, in particular, strengthens the argument that when coupling RI with Grand Societal Challenges (capitals deliberate) the focus of innovation should shift to the most impacted, thus opening up discussions of how societally beneficial innovation may take new shapes, particularly in countries whose markets are weakly regulated or still emerging.

Where the collection falls noticeably short, however, is in advancing RRI's own 'pillar' promoting attention to gender -- both as a research topic or variable and as a means of redressing a severe imbalance within STEM fields and the innovation landscape more broadly. Of the sixty-four authors represented in total, only fourteen are female; the thirty-three research articles include only four which are either single- or first-authored by women and 'gender' as a topic does not appear at all. While the collection succeeds in showing how RI in practice and scholarship has travelled and developed since that 2011 meeting, it also shows that as a way of guiding research and innovation systems towards ethical, socially desirable and equitable goals, there is still some way to go.

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