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Innovation for a steady state: a case for responsible stagnation

Stevienna de Saille and Fabien Medvecky

Abstract

The proponents of responsible innovation (RI) have often opened their discussions with the reassurance that while they are against irresponsible innovation, they are not advocating irresponsible stagnation. In the two-by-two matrix generally used to illustrate this model of innovation, the quadrant for responsible stagnation has so far gone largely unmentioned, let alone explored. This paper draws on existing real-world cases to examine what arguments drawn from ecological economics might contribute to the discussion of RI. It questions the present growth-driven paradigm and asks whether opening the black box of 'responsible stagnation' might also open the door for a reasoned discussion about resource consumption and pace of development in over-productive or too-risky sectors and technologies, as an intrinsic part of responsible innovation, rather than its opposite.

Keywords: responsible innovation; steady-state; stagnation; ecological economics; degrowth; benefit corporations.

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Proponents of responsible innovation (RI) have often opened their discussions with a two-by-two matrix where one axis encodes the binary of 'responsible' and 'irresponsible', and the other 'innovation' and 'stagnation'. RI, we are told, is meant to prevent both irresponsible innovation and the irresponsible stagnation which results from lack of investment in R&D, impeding the transfer of new and important discoveries from the laboratory to the market. Through careful anticipation of social, economic and environmental risks and benefits, reflection on the part of scientists and innovators, inclusive engagement and subsequent responsive action,[1] RI promises to help bridge this 'Valley of Death' (UK Commons, 2013), promoting a culture of innovation for societal benefit, jobs and growth. Exactly *how* we are sure that innovation will drive growth, what *kind(s)* of growth and whether we should even be seeking growth given our planetary limitations are not questions which tend to be asked in most of the RI literature, particularly not in the policy documents which have established Responsible (Research and) Innovation as a means of governing scientific research (see, for example, European Commission [EC], 2013). The implication for both discourses is that if some is good, more is surely better, obscuring the possibility that useful innovation can become irresponsible if allowed to grow unchecked, as recently seen in the 2008 financial crisis (Owen *et al.*, 2009). Thus, while innovation may drive the global economy, it may also destroy it. The statement that 'innovation drives growth' forms the basis not only of the formative work in RI (see again Owen *et al.*, 2009), but also of science, technology and innovation (STI) policy as a whole. This formulation has allowed policymakers to remain faithful to the assumptions of neo-classical economic theory, limiting the transformative potential of RI for fear it might cause stagnation, either in innovation or in growth. 'Who', we are asked, 'would wave a flag for Irresponsible Stagnation?' (Stilgoe, 2013, p. xv) We agree: no one. Indeed there are suggestions that not to innovate would be hugely irresponsible given the problems humanity faces (Jones, 2014).

Within this matrix, however, there is one quadrant so far unexamined, which is that of Responsible Stagnation. Perhaps this is because what is meant by 'stagnation' is inherently ambiguous; it has both a techno-scientific and an economic meaning, and, in both these fields, it is a negatively loaded term. Framed, as it has been, in a matrix of binary opposites, agreeing that innovation is indeed desirable has effectively black-boxed questions about the desirability of growth. Our question is whether RI can instead use the concept of 'responsible stagnation' (RS) to clarify and support its loftier goals, rather than setting itself in opposition to it.

Briefly examining the concept of RS in a recent editorial, Guston (2015, p. 2) argues:

> Given that innovation in part is what got us into this mess of pushing past planetary limits in an unsustainable fashion, and that the drive for growth and the satisfaction of the human needs and desires of a still increasing human population globally is what compels innovation, we need to consider how we can stop being dependent upon innovation and growth to get what we want .... [But that] is

> going to be dependent upon on [*sic*] the generation and implementation of new knowledge and social and technological innovation each step of the way.

In other words, RS does not have to mean a cessation of invention, novelty and creative problem-solving. We offer this paper as the first step in a research programme we have been developing to open the black box of Responsible Stagnation, teasing out such ambiguities and searching for empirical examples in order to clarify what RS might mean, and what innovation might look like under a model which is not based on the fallacy of a self-regulating economy with no external limits to growth (Hatgioannides & Karanassou, 2011). We draw attention to heterodox theories which acknowledge the limited resources which may be extracted from the environment and argue that RS might have something to contribute to ecological economists' discussions about balance and equilibrium in the production and consumption of material goods, as well as opening the possibility for discussion of innovation for controlled, deliberate degrowth of unproductive, over-productive or existentially challenging sectors and technologies amongst scholars of RI. We would like to see heterodox economists begin their own programme of reflexive engagement with the precepts of RI, in much the same way that we are now requiring this of research scientists. At the same time, proponents of RI must develop the necessary skills to reflexively examine and, if necessary, challenge the limitations and excesses of the dominant growth-based paradigm and seriously consider whether an alternative approach to macroeconomics will be required in order to achieve RI's ideals.

Background

Over the last five years, discussion of RI has grown from a small handful of papers emanating from a corner of Science and Technology Studies (STS) working on various aspects of governance of emerging technologies (Hellström, 2003; Owen & Goldberg, 2010; Robinson, 2009) to a veritable deluge. The number of peer-review publications on RI has doubled each year from 2012 to 2014 and can be expected to double again this year (Figure 1). Added to these totals should be the 45 articles now published each year in the *Journal of Responsible Innovation* (JRI), which launched in January 2014 and is not yet indexed by Web of Science (WoS), as well as the papers collected in four edited volumes (Koops *et al.*, 2015; Owen, Bessant, *et al.*, 2013; Pavie *et al.*, 2014; van den Hoven *et al.*, 2015).

Delving through the 123 papers indexed by WoS shows that discussion and research into ways of involving the public more closely in the processes of innovation and into developing RI frameworks, guidelines and models of implementation is taking place in fields as diverse as finance (Pandza & Ellwood, 2013), port control (Ravesteijn *et al.*, 2014), farming (Escareno *et al.*, 2013) and surgery (Hodges & Angelos, 2014). This is in addition to the already significant body of work on RI from high-tech fields such as ICT, geo-engineering,

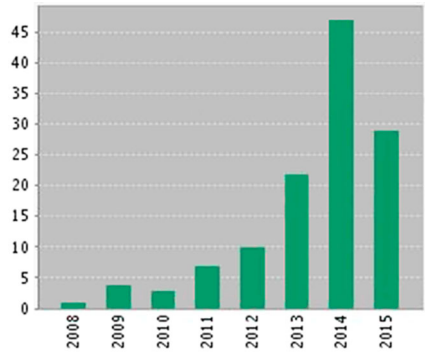

Figure 1 Number of recent publications for responsible (research and) innovation on Web of Science.
Source: http://webofknowledge.com.
Note: Figures based on a topic search for Boolean string 'responsible+innovation OR responsible+research+and+innovation', carried out on 4 October 2015.

nanotechnology and synthetic biology, based on constructive technology assessment, upstream engagement and related approaches (Stilgoe *et al.*, 2013; see also Douglas & Stemerding, 2013; Grunwald, 2014; Rip, 2014; Stahl, 2012). The concept is increasingly mainstreamed in research policy in a number of national contexts, as well as in the EU, where Responsible Research and Innovation (RRI) now has its own cross-cutting theme in Horizon 2020 (COM (2011) 808 final), the Framework Programme for Research and Innovation which launched in 2014.

Although there is no singular definition of RI, in general it calls for continuous engagement of the public along the entire innovation pathway from research to the market, and careful assessment of possible risks, benefits and motivations – including impact on values, morals and social relations, as well as on health, the environment and the economy. It also, in one of its original formations, calls for 'a collective commitment of care for the future through responsive stewardship of science and innovation in the present' (Owen, Stilgoe, *et al.*, 2013, p. 36). The attention to unforeseeable social and environmental harm owes much to RI's antecedent, the 'precautionary principle' (COM (2000) 1), which has significant traction amongst concerned policymakers (Gardiner, 2006), particularly in the EU, where it has achieved the force of law (von Schomberg, 2013).

However, despite its emphasis on promoting public debate and attention to adverse environmental and social impacts, it is important to note that RI, as a framework for STI policy, emerged during a global economic crisis from which it has been, particularly if viewed from the Eurozone, difficult to escape. The context of crisis has both spurred the intensity of claims for the economic advantages of investing public money in innovation, and closed off many of the original moral arguments which suggested that RI could be used to soothe public unease at the rapid pace of technological innovation by

opening some decision-making structures to public participation and examination. Within this strand of argumentation, much is made of the 'failure' of genetically modified organisms in Europe (see EC, 2013, p. 14) and of the relative success of upstream engagement with nanotech, at least in the sense that its introduction to the market (particularly via the cosmetics industry), has for the most part gone uncontested.[2] Overall, while there has been much discussion of 'responsibility' in the context of unknown risks, considerably less attention is paid to 'innovation' and to how differing understandings of this word, exacerbated by the multiplicity of academic disciplines now engaging with various aspects of RI, may be leading to outcomes which are the opposite of those intended by its earliest proponents. Whereas many people would define innovation simply as something new, others argue that this is invention, which alone does not constitute innovation. Barry (2001, p. 211), in fact, argues that invention is neither merely new nor always technological, but is about the capacity of something new to change current arrangements. By this definition, innovation is the process by which invention is taken up and circulated, creating the capacity for change. Economics, business studies, engineering and to a large extent natural science, however, have a more restricted definition of innovation as a set of processes for bringing something new *to the market*. This explicit and narrow definition of innovation as occurring only when something novel is 'first used in a company's production process or is first offered *for sale*' (Swann, 2009, p. 23) delineates innovation as the creation of monetary value. As Blok and Lemmens have recently pointed out, this formulation appears to have been adopted uncritically within the RI literature, so that too often:

> innovation is self-evidently seen as (1) technological innovation, (2) is primarily perceived from an economic perspective, (3) is inherently good and (4) presupposes a symmetry between moral agents and moral addressees. (Blok & Lemmens, 2015, p. 19)

The orthodox economic view that technology drives progress helps to explain this coupling of innovation (as opposed to other forms of productive economic activity) with a return to economic growth, a relationship which has become the driving rationale for STI policy. The 1995 *Green Paper on Innovation* (COM (95) 688) first set out the 'European paradox' as a problem of being unable to translate Europe's expertise in science into marketable products which would help the EU to compete with the United States and Japan. However, innovation at this time was seen as only one aspect of overall market activity. By 2010, a new 'integrated, market-based, demand-driven approach' (Anvret *et al.*, 2010) was being called for, the result of which is the EU's present flagship policy, *Innovation Union*, which exemplifies this very noticeable increase of emphasis on 'innovation as the driver of growth' (COM (2010) 546 final) and the only way out of the present economic crisis (EC, 2012). However, once RI is unpacked to reveal the moral underpinnings of its original formulation – in which 'responsible' has a caretaker mission to ensure that new technologies are both

environmentally safe and *sustainable* (the requirements for which are not necessarily commensurate) – the relationship between RI and economic growth can become very unhappy indeed.

RI is usually discussed in the context of high technology fields which promise profound 'creative destruction' (Schumpeter, 1942 [2003]) as the fields of nanotechnology, biotechnology, information systems and cognitive science increasingly overlap. These are lauded as platform technologies which will create entirely new economic sectors, enabling new and presumably endless streams of lucrative innovation. As much of the underlying science is still unproven, making risk difficult to assess, this has also shifted the burden of responsibility 'upstream', towards those engaged in basic research and prototype engineering, leaving those more actively engaged with downstream processes, such as resource-producers, manufacturers, entrepreneurs, marketers and regulators, operating as normal. The UK Engineering and Physical Sciences Research Council (EPSRC), for example, has been instrumental in developing an RI framework for governance of projects using emergent technologies such as synthetic biology and geo-engineering as part of a deliberate shift from mere 'funder' to 'shaper' of research (Stilgoe *et al.*, 2013; see also EPSRC 2015b). However, the EPSRC cannot, nor should it, be tasked with modifying business and regulatory practices in the ways which will be necessary in order to ensure that these technologies remain responsible to society and the environment as they become incorporated into the market.

The EPSRC's perspective on RI is also not necessarily shared by researchers in non-technical disciplines which do not routinely commercialize the products of their own research and therefore have their own definition of innovation. For example, a 2012 press release by the Economic and Social Research Council (ESRC) claimed a new study had found that the 'UK hotel industry [is] alive with innovation'.[3] Here, the term 'innovation' was applied to the introduction of energy-efficient lights, use of different fabrics for interior decoration and purchase of accounting software, as well as the appearance of whole new sectors within the industry itself, such as the emergence of 'boutique' hotels. In other words, 'innovation' in this one document includes mundane practices such as redecoration, as well as the actual invention and insertion into the market of products, services and sectors aimed at entirely new ways of making money. It provides an excellent example of the kind of confusion increasingly surrounding the term as it gains traction as a buzzword in multiple domains.

Although we do not argue that ours is the 'correct' definition, for the sake of clarity, we will therefore begin our own discussion by an examination of what is meant by the term. Along with Blok and Lemmens (2015), we argue that what has been black-boxed in the literature of RI is not 'responsibility' – which has been the subject of much interrogation – but 'innovation'. By interrogating our own understanding of the term, we aim first to show how the market-based definition impedes the ability to decouple RI from the growth agenda or to prevent 'the market' from functioning as a discursive stand-in for

'society' (Rieff, 1999). We then use this decoupling to consider what might be meant by responsible stagnation.

We define innovation as *the process by which novelty is taken up and circulated in the public sphere (including the application of something existing to something entirely different), producing some kind of profound re-ordering of what-has-been*, something more fundamentally novel than changing light bulbs or redecorating with natural fabrics. This does not exclude market-oriented innovation, but also does not limit innovation to that which creates its value through the market. Indeed, innovation can constitute a deliberate challenge to growth, through seeking to reduce the circulation and purchase of new goods. Freecycle, for example, is an innovation which created an international online community of local groups of people who choose to give each other items which still have use value, rather than offering them for sale, or simply throwing them away. Innovation can also occur within areas traditionally protected from the market. Research councils encourage proposals for methodological innovation, which is aimed at new ways of producing and validating knowledge. Indeed, the first use of the term 'responsible innovation' recorded by WoS (Duke, 1978) is a call to apply the tools of technology assessment to anticipate the possible unintended consequences of educational reform. Some might describe these as 'social innovation' precisely because they are not market-oriented. We, however, would use that term in a more literal sense, as a *direct* innovation in social order rather than a means to describe innovation arenas, such as open-source software, which deliberately place themselves outside the market. The invention and insertion into the British legal system of civil partnership as an alternative marital institution for homosexual couples is one example of what we would mean by social innovation.

These few examples give some idea of the conflicts embedded in the term 'innovation' – as goods and services for the market, as new forms of exchange of goods outside the market, as ways of producing knowledge, as rearrangement of social order. Which definition is used is, therefore, crucially important both for interrogating the purpose and motivation for innovation, and to the discussion of stagnation, as we will show below.

Innovation and economic growth

Orthodox economic models, such as the Solow–Swan model of long-run economic growth (taken as the starting-point for most neo-classical models), present growth as resulting from either capital accumulation or technological progress (Van den Berg, 2012). Technological progress here is not implicitly linked to social progress, as it often is outside this realm, but is defined simply as *any change that leads either to an increase in the levels of output for the same levels of input, or a decrease in input for the same levels of output* (Hubbard *et al.*, 2012). Classic examples of technological progress include faster processing chips, which lead to greater production for the same cost, or more efficient machines,

which lead to lower production costs for the same output. Blanchard and Sheen (2007), for example, mention improved mechanical lubricant or new devices such as the fax machine and mobile phones as examples of technological progress which lead to a greater output for a given level of input. This may include higher manufacturing output or a decrease in the cost of information management and sharing. These are indeed very much in keeping with the notion of innovation as understood in the RI literature. However, while 'stagnation' has a clear meaning in economics as a prolonged period of slow economic growth, exactly what it means in the context of innovation is not clear. In order to make sense of the idea of responsible stagnation, therefore, we first need to make sense of the matrix of responsible innovation (Figure 2).

As the figure above illustrates, stagnation is generally understood as the antithesis of innovation. If innovation (whatever we might mean it to be) is a positively loaded term, then – as the model is binary – stagnation can only be used in a negative way. Indeed, policy discussions of RI generally begin with the reassurance that we all want innovation, that innovation is always a good thing (see, for example, EESC, 2014) and therefore speeding up the innovation process can only make things better. Similar assumptions are made about the relationship of innovation to economic growth, so that any slowdown in the activity of getting *new* things to the market (not in market activity *per se*) is equated with the threat of economic stagnation (Blauwhof, 2012).

However, much depends upon exactly how one is defining innovation. The idea that humans – an intensely curious and inventive species – would ever stop innovating in terms of creating new objects and new ways of doing and knowing things, and sharing this with others, seems incredibly unlikely. So, if we define innovation as above, simply to mean bringing something novel into the public sphere (whether for the purpose of creating exchange value or not), then stagnation is an improbable concept and 'responsible stagnation' a vacuous

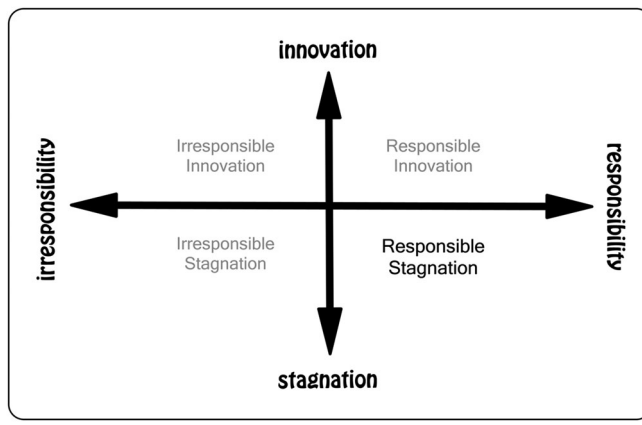

Figure 2. The two-by-two RI matrix.
Source: Adapted from Guston (2015, p. 2, Figure 1).

term. It is only by restricting the meaning of innovation to 'bringing new goods and services *to the market*' that 'stagnation' can take on meaning. The distinction between innovation as circulation of novelty and innovation as bringing-to-market is all-important when we try and make sense of the interaction between innovation and stagnation. For example, Innovation Union is aimed at generating 3 per cent growth as measured by gross domestic product (GDP) across the EU. As RRI is framed as an embedded part of Horizon 2020, which allocates research funding as part of Innovation Union, this would suggest that, in order to be responsible, innovation must contribute to GDP. The perverse corollary would be that innovation which displays all the other desirable qualities of RI – sustainability, stewardship, public engagement and equally distributed societal benefit – but in fact reduces throughput and therefore reduces contribution to GDP, becomes de facto *ir*responsible according to the matrix.

This, as we see it, is a key problem as RI becomes operationalized through research policy. Just as the RI literature assumes techno-scientific innovation to be inherently desirable, orthodox economics also assumes that growth is inherently good, so that research policy is increasingly 'shaped' towards growth through new technology, regardless of material cost. And while there are now debates amongst economists about how we should measure growth (for example, Fleurbaey, 2009; Stiglitz *et al.*, 2010), there is not nearly enough debate within policy circles about the feasibility, let alone the wisdom, of attempting to return to pre-crisis levels of growth. Heterodox macroeconomic theories which separate well-being from GDP have gained both intellectual and popular legitimacy since the 2008 crisis (see Jackson, 2009; Dietz & O'Neill, 2013), but policymakers are still arguing for more innovation to stimulate growth. Importantly, as discussed above, the prevailing view is that if the pace of innovation slows, we stagnate the entire economy, causing disastrous results (OECD, 2010).

Accepting for the purpose of this argument the definition of innovation as only that which is for the market, true economic stagnation, with all its accompanying imagery of a fetid, decomposing swamp, is not actually possible within a system of capital accumulation. As Schumpeter (1942 [2003]) argued, capitalism is constantly in a state of creative destruction, growing and shrinking simultaneously as new technology makes processes, workers and material objects obsolete and new sectors emerge. What we call stagnation is in fact still economic growth, but a prolonged period of very slow growth as measured by GDP (Blanchard & Sheen, 2007). Therefore, any meaningful discussion on stagnation of innovation can only take place within a context that limits the definition of 'innovation' to goods and services brought to market. Our question is whether RI makes it possible deliberately to slow, change or even stop a trajectory of market-based innovation because of reasonable concerns (in other words, to practise responsible stagnation) without necessarily leading to stagnation of the economy, and under what circumstances this might constitute not the *opposite* of RI, but a crucial aspect of truly responsible innovation.

Within the market-based definition, predicting exactly how stagnation of a particular line of innovation will affect the economy is exceedingly complex. First, the effects of widespread stagnation in innovation on overall economic performance would depend largely on how much non-market-oriented but productivity-changing innovation was still being created and whether for-market activities were being displaced. Freecycle, for example, could stand accused of contributing to stagnation within the retail economy, as it encourages people to recirculate usable goods rather than purchase something new. As a niche activity, it does not presently affect GDP in any significant way, but if similar practices of local exchange, gift and barter were to be taken up widely within a national population in the same way that recycling has been, this might not remain the case. Freecycle, in fact, provides an excellent example of how socially beneficial innovation often does the opposite of contributing to GDP, while contributing instead to social and planetary well-being. This is a conundrum for RI within its current economic framework: while RI is meant to direct innovation towards globalized problems such as climate change, the economic paradigm in which it is embedded calls for maximizing competitive economic output, even if this implies continued extraction of diminishing resources or a disregard for mass unemployment of lower-skilled workers due to automation. Innovation, therefore, occurs in a context in which it is impossible for all, or even most, members of society to share its benefits, let alone have the political capital to engage with its direction; a lacuna which the RI literature also tends to neglect (van Oudheusden, 2014). We suggest that a deeper exploration of arguments and models stemming from heterodox economics, particularly from ecological economics, might help provide insight into the kind of macroeconomic paradigm which RI would require in order to fulfil its call for innovation which can 'respond to the needs and ambitions of society' (EC, 2014) and provide real solutions to the complex problems we now face.

Heterodox paradigms to growth

Neo-classical economics takes the pursuit of economic growth, measured in terms of increases in GDP year over year, as a fundamental good, if not a fundamental duty (Van den Berg, 2012). This 'tyranny of growth' (Latouche, 2005) has increasingly come under pressure from two fronts. The first questions whether GDP is in fact the right measure by which to be assessing growth, while the second questions whether growth is, in and of itself, the inherent good its proponents claim it is.

GDP, which measures the monetary value of all goods and services in circulation within a specified region, is the textbook measure of economic activity (see Blanchard & Sheen, 2007). However, there are some well-established alternatives. The best known amongst these are the World Bank's Human Development Index (HDI), which combines GDP with other measures such as educational outcome, life expectancy and infant mortality (UNDP, 2015). Another approach is the Net National Product (NNP), or 'the amount society can consume without

shortchanging the future' (Nordhaus & Tobin, 1972), which, unlike GDP, accounts for the reduction in natural resources as a result of production, subtracting this from the monetary value of goods and services in circulation.

The argument that a developed economy would eventually reach the limits of growth is neither radical nor new. The Solow (1956) model, which is generally taken to represent a neo-classical model of growth, claims that, all else being unchanged, economic activity will slow as a nation nears a 'steady state' in which capital, consumption, output and population come to a balance. Once a steady state is reached, GDP can still increase through an increase in population, or the introduction of new technology which changes input, but only at costs which tend to diminish returns. In other words, an economy below its steady-state value will always grow much faster than one which is at or above it because it has not yet reached maximum productivity; past this point, there is little to be gained. While classical economists would generally equate any slowdown in activity as undesirable stagnation, heterodox economists suggest that if a nation's productivity is already high, it does not necessarily follow that prosperity or material well-being will either stagnate or decline (Dietz & O'Neill, 2013). Even John Stuart Mill understood that at some point industrial progress would slow, capital and wealth would become 'stationary', and this did not necessarily mean that the conditions of life would cease to improve (Jackson, 2009). While stagnation would indeed be a disaster in an economy where the majority of the population's basic needs are not being met, a steady state in a rich nation may instead represent an optimal state of equilibrium, 'an economy with constant stocks of people and artefacts, maintained at some desired, sufficient levels' (Daly, 1991, p. 17). This is not a state of stagflation in which productivity slows while prices continue to rise, but rather a stabilization of productivity across the entire economy which in fact would be quite difficult either to reach or maintain.

Daly's vision of a steady-state economy (SSE), like other challenges to the growth-centred paradigm, is motivated by two core observations: first, that the current consumption-based growth trajectory is not sustainable given the limited environmental stock available, and second, that continuing economic growth beyond that already achieved in developed countries does not necessarily lead to a bettering of the lives of the individuals in these countries (Stiglitz *et al.*, 2010). Innovation in an SSE is not directed towards finding new ways to grow the economy, but rather towards finding ways to increase individual well-being within a limited ecology (Jackson, 2009). Proponents of SSE have long been dismissive of GDP as a useful measure of economic performance, precisely because it 'conflates qualitative improvement (development) with quantitative increase (growth)' (Daly, 2007, p. 15).

More recently, concerns over the limits of growth have led to arguments for actively decreasing productivity (degrowth) in specific sectors of the economy so as to ensure we remain within our ecological limits, despite the inevitable decline in GDP (Kallis, 2011; Kerschner, 2010). Others, however, even in ecological economics, predict this would create another

'implosion' on a worse scale than 2008 (Klitgaard & Krall, 2012; Tokic, 2012). As a third way, van den Bergh (2011) has proposed an 'a-growth' paradigm, where we pursue socially and environmentally desirable ends while remaining agnostic as to the consequence of our actions on GDP growth. This a-growth paradigm is fundamentally about opposing GDP as a measure, not about opposing growth *per se*. In fact, such a view is much more reminiscent of Daly's intentions with SSE than van den Bergh might concede. The usefulness of GDP is arguably the core difference between the view espoused by proponents of SSE and the view supported by economists who claim that we should strive for sustained economic growth, assuming development to occur in tandem, and technological progress to be key to both. To a large extent it also explains classical economists' view of the relationship between science and innovation, and between innovation and economic growth. It is therefore unsurprising that RI has become part of, rather than a challenge to, policies aimed at increasing throughput to increase GDP. This is particularly true in the European Union, where the policy activities of the Commission are answerable to the political agenda of a European Council which must placate both business interests and voters back home, and thus appears increasingly committed to the incommensurable objectives of fiscal austerity and macroeconomic growth (de Saille, 2015). But it is important to remind ourselves that the classical economists' definition of technological progress (from which innovation gains its traction) is *any change that leads to an increase in the levels of output for the same levels of inputs, or, to the same levels of outputs given lower levels of inputs.* This makes no distinction as to whether that change is a material object or an intangible process, or whether it is enacted through the market. However, Blok and Lemmens (2015) argue that in the policy setting, the term 'innovation' has increasingly become restricted *only* to technological, patentable, commercialization of novelty, because that is the only kind of innovation upon which a business model can be based. We agree with the first premise, that RI, whether intentionally or not, presently functions to reify the narrowing of both 'innovation' as a term and free-market capitalism as the only viable economic paradigm. Von Schomberg's (2013, p. 63) oft-quoted formulation of RRI[4] as '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*' would seem to uphold this argument. However, we are not certain about the second premise, as we shall discuss in the next section.

Responsible stagnation

In so far as it is a policy innovation, anticipating and being reflexive about the potential risks, benefits and impact of RI itself is essential if it is to achieve its

loftier goals. RI discourse is partially shaped by the assumption that publicly funded basic research will be taken up by industry–university partnerships and developed into goods and services to be sold through spin-offs. One possible detrimental impact is the increasing burden placed upon scientists as RI becomes a requirement for research funding at both UK and EU levels, particularly when coupled with demands to produce research which can be commercialized (Holloway, 2015). Emergent platform technologies such as nano- or biotechnology promise to feed, warm and heal as well as enrich through creation of GDP wealth and high-tech, well-paid jobs (Marris, 2015). However, there is a danger that by claiming to have already anticipated and reflected on negative impact 'upstream', while promissory research is still being done, RI will instead redouble efforts to get these technologies to the market as quickly as possible, before effective resistance movements can be formed (Singh, 2008). Some areas of research have already generated so much public unease, particularly about the quality and effectiveness of regulation, that attempts to commercialize it have been forcibly (and in some opinions, irresponsibly) stagnated by widespread resistance, and worry over the 'failed' attempt to commercialize GM in Europe still lurks behind much of the discussion of RI, particularly when viewed from the policymaker's desk (see EC, 2013, p. 14). However, history shows us that in certain instances, both policymakers and scientists have chosen forms of what might be called stagnation – a slowdown or cessation of activity – as the most responsible course of action in the face of uncertainty and public unease. The voluntary moratorium on recombinant DNA research in the early 1970s and the near worldwide ban on human reproductive cloning provide two historical cases of what could be considered responsible stagnation of scientific research.

RS in science

While (broad-based) innovation is unlikely ever to come to a complete halt, RS in research can indeed mean a programme is paused or even abandoned. Perhaps the best, or at least the most powerfully remembered, example is the Asilomar conference held in 1975. This meeting of scientists, journalists, policymakers and lawyers – what might now be called multi-stakeholder engagement – was held to determine under what conditions research on recombinant DNA, at that point under a voluntary year-long moratorium, could be done responsibly. Writing about Asilomar over 30 years later, one of its organizers surmised that it was proof that the best way for controversial research to progress was for publicly funded scientists to respond openly to concerns and involve the public early on in discussions about how to regulate such research, because once corporate scientists entered the field, it would 'simply be too late' (Berg, 2008, p. 291): economic interest would take over. Asilomar persists as a cultural referent, partly because it succeeded in allowing a controversial programme of research to continue, but also because it casts science as having taken a

principled stance by stopping to clarify where it was heading, both for those who would do the research, and as a means of seeking public legitimation (Hurlbut, 2015).

Similarly, reproductive cloning formed part of a larger discussion in the early 1980s about the regulation of assisted reproduction. While embryo research was eventually allowed in most countries, the general consensus which prohibited research into human reproductive cloning has so far held, and was perhaps even strengthened after the birth of Dolly the Sheep in 1997, which proved the process was viable in mammals. In the very public debate which ensued after a pair of already-controversial IVF doctors and a religious cult[5] swore to create a cloned child no matter where they had to go to do the research, the scientists who had created Dolly argued vociferously against ever using the technique in humans, calling the idea 'repugnant' (Wilmut *et al.*, 2000). Rather than stopping research altogether, the debate helped clarify an ethical position which claimed that using the somatic cell nuclear transfer technique to produce human beings was a separate issue from using it to clone prize livestock, or produce human embryos with a patient's DNA in order to harvest stem cells for medical treatment. In this instance, scientific agreement that some applications of an innovation should not be pursued allowed controversial research in the overall field to continue, albeit under strict control. In other words, cessation or imposition of regulation on one specific pathway for an innovation does not necessarily mean stagnation of the whole.

Another case might be the adoption of Directive 86/809/EEC in the EU in 2012, which codified the '3Rs' in animal research – reduce, refine, replace – into law as a form of controlled degrowth in the use of animals for experimentation. While initially it seemed possible that animal researchers would simply relocate elsewhere (Wells, 2011), ultimately the Directive seems to have opened up opportunities for innovation in tissue culture, nanotechnology and research into ways of obtaining results without animal models (research*eu, 2015). The 3Rs could be considered a form of RS, analogous to input reduction in the larger economy by using less or different materials to gain the same result, guided by ethical principles which seek to protect a basic activity, but substantially reduce its harm. The case also points to deeper questions about the 'human-centric' nature of RRI (McLeod, 2015) and the interplay of RRI with other aspects of European Union law.

Last, there is the original example of RS, although it is likely that many within the field of RI would not see it as such. The EPSRC developed its version of RI as part of a project which looked at seeding the atmosphere with nanoparticles to combat climate change. The test bed stage of the project was halted due to public unease (and/or patent conflicts, depending upon who is telling the story) and is now used as an example of successful stage-gating, where pauses are built into the research strategy to consider how best or even whether to proceed (Stilgoe *et al.*, 2013). RS in science, therefore, need not be something to fear and does not necessarily call for a complete or even permanent halt to a

research programme. Rather, as seen in all four cases above, it can be an integral component of a responsible approach to mitigating potential harm.

RS in business: the benefit corporation

Corporate social responsibility (CSR) programmes have had an uneven implementation, in part because of the shaping of corporate governance itself, where truly beneficial but expensive actions cannot be taken by managers who are restricted by the obligation to maximize shareholder returns as their first priority (Lazonick & O'Sullivan, 2010). 'Benefit corporations', or b corps, are a recent legal innovation which allows for-profit corporations to pursue goals besides maximization of profit. B corps have 'a purpose to create a material positive impact on society and the environment; [and] are required to consider the impact of their decisions not only on shareholders but also on workers, community, and the environment' (Benefitcorp.net, 2015). Unlike traditional shareholders, investors in B corps cannot sue if ethical decision-making reduces investment returns. Instead, they can sue the company for not living up to its primary philanthropic obligations. From the first laws passed in Maryland in 2010, preliminary data suggest there are presently over 2,100 B corps in the United States (Berrey, 2015), and close to 1,500 in the EU since they became legal in April 2015 (mhoftijzer, 2015).

One example of this movement is Patagonia, which sells outdoor equipment and engages in extensive R&D with scientific and industrial partners, for example, seeking to develop a plant-based substitute for the petroleum-based neoprene used in wet suits (Patagonia, 2015a). It focuses heavily on reducing its footprint of production, as well as improving the quality, sustainability and recyclability of its products, many of which are now made from reclaimed wool, cotton and polyester. Patagonia has also attempted to reduce the toxic effects of pesticides used for producing cotton by switching to organic, despite fear that the much higher cost of production would put it out of business. By choosing a modest price increase coupled with a substantial reduction in both products for sale and profit margins, the company proved such transitions were possible and is now a prime mover in the organic cotton movement (Patagonia, 2015b). However, Patagonia is probably most famous for taking out ads in major US newspapers on Black Friday in 2011 (the day after Thanksgiving, which has become a consumer stampede to get sale-price goods), explaining the exact environmental footprint of one of their most popular jackets, including water consumed and carbon produced, and urging people not to buy what they do not need, but to recycle, repair and re-use their Patagonia goods instead.[6]

Because its specific clientele tends to be environmentally conscious, competition in the outdoor equipment industry is not just about pricing and quality, but also about who has the most sustainable manufacturing and ethical labour

practices along their supply chain. Patagonia therefore has an element of leeway which might not exist in other industries; however, even so, its business model is probably best described as a-growth. This is partly a result of creditors calling in their loans during the 1991 recession, a disaster which nearly bankrupted the company and has made its founder growth-wary ever since (Chouinard, 2013). As a form of RS in business (for example, by phasing out traditional cotton over a period of two years to avoid a sudden shock to their former suppliers, or ceasing to sell lucrative but environmentally costly goods) Patagonia and other B corps suggest that it is possible to place social and environmental concerns first all along their value chain and, despite being a-growth, still increase profit – the company is now valued at over $700 m (Bradley, 2015). Additionally, Patagonia self-taxes 1 per cent of sales to be donated to environmental charities and allows employees time off to do research or join campaigns (Patagonia, 2015c).

Since RI seeks to point innovation towards socially beneficial technology aimed at solving complex, global problems, there may be much to be learned from the B corp movement, in particular about sharing benefits with communities which often do not experience 'technological progress' in a positive manner. We suggest not that RI can only be enacted through a B corp, but rather that the existence of a new alternative legal framework for governance of for-profit corporations is an innovative and welcome step away from maximizing output/shareholder value models and an under-researched area which may contribute much to the discussion of both RS and RI.

Why should we study responsible stagnation?

In the discussion above, we have outlined some preliminary cases of what we might call RS, which we have identified for deeper study in subsequent work. We now turn to the question of why we think the study of RS is an important component of RI scholarship, and what we think might be learned. In his masterwork, *The Great Transformation*, Polanyi suggested that:

> It should need no elaboration that a process of undirected change, the pace of which is deemed too fast, should be slowed down, if possible, so as to safeguard the welfare of the community … (Polanyi, 2001, pp. 32–33)

This, we would suggest, is the underpinning of our idea of Responsible Stagnation. Polanyi's work argues that economics is a set of social relationships; where these relationships have become 'disembedded', so that monetary interests outweigh social interests, capitalism may provide wealth for a few, but at an enormous cost for the rest. Anticipation, reflection, inclusion and responsive action require time and effort, which is against the prevailing policy discourse of seeking ways to remove barriers to innovation and reduce regulation, and a more expensive process than traditional shareholders are likely to support. We suggest that in order to achieve a 'proper embedding of innovation in

society' (von Schomberg, 2013), some elements of RS will need to be incorporated into the discussion of RI, so that social and ecological costs hold equal, if not more, importance than projected possible economic benefits as its framework activities are carried out. Arguments and measurement tools being developed by institutions such as the Centre for Steady State Economics (CASSE) and the New Economics Society may provide new ideas for discussions about what constitutes responsible innovation, helping to find (and define) the optimal balance for new sectors, and incorporating better ways to measure environmental and social costs, including the distribution of negative impact, such as environmental depletion and job losses, to offset the rhetoric of jobs created and GDP achieved. RI then becomes not just a matter of upstream public engagement to successfully embed an innovation in the market, but a way of using anticipation and reflexivity to consider the most socially and environmentally responsible pathway to reach a specific goal, and then developing the best solutions for achieving it.

We also wonder, not just what SSE can offer to RI, but what RI might offer to SSE as it seeks policy alternatives to limit resource use and waste production, and encourage changes in business practices, consumer behaviour and policy goals (Dietz & O'Neill, 2013). We see possibility for RS, as part of the RI framework, to help unpick the very confusing messages presently emanating from the media (Consume less! Buy more!) and from a political establishment simultaneously demanding both austerity and growth. The incommensurability of these objectives suggests that, as social actors, politicians, academics and economists are as confused about how to achieve a sustainable future as the increasingly disempowered public (Bryan *et al.*, 2012). Finding our way out of the present financial crisis will require much more than growth; it will require a concerted effort to understand the intertwined crises for nature and society as well (Fraser, 2014).

RI suggests itself partly as a decision-making endeavour, allowing a debate on impacts, benefits and motivations for technological development to occur far upstream, before innovation pathways are set. This would imply that its main activities take place at a point where multiple pathways are still possible. We argue that considering RS as a genuine option allows for a wider debate, and a broader set of policy options about the role of innovation in our economic system and the real-world consequences of continuing to seek productivity growth. We have argued that the present socio-technical political economy relies upon the parallel assumptions that innovation/growth is always good, therefore more and faster innovation/growth must be better. Within this single-minded responsibility to innovate to increase GDP, RI can do little to question whether growth is truly desirable, or even necessary for a flourishing society, let alone whether a risky innovation pathway can achieve its projected goals. It may be argued that what we are suggesting is beyond the scope of what RI can or should do. However, we are not certain why that should be the case, or indeed how RI can achieve its objective of socially beneficial innovation to solve complex problems if it cannot question its own normative

conditions, change trajectories or suggest that certain areas are too environmentally or socially costly to pursue. In this sense, we consider RI itself to be a social innovation which should also be subjected to the anticipate–reflect–engage–act framework (EPSRC, 2015a).

Our research, preliminary though it is, suggests that rather than an empty space or a dead, fetid pond, the quadrant for Responsible Stagnation is full of rich ideas and vibrant, highly inventive (in the broadest possible sense of the word) activities, aimed at a fundamental transformation of the relationship between production, consumption and quality of life. Opening the black box of RS allows us to question normative economic assumptions which equate technology with social progress, progress with economic growth and economic growth with individual well-being in all its forms. We do not suggest that innovation, progress and growth must stop, but rather that RS, *as an integral component of RI and not its antithesis*, provides a mechanism through which those assumptions can be made visible and questioned, opening possibilities for innovation directed at achieving social, ecological and economic equilibrium and for reducing input rather than always seeking to produce more. It may, in fact, be necessary to get rid of the matrix entirely, to move away from the two binaries setting innovation and stagnation in opposition to each other, in order to understand the part that both will have to play in the transition to the more sustainable, more socially equitable society RI claims to want.

We invite others to pursue this programme of research with us.

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Notes

1 Variously acronymed as ARIR (Stilgoe *et al.*, 2013) or AREA (EPSRC, 2015a).

2 There has been some question as to whether this 'success' is due to acceptance, or to lack of labelling, so that the public is not generally aware of how much nanotechnology is already in many products they consume (Falkner *et al.*, 2009).
3 As of October 2015, the original press release could no longer be found on the ESRC's website. It is mirrored at http://phys.org/news/2012-08-uk-hotel-industry-alive.html.
4 We use RI here as the generic and RRI to refer specifically to EU policy.
5 Both doctors (Severino Antinori and Panos Zavos) and the Raelian cult claimed in the early 2000s to have engineered cloned children, but these claims were never verified.
6 The campaign was selected, with some bemusement, by Adweek as its ad of the day (Nudd, 2011).

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