Responsible Research and Innovation – The Strategic Challenge for Universities

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Abstract

Responsible Research and Innovation (RRI) has become a core point of reference for university researchers. This paper poses five critical questions:

1. What responsibility does the researcher have for the transformations of society that follow from their research?
2. How far can researchers anticipate the range of these future transformations?
3. What does it entail, to engage with the wider public over these futures?
4. Is RRI a responsibility for the individual researcher or necessarily an inter-disciplinary endeavour?
5. What are the strategic implications for universities in relation to the wider society?

It argues that RRI should typically involve a whole series of actors: (a) researchers ranging from basic science to applied science – including social science; (b) engagement with the companies and government bodies who apply their innovations in the wider world; (c) the dynamics of markets and other channels of diffusion of innovation; and (d) public and political actors taking stock of the changes under way.

No one scientist can assess their own responsibility therefore without situating it in within this larger chain – of our interrelated disciplines and of action beyond the university. This paper argues for an integrative notion of RRI, connecting up the university disciplines in a collaborative rather than a dispersive endeavour.

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1 Contents

1. Introduction

Responsible Research and Innovation (RRI) has become a core point of reference for university researchers. Within the UK, the EPSRC (Engineering & Physical Sciences Research Council) has played a major role in promoting this agenda; UKRI (UK Research and Innovation), the umbrella organisation for Research Councils, is now championing it more generally, and it is a core question on all research council applications (Owen et al., 2013; Owen and Pansera, 2019, pp 27-8).[1]

RRI places on academic researchers the requirement:

- To anticipate the impact of their research and the practical benefit it is expected to bring, notably in relation to innovations that address the global challenges that our societies face;
- To reflect on the social transformations and the dilemmas and uncertainties that these innovations may bring;
- To engage with the wider public as to these impacts, consequences and dilemmas;
- To enable policy makers to make informed judgments and choices about alternative futures.

It is quite possible that RRI will remain little more than another tick-box exercise with which academics have to comply, in their grant applications and reporting. This paper however sets out a more creative and critical stance on RRI – with significant implications for research environment and culture.

This paper therefore poses five critical questions for the RRI agenda:

1. What responsibility does the researcher have for the transformations of society that follow from their research?
2. How far can researchers anticipate the range of futures that may follow from their research?
3. What does it entail, to engage with the wider public over these futures?
4. Is RRI a responsibility for the individual researcher or is it necessarily an inter-disciplinarity endeavour?
5. What are the implications for universities and their strategic development in relation to the wider society?

[1] 'Responsible Innovation' was the phrase used until recently by EPSRC. The discourse at EU level speaks of Responsible Research and Innovation (RRI). On the differences in emphasis see Owen et al. (2012) and more recently Owen and Pansera (2019, pp 26-7). Owen points to the significant differences between the RI agenda of EPSRC and the RRI agenda at European level – a difference that has in some ways been further muddied by the recent adoption by UKRI of RRI as its preferred nomenclature.

2. The STEM Origins

The RRI debate in universities developed first and most obviously within the STEM subjects – Science, Technology, Engineering and Mathematics. This is not to say that STEM researchers were previously unconcerned with the impact of their research. No less than other university researchers in the UK at least, they have got used to developing case studies of their research 'impact' for the Research Excellence Framework.[2] Nevertheless, these case studies have tended to focus upon the specific public and private sector organisations, from whom tight evidence of the impact can be garnered – albeit just the positive impacts as far as those respondents are concerned. The larger impact, for example in relation to global challenges, is typically stated in looser terms.[3]

STEM researchers also include many impressive examples of natural scientists and engineers engaging with the wider public and contributing to popular appreciation of scientific advances by reference to global challenges.[4] This does not, however, necessarily produce a more rigorous and sustained public debate about alternative futures, sufficient to shift the terms of strategic political decisions about the global challenges that we face.

Institutional and intellectual path dependencies matter. In order to make sense of any new discourse, we need to understand the context from which it has emerged. We will then appreciate better how the STEM legacy has shaped the terms in which RRI has been couched, and what blind spots this may have left. It may also then be possible to develop a richer discourse on RRI, from which our various disciplines can all draw – and to shed light on the benefits of collaborating with each other.

RRI is concerned with what happens when the results of university research are taken out into the wider society. But while the research is still under way in the academy, there is an agenda of research ethics that is commonly prescribed and followed. This is most obvious in the biological, health and social sciences, involving a rich menu of ethical questions, concerned with animal welfare, vulnerable respondents and communities, their data privacy, their mental and physical health and wellbeing.

Some of this research may be undertaken off-campus. It may for example involve the setting up of randomised controlled trials of new medicines or of action-research projects to test new methods of intervention in local communities. But for as long as this research, whether on or off-campus, is under academic governance, the university research ethics procedures will be applied, including in particular avoiding harm to those deemed vulnerable.

Those same researchers may then address the larger societal consequences of research, and the innovations that it generates. Thus, for example, academic researchers may evaluate local projects addressing social deprivation; they may then

[2] "Impact is defined as an effect on, change or to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia" (Research England, REF 2021). ESRC provides an impact toolkit: https://www.ukri.org/councils/esrc/impact-toolkit-for-economic-and-social-sciences/

[3] The disruptive 'impact' of research which puts prevailing practices and assumptions in question is also arguably neglected (Stein, 2018).

[4] See, for example, the Royal Institution Christmas Lectures: https://www.rigb.org/christmas-lectures

commend them to government, as being worth implementing on a larger scale (Halsey 1972). They may also point to some of the likely knock-on consequences of intervention for other local social actors and other public programmes.

On the basis of their research, social scientists often go on to critique the ways in which the powerful shape the lives of the vulnerable; and to empower the vulnerable and their representatives, with well-evidenced arguments to improve their lot. They thus anticipate impact from their research, in part through their own engagement with publics beyond the university and in relation to some of the larger challenges which our societies face. This is not incompatible with academic rigour. Nevertheless, this dissemination of social science research, while it can bring benefit to some, can sometimes bring negatives for others.[5] It will then be a political judgment as to the aggregate effects of these various developments and the societal future these make more likely.

Engineering and the physical sciences have generally not had to face such questions, as far as laboratory research is concerned. It is when this research is translated into action, most obviously by business organisations and governments, that questions do indeed arise about the societal consequences for good and ill – and who should take responsibility.

Before addressing the five critical questions posed above, we take stock of some of the critical discussions around RRI over recent years.

3. Criticisms of RRI

3.1 Introduction

UKRI wants research into the science, engineering and bio-systems that can support human living over the coming century. Those systems do not however unfold of their own accord – they are shaped by the purposeful activities – albeit contested – of those with power. To make sense of those purposes and the interactions of the said actors is central to the contribution of the social sciences: exposing the dynamics of the changes now underway and the political economy of the struggles that will shape the future.

It would be naïve and misleading therefore, to assume that markets work as impersonal drivers of innovation and to overlook how corporations actively re-shape their environment. They re-work the institutions through which they manage suppliers, workers and customers. They look to government policy makers to re-work the regulatory and fiduciary frameworks within which they operate. They seek to re-make the polities of the countries in which they operate.

Responsible innovation is therefore not so much about labelling a technology in advance as being 'good' or 'bad'; it also requires analysis of the institutional context

[5] See, for example, 'Negative Impact – Is it possible to manage potentially harmful research findings?' (https://blogs.lse.ac.uk/impactofsocialsciences/2019/04/03/negative-impact-is-it-possible-to-manage-potentially-harmful-research-findings)

and the distribution of power, within which those technologies unfold. Depending on that context, introducing a technology can create various lock-ins and new institutional mixes that will tend to benefit and hurt different groups, both present and future. This can also then shift the terms of the policy debate in subsequent years.[6]

As the rhetoric and practice of RRI have developed over the last decade, social scientists have been somewhat critical of what has so far emerged. Owen, who played a major role in developing the RRI agenda at European level as well as within the UK research community, has also been a prominent and insightful critic: concerned in particular with the ways in which responsible innovation has been institutionalised (Owen et al., 2021).

3.2 The tick box of social goods

RRI encourages researchers to demonstrate the relevance of their research to the global challenges that our societies face, and the social benefits the research will yield. One frequent point of reference is provided by the UN Global Sustainable Development Goals (SDGs), aiming to end poverty, protect the planet and ensure prosperity for all.

Critics however express disappointment, that these statements often amount to little more than a tick-box exercise of pious hopes and good intent (Owen and Pansera, 2019, pp 37-42). As a simple illustration, notice that many UK universities have adopted an Elsevier algorithm for their on-line research pages, which shows, for each academic member of staff, how their publications relate to the UN Sustainable Development Goals. With no additional effort, the algorithm ticks the boxes of having contributed to those global goods, whether or not that was the researcher's intention.[7]

As Owen points out, the social consequences of technological innovations are emergent and far-reaching. It is not enough to have such tick-box exercises – certainly not if they are just ex ante. Notice also the way that the SDGs are being used by global corporations to justify and legitimate their operations in the global south – ticking those SDG boxes even when there may be substantial reductions in wellbeing for some of the population groups affected.[8]

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[6] Thus, for example, collaboration of public health services with companies expert in new information technologies can undermine and weaken the not-for-profit ethos of those services; and the resort to predictive algorithms for policing can undermine the transparency of the justice system. See: 'Is public accountability possible in algorithmic policymaking? The case for a public watchdog' (https://blogs.lse.ac.uk/impactofsocialsciences/2020/07/24/is-public-accountability-possible-in-algorithmic-policymaking-the-case-for-a-public-watchdog/)

[7] The individual academic is given more information on how the algorithm works and how they can change the SDGs that are being associated with their work: https://www.bath.ac.uk/guides/editing-sdg-keywords-in-pure/

[8] Godt examines the role that two western companies have developed in the health and education services in Kenya and Uganda (Godt, 2022). They target the middle classes in those countries – the expanding section of the population with money to spend on these western services – and they argue that national governments can then concentrate on the poorer sections. They claim that they are thereby supporting the SDGs – and they use this claim to justify applying to international donors for grants to offset the extra 'risks' associated with service roll-out in the global south. They also monetise the individual data they collect by making it available to other international companies. Meanwhile however this two-sector model undermines the efforts of those national governments to develop a truly national policy on education and health.

3.3 The banality of 'innovation'

The RRI literature tends to assume that it is from research that innovation invariably springs; and that researchers should therefore be held responsible for its social effects.

We should however recognise the processes by which the research ideas which have been valorised within the university are selectively picked up and run with by actors in powerful positions in the wider society. This is not necessarily a world in which ideas and research findings triumph on their own merit – a world in which, sooner or later, the 'truth will out' and the best mousetrap will capture the global markets. Nor is it a necessarily a world in which ideas spread according to certain well-defined processes of diffusion (Rogers, 2003; Brown, 2007).

Innovation may unfold initially within a local arena – but then spill over into larger realms, producing multiple unforeseen possibilities, over which a wider array of social actors may struggle. This applies as much to institutional as to technological innovations. Owen and his colleagues question therefore the rather bland or 'banal' way that the RRI discourse takes for granted that 'innovation' is a good thing for all concerned, bringing larger social benefit. They argue that on the contrary, any innovation sits within a particular historical context and can 'create and transform futures … unintentionally or by design' (Owen and Pansera, 2019, p 28). It can also disrupt and destroy: bringing benefits for some but uncertainties and vulnerabilities for others, with new conflicts of interest (Owen et al., 2021, p 1).

There are further banalities of innovation highlighted by Owen and his colleagues. Markets are commonly assumed to work as drivers of innovation – and innovation is thus 'unreflectively tied to … gaining competitive advantage'. This is in the spirit of Hayek and Schumpeter; but it is a framing that we should interrogate. Letting each technology rip in the marketplace and then using market measures to tame and compensate may not be enough; especially if it is 'insufficiently directed at the deepening problems facing society' (Owen and Pansera, 2019, p 43).

Our task is therefore to acknowledge – but also to delimit – the responsibility of researchers for the social and technological innovations to which their research contributes.

3.4 The ambiguities of corporate power

The unthinking stress on 'innovation' also overlooks how business may capture government to support its adventures. The 'market economy' of the textbook hardly exists – think rather of the State variously serving those corporations, and limiting the risks to which they are exposed. The behemoths of the internet age by-pass or strike bargains with powerful political elites, to the detriment of ordinary citizens. At worst this is the 'Predator State' (Galbraith, 2009).

RRI is therefore liable to be resisted, if it questions 'political imperatives …. based on economic growth and productivity; vested interests and engrained … organisational practices … power dynamics and strategic behaviour' (Owen and Pansera, 2019, pp 27, 33-35). That extends to corporate protection of its intellectual property as against 'open innovation' and open access to science. Studies of RRI have however until now

given little place to such politics, understood as the 'constitution and contestation of power' (Van Oudheusden, 2014).

The foregoing can be read as a critical appraisal of how giant corporations capture government power and resources and steer the economy in new directions. It can also be read as an acknowledgement that market efficiencies, technological innovation and social responsibility are too important to be left to corporations – instead they require the massed political and economic resources of which governments dispose.

Looking down the chain of innovation, therefore, a further task is to examine critically the claims that commercial companies make of their own responsible concern. Notice again that some of these corporations use the SDGs as a point of reference, as they justify their role in international development programmes across the global south and point to the 'shared value' their involvement can bring (Godt, 2022). Notice also corporate efforts to capture and manage the RRI agenda itself.[9]

3.5 Engaging purposefully with societal futures

Beyond academia, technological innovations unfold within a variety of contested institutional settings. Owen and his fellow critics widen the debate beyond technology to institutions and politics as contested spaces.

This however is a further area of weakness that Owen and his colleagues identify in the way RRI is typically addressed. This concerns 'the lack of formal and systematic processes for engaging citizens and stakeholders with the purposes, agenda and politics of potentially disruptive science and innovation - and their broader impacts on culture and society' (Owen and Pansera, 2019, p 30).

What is therefore needed is well-informed and forward-viewing leaders who are subject to democratic control and debate: with innovation more accountable to society. This means 'taking back control' of the future. Social scientists in particular have a responsibility to assess critically the political options that our societies confront, the actions they take, in terms of both technological and institutional change, and the consequences that flow for humanity.

It is against this critical background that we now consider the questions posed at the outset to this paper.

[9] See, for example: Responsible Innovation Founder Summit (https://www.betaworks.com/event/responsible-innovation-founder-summit-2022); Responsible Innovation Labs (https://www.rilabs.org/); Emerald Publishing: Our goals (https://www.emeraldgrouppublishing.com/our-goals)

4. The Great Chain of Innovation and Contingent Responsibility

The introduction to this article summarised the RRI agenda in terms of four requirements. EPSRC and UKRI offer this more detailed AREA graphic (with key phrases highlighted) as a summary of the requirements that RRI places on the individual researcher:

- **Anticipate** – *describing and analysing the **impacts, intended or otherwise**, (for example economic, social, environmental) that might arise. This does **not seek to predict** but rather to support **an exploration of possible impacts and implications** that may otherwise remain uncovered and little discussed.*
- **Reflect** – *reflecting on the purposes of, motivations for and potential implications of the research, and the associated **uncertainties, areas of ignorance, assumptions, framings, questions, dilemmas and social transformations** these may bring.*
- **Engage** – *opening up such visions, impacts and questioning to **broader deliberation, dialogue, engagement and debate in an inclusive way.***
- **Act** – *using these processes to **influence the direction and trajectory of the research and innovation process** itself.*

It is by reference to this graphic that we may address the first question defined for this paper: ***What responsibility does the researcher have for the transformations of society that follow from their research?***

It follows from the discussion in Section 3 that there is no simple relationship between the individual scientist and the new technologies that eventually result. The scientist is just one actor in a larger struggle of interests. Much of the responsibility lies instead with the governments and corporations who apply those technologies. The resulting transformations of the world will depend on a whole lot of complex interactions that nobody can entirely anticipate.

Social scientists watch these real-world actors, as they develop their strategic thinking and pivot to find new opportunities. They variously critique those actors and expose their responsibility for futures that should not be taken for granted. They may even stand as judges on behalf of the children yet to be born[10]: assisting our societies in their self-reflection and their efforts to hold those big actors to account. This is consistent

[10] See for example National Assembly of Wales (2015) "*Well-being of Future Generations (Wales) Act*" (https://www.futuregenerations.wales/about-us/future-generations-act/)

with the sociologist Max Weber's exposition of the vocation of the scientific community, in face of social and political futures (Weber 1948a, 1948b).[11]

This is what we might describe as the **great chain of innovation and contingent responsibility**.[12] To repeat therefore: our task in RRI is not only to acknowledge – but also to delimit – the responsibility of researchers for the social and technological innovations to which their research contributes. This means avoiding what we might (in an echo of Owen) call the 'banality of responsibility'.

4.1 Social scientists and the great chain

What role then should social scientists play in RRI? Owen and his fellow critics suggest that STEM scientists too often see social science as doing little more than aiding public consultation – and easing public acceptance of STEM research and its impacts. This leaves RRI in an emaciated state, when judged against the earlier debates on the **social responsibility of science**, from which it emerged.

The foregoing discussion instead implies a much more central role for social scientists – enabling the engineer and the natural scientist to evaluate critically the role and responsibility of governmental and corporate actors in exploiting their research and shaping the future. Social scientists may also, we will argue, be able to play a useful role in the conversation which those natural scientists and engineers have with diverse publics – and the competing views the latter hold of the public good. Scientists and engineers can thereby take a more thoughtful and active responsibility for their research and its consequences – while also recognising the limits of that responsibility, within the overall chain of innovation.

But first, it will make sense to consider the research in which social scientists themselves engage – and its relationship to the great chain of innovation and contingent responsibility.

Many social scientists already study new technologies and the social and institutional transformations that they generate. Think, for example, of the new forms of working and shopping, the new social media and the new forms of political mobilisation that information technologies have in recent years made possible – along with such unforeseen consequences as the death of many high streets. This also involves study of the behemoths of the internet age – Amazon and Uber, for example – as they re-make the world and, in doing so, bypass or strike bargains with powerful political elites, sometimes to the detriment of ordinary citizens.[13]

Away from the heat of technological innovation, many social scientists have long focused their research on a wide range of institutions of social and economic welfare. Some social scientists – no less than engineers – produce innovations (in this case institutional) that they hope will change the world.

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[11] Weber further argued that even if all individuals act morally (selflessly), the aggregate outcome may nevertheless be damaging to the public welfare. Meanwhile much of mainstream economic science argues that if individuals act selfishly, the overall outcome will maximise public well-being (recall Mandeville's *Fable of the Bees* and arguably Adam Smith, *The Wealth of Nations*).

[12] Cf Lovejoy, *The Great Chain of Being*

[13] 'Uber broke laws, duped policy and secretly lobbied governments, leak reveals', *The Guardian*, 2022 (https://www.theguardian.com/news/2022/jul/10/uber-files-leak-reveals-global-lobbying-campaign)

An example is the role of western economists (including the UK Know How Fund) in the dismantling of Soviet communism in the 1990s and the marketisation of the Russian economy.[14] The result was the impoverishment of the Russian population and the fall in their life expectancy; the rise of the oligarchs, snatching up state assets via deals with Yeltsin and Putin; and the rise of London as the dirty money laundry of the world.[15] Here was an **institutional innovation** that **changed the world** … and that was born, in some degree at least, out of the academy. The same can be said, more generally, of the privatisation agenda that infected the Anglo-Saxon world in particular from the 1980s onwards – and its heirs today, with PPP (Public-Private Partnerships) and the marketisation of public services.

Other social scientists research the poor living circumstances of particular population groups and the reasons for their persistence.[16] They are not in the main looking at technological innovations, nor indeed at institutional innovations. Nor are they describing the living conditions of these people merely in order to evoke our sympathy and make us aware of the inhumane conditions in which many of them are living. What they are doing is, rather, to identify the power holders (governments, international organisations, armies and others) who not only avert their eyes, but who for their own strategic reasons neglect these groups and may even find it convenient to blame them for their own situation.

What these researchers then typically do – through their careful research and the dissemination of their analysis – is to hold those power holders to account: for doing nothing beyond maintaining the status quo; and for failing to innovate and change their ways, even if those ways are directly responsible for social harms. As responsible social researchers, they analyse and expose these irresponsible behaviours and they identify reforms that would mitigate – or indeed eliminate – such a bad situation. This locates much of social science in the later stages of the chain of innovation and contingent responsibility – focusing on the responsibility of the powerful, both corporate and governmental, in shaping the lives of ordinary people in their communities.

4.2 From the banality of RRI to the great chain

It is of course possible that some such situations are in part the result, not of neglect by the powerful, but of the technological challenges of reaching some populations, including for example remote communities in rural areas. To engineers, a new technology may be the obvious answer to any problem. To social scientists, it may be equally obvious that any problem attests to the lack of power of the social groups in question and a lack of political will by the powerful; new technologies will then merely reinforce the status quo and the persistence of these human neglects. Both however

[14] Hamilton, K. (1997). *The Know How Fund: The Early Years*. Foreign & Commonwealth Office. See: https://issuu.com/fcohistorians/docs/hpopub_2

[15] See: Chua, A. (2003). *World on Fire*, Heinemann, Chapter 3; 'How London became the place to be for Putin's oligarchs', *The Observer*, 2022 (https://www.theguardian.com/uk-news/2022/mar/06/how-london-became-the-place-to-be-for-putins-oligarchs); 'The tight web of lawyers and PR firms who oil the wheels for billionaires', *The Observer*, 2022 (https://www.theguardian.com/world/2022/mar/06/oligarchs-russia-london-web-lawyers-pr-firms-oil-wheels-for-billionaires)

[16] In my own department, examples include child neglect among refugee communities in the Middle East; victims of famine in South Sudan; violence against LGBT communities in south Asia; people with disabilities in the UK.

may be over-simplifications: and this argues for the reciprocal research benefits of linking up these different disciplines in a fuller and multi-disciplinary version of RRI.

We can thereby expect to develop better system-level research questions for RRI in a complex world - and for illuminating the contingent and interconnected responsibilities of researchers in different disciplines and, on the other hand, of powerful corporate, governmental and other social actors. This will in turn allow us, in any particular case, to address the first of our overriding questions: **What responsibility does the researcher have for the transformations of society that follow from their research?**

The foregoing suggests modifications to the EPSRC's AREA graphic set out at the start of this section:

RRI – The Great Chain of Innovation and Contingent Responsibility

A revision of EPSRC's AREA graphic

Step 1 involves a thought process undertaken by researchers, going beyond the impacts anticipated and asking: How will my research affect different groups in the population? What sort of dilemmas and trade-offs is this likely to pose for society?

Step 2 relates these trade-offs to externally defined standards and principles. An example often cited is the UN Sustainable Development Goals. That however raises further questions around the relationship between the SDGs and the multiple communities within developing countries whom they are supposedly supporting. Similar issues will arise with other externally defined standards and moral principles.

Step 3 engages in broader deliberation and dialogue – but recognises that the rich and powerful tend to dominate the debate, including the parameters within which RRI is discussed. It asks how we can engage with other public voices and local communities.

Step 4 recognises that innovation is about the future. RRI therefore requires all those involved in this great chain to engage critically with debates about the societal futures consequent on technological and other changes under way. But again, this requires us to recognise that the voices in these debates are weighted by the way in which political and economic power is distributed.

5. Anticipating the Future

How far can researchers anticipate the range of futures that may follow from their research? This the second question which this paper addresses.

For some social scientists, there is a fundamental flaw in the RRI agenda, involving as it does anticipation of the impact of the research in relation to the global challenges that our societies face; and the aim of enabling policy makers to make informed judgments and choices about alternative futures. That immediately raises doubts, as expressed in a classic article by Goldthorpe (1972).

First, Goldthorpe points out that in each generation new forecasts appear of the future, which on closer inspection turn out to be extrapolations of the present – or, more precisely, extrapolation of those elements which the authors in question welcome, or against which they warn. Such studies often serve a hidden purpose – to convince us that those elements writ large are bound to prevail – and thus that the scope for choice is very limited. Among the common recipes are those that ask us to surrender to technological change – and to limit ourselves to finding ways of spreading the pain and the benefits that technological change brings.

Surrender to the market is likewise deeply embedded in our modern political culture: with an assumption that the pursuit of private greed contributes to the public good. In support of this, much of economics as a discipline appeals to economic laws and theorems that uncritically take such markets for granted. There are, however, many assumptions here, that may not hold empirically, and where they do not, the market system does not necessarily produce optimal outcomes for the rest of society.[17] (Owen and Pansera, 2019, pp 33-4, 42-3).

So also, when Schumpeter and Hayek celebrate the creativity of capitalist markets, notwithstanding the destruction of older technologies and the local communities dependent on them, there is little on the compensation due to those communities and the corresponding case for new public investments. Hirschman (1967) recognises that such compensation is unlikely – and certainly not assured – and that this absence may indeed be a condition for entrepreneurs to invest at all.

All these are taken-for-granted limitations on public responsibility for the downside of innovation. They are to some extent rooted in the assumptions of Pareto optimality – that a market system delivers winners and losers, but that the winners could in principle compensate the losers and still enjoy much of their wins. Pareto crowds out such debates, encourages intellectual laziness and insulates the powerful from criticism.

Second, and echoing Popper, Goldthorpe points out that we cannot predict future knowledge (and human capabilities more generally) and we therefore cannot predict the future. Nevertheless, this surely does not mean that the future is entirely a mystery. We have become used to reading well-grounded modelling of the co-evolution of

[17] See, for example, Lipsey and Lancaster (1956).

complex climate-related systems and anticipations of environmental 'tipping points'.[18] These are important parts of a responsible science. This extends far beyond the dynamics of climate change – to include other policy areas such as migration and refugees, the welfare crisis and pandemics. Foresight studies of such challenges are now well-established – they must be viewed with care, for the assumptions they make, but they surely have some value.[19]

Corporations are powerful actors. Instead of just extrapolating current trends, they are better placed than most to 'read' the emerging future and to detect changes in the dynamics of economic and social change – the 'burning platforms' of doomed technologies and the 'blue oceans' of tomorrow's innovations (Freedman, 2013, pp 536-41). They are also therefore more able to shape the direction of change, rather than just waiting to see what turns up.

We may not as researchers be able to predict the future. Those who are powerful can however to some significant extent shape the future they want: in terms of public investment – in communications and transport systems, education and training – and in the public regulation of their activities. No technological innovation ever yielded a future stream of income for its owner, except under favourable institutional conditions.

The way that political leaders exercise this responsibility affects the forms of innovation that will then be feasible and those that will not. A nightwatchman state is a negation of this. It can also be a pretext for leaving the rich to predate the public realm and impoverish the mass of the population.[20]

This surely goes to the heart of RRI – to expose those economic and political actors who stand to benefit from the quiescence of the wider population, securing their own positional advantage and 'occupying' the future, while sidelining the alternative futures that lie hidden in plain sight. The political economy of the present is fateful therefore for the configuration of the future. Foresight studies which neglect the plurality of alternative possible futures, contingent on the power of different actors to shape them, are unwittingly and unnecessarily blind.[21]

Social scientists have a key role to play in illuminating these processes. They can identify who is in power now, so as to understand who is well-placed to occupy and dominate the future. They can model these complex dynamics and catch change 'on the wing'. They are then well-placed to call the powerful to account and to hold them responsible, before the public and their political leadership.

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[18] See, for example Steffen et al. (2018). "Trajectories of the Earth System in the Anthropocene." *Proceedings of the National Academy of Sciences*, 115(33), pp8252-8259. (https://www.pnas.org/doi/10.1073/pnas.1810141115)

[19] See, for example, the work of Policy Horizons Canada (https://horizons.gc.ca/en/home/)

[20] See, for example, "Betting against the NHS': £1bn private hospital to open in central London', *The Guardian*, 2022 (https://www.theguardian.com/society/2022/mar/17/betting-against-the-nhs-1bn-private-hospital-to-open-in-central-london)

[21] The Canadian Government's Policy Horizons institute in its reports is sometimes weak on this; so also the UK Government Foresight Unit: 'The Futures Toolkit: Tools for Futures Thinking and Foresight across UK Government' (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/674209/futures-toolkit-edition-1.pdf)

6. Taking Back Control of the Future

Our third question: **What does it entail, to engage with the wider public in regard to possible futures?**

Political leaders may be slow to consider the consequences of new technologies for national wellbeing. Responsible innovation can therefore be viewed as an exhortation to such leaders, to recognise and confront these implications: what futures we are creating, and which we are destroying.

The challenge for **government** is then to imagine and shape the future terrain, but in open discussion with corporations, civil society organisations and citizens. This requires a public policy strategy for technologies and institutions and their democratic oversight. This can hardly be limited to an ex-ante tick-box exercise.[22]

The challenge for **scientists** is to assess and illuminate critically these policy choices, both within the university and in the wider public forum, and to call the key players to account. This would seem to require a much stronger contribution by social scientists: exposing alternative futures and enabling strategic political leadership.

There must also be citizen scrutiny. Owen and his fellow critics of RI therefore consider what **institutions for deliberation and anticipatory governance** can enable this discussion between citizens and political leaders (Van Oudheusden, 2014). They criticise 'the lack of formal and systematic processes for engaging citizens and stakeholders with the purposes, agenda and politics of potentially disruptive science and innovation - and their broader impacts on culture and society' (Owen and Pansera, 2019, p 30; Owen et al., 2021). What is needed is well-informed and forward-viewing leaders who are subject to democratic control and debate: with innovation more accountable to society.[23] This we might describe as 'taking back control' of the future.

But how can citizens engage with political leadership? And how can citizens and political leaders then engage with corporations and counter their efforts to fend off such calls for responsibility?

Social scientists can play a significant role in such citizen involvement, anticipating alternative futures. This need not be limited to grand models of the dynamics of change at a societal level. The much smaller-scale empirical research, that social scientists often undertake, looking at communities coping with a changing society, can also be infused with these perspectives and questions. Indeed, to engage with citizens, as they make sense of different ways of living in the future, those dialogues will need to be at a local scale. Our responsibilities to each other and to our shared future are worked out there, as much as in national and global arenas.

Local observatories on technological change and social responses may have a role here, exploring different such scenarios. How for example can local communities

[22] See, for example, the AI conference in November 2023 at Bletchley Park: 'UK, US, EU and China sign declaration of AI's 'catastrophic' danger', *The Guardian*, 2023. (https://www.theguardian.com/technology/2023/nov/01/uk-us-eu-and-china-sign-declaration-of-ais-catastrophic-danger)

[23] See, for example, Campaign for Science and Engineering: About the Discovery Decade (https://www.sciencecampaign.org.uk/what-we-do/public-opinion/about-the-discovery-decade/)

debate scenarios of their transport futures – in conjunction with town planners and transport engineers?[24] This in turn resonates with some of Owen's recommendations on the training of researchers and local leaders, in new forms of practice appropriate to RI (Owen et al., 2021, p 10).

I have written elsewhere (Room, 1986, Ch 4); 2019) about the way in which citizens may link up with local communities elsewhere, thereby enrichening their critical contribution from below to local and regional policy debates and their confrontation with politics.[25] Here we might foresee models of citizenship and governance drawn from elsewhere being set against prevailing local practices. This suggests a reflective-critical citizen practice in relation to the re-making of institutions – distributed across different technology sectors and different governance systems. This can be a way of addressing the gap that Owen sees in appeals to deliberative democracy. He calls for political leadership of such deliberation: one tool of the political leader is to be connected to brokers of such experience elsewhere.

Citizens in their local communities are not however the only ones ready and entitled to some voice in responsible technological and institutional change and the variety of futures that these could entail. A whole range of social actors – locally, nationally and internationally – can claim some legitimate voice in this quest. Stelzer (2020) therefore steps back from too unthinking a commitment to popular debate around technological futures. Taking the example of climate engineering, he questions calls for the 'democratisation' of science and the development of a collective stewardship, over matters where the general public can hardly be expected to develop a sufficient level of understanding. Opening up the debate may simply prevent it happening; and where reliable knowledge is hard to achieve, fears and hopes may play too strong a role.

It is surely the university which has the mission in a modern complex society of nurturing a purposeful, civilised and well-informed debate of this sort – both within its walls and in conjunction with the full range of social actors and publics.

[24] See, for example, Lyons, G. (2022). "The Driverless Cars Emulsion: Using participatory foresight and constructive conflict to address transport's wicked problems." *Futures*, 126. (https://www.sciencedirect.com/science/article/pii/S0016328721001981)

[25] A more recent example is provided by Rebel Cities (or Cities for Change): "...the construction and development on a European level of networks between the 'cities for change' can be decisive in increasing the potential of intervention and political pressure on national governments and European institutions. It can affirm a real protagonism of the communities and local governments in political decisions that affect them." (https://www.opendemocracy.net/en/can-europe-make-it/european-network-of-rebel-cities/)

7. A Well-Conducted Critical Discussion

Our fourth question: **Is RRI a responsibility for the individual researcher or is it necessarily an inter-disciplinarity endeavour?**

RI is emerging as a priority across all university disciplines. UKRI encourages us to develop a general wisdom about RRI across the university; but it then leaves this wisdom to disperse to individual researchers, as they apply it to their own specific discipline and research area.

This paper has however argued that we should conceive of RRI as a process of research and innovation that typically involves a whole series of actors: extending from (a) researchers in basic science to applied science – including social science, not just natural science and engineering – and then (b) engagement with the companies and government bodies who turn their innovations into real world change-makers; then (c) the dynamics of markets and other channels of diffusion of innovation; and finally (d) publics and political actors taking stock of the changes under way and their impacts and benefits and harms.

This means that no one scientist can assess their own responsibility without situating it in within this larger chain – of our interrelated disciplines and of action beyond the university. To recognise this is to argue for an **integrative notion of RRI, connecting up the university disciplines in a collaborative** rather than a **dispersive endeavour.**

This also brings RRI to the heart of our training of the next generation of researchers – and building the university as a well-connected and multi-disciplinary research culture.

This makes RRI a fundamentally critical ***intellectual*** and interdisciplinary project, and one moreover in which university researchers will need to engage purposefully and self-critically with each other – together reflecting on the implications of their research for societal futures.

Within social science there is already a strong culture of research impact and knowledge exchange. In order to address responsible innovation, researchers will need some self-critical examination of the various social science paradigms and their relevance to this task. This may be uncomfortable. Academic disciplines however develop in part through their critique of others, and such critique is something from which all social scientists can in principle benefit. Universities can support inter-disciplinary collaboration, but this need not be antithetical to providing a forum for robust mutual critique. This is surely part of the 'well-conducted critical discussion' inside the scientific community called for by scholars such as Popper (1994).

Only then can researchers and universities illuminate a critical discussion with political leaders and the general public, over the range of available futures and the terms on which political choices can be made (recall again Max Weber's statement of the scientific vocation, cited earlier).

8. Conclusion

Finally, our fifth question: **What are the implications of RRI for universities and their strategic development in relation to the wider society?**

It is quite possible that RRI will remain little more than another tick-box exercise with which academics will have to comply in their grant applications. It may be meaningful to university managers only to the degree that it results in grant capture and quality-related research (QR) funding.

It is still unclear how far UKRI will itself engage in deliberation about what RRI means for how it funds research, and what it chooses to fund.

Nevertheless, this paper has suggested a more creative and critical stance on RRI – with significant implications for our research environment and culture. This would then require social and natural scientists to engage more critically with other milieux of debate on these issues, including those associated with Government, with pressure groups and with the wide range of think tanks and institutes that seek to shape the contemporary policy discourse. It would draw us into debates on resilience planning, transport futures, levelling-up and other current policy agendas. It would require intensified exchanges between academia and the wider ecosystem of foresight debates.

It would address the need for a 'well-conducted critical discussion' not only within the scientific community; there is also a need for safe spaces in which broader discussions around contentious policy agendas can be examined with a wide range of interested publics.

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