It takes two to tango: toward a political concept of responsible innovation

Lucien von Schomberg & Vincent Blok

Published online: 11 Oct 2023.

Submit your article to this journal ↗

View related articles ↗

View Crossmark data ↗

Routledge
Taylor & Francis Group

RESEARCH ARTICLE

It takes two to tango: toward a political concept of responsible innovation

Lucien von Schomberg [a] and Vincent Blok[b]

aFaculty of Business, University of Greenwich, London, UK; bPhilosophy Group, University of Wageningen, Wageningen, The Netherlands

ABSTRACT

This paper proposes a political concept of Responsible Innovation (RI). As a first step, we diagnose the RI discourse with a conceptual ambiguity, struggling to accommodate both private and public interests. To address this ambiguity, we distinguish between weak RI, which seeks to govern a techno-economic concept of innovation; and strong RI, which seeks to conceive a political concept of innovation beyond techno-economic ideology and practice. Secondly, we consult *The Human Condition*, in which Hannah Arendt articulates a threefold distinction between the activities of labor, work, and action. Although Arendt does not explicitly address the topic of innovation, her equation of politics with the human capacity to "begin the unexpected" inspires a political concept of RI which fundamentally empowers the public sphere and drives radical novelty. Finally, we account for how this political concept of RI can be operationalized, advocating for its integration at both substantive and procedural level.

Introduction

The EU policy discourse on Responsible Innovation (RI)[1] has recently been diagnosed with a discrepancy between its strong normative ideals and its concrete implementation in practice (Novitzky et al. 2020). On the one hand, at the declarative level, policies urge innovation processes to generate societally desirable outcomes, particularly in response to global objectives such as the Sustainable Development Goals (Von Schomberg 2019). On the other hand, at the operational level, the integration of RI faces structural tensions with other policy goals, such as scientific excellence and economic value (Rodríguez, Eizagirre, and Ibarra 2019). As a result, frameworks of RI are exposed to potential instrumentalization, while falling short on the promoted ambitions of the EU (Novitzky et al. 2020).

To counter this tendency, the academic discourse on RI insists on rigorous innovation governance and typically proposes that to innovate responsibly requires a permanent

commitment to be anticipatory, reflective, inclusively deliberative, and responsive (Owen et al. 2013). RI scholars also suggest broadening societal value inputs into design requirements (Van de Poel 2013) and anchoring innovation processes in the normative values of the EU to define the right impacts (Von Schomberg 2013). Under the sway of science *for* society *with* society, the idea is that innovation can only respond to the needs and ambitions of society insofar as all its actors are included in the process. Even so, questions about the politics in and of innovation are often left unaccounted for, despite the long-standing call to democratize innovation processes (Van Oudheusden 2014). Discussions on political questions concerning, for instance, which actors to include and how they are expected to co-create outcomes, remain scarce throughout the literature. This brings into question what a political concept of innovation consists of and how it may contribute to the discourse of RI. Against this background, this paper aims to establish a political concept of RI. In doing so, it articulates a vision of what it means to include the public in innovation processes, why it is important to do so, and how this can be operationalized. The aspiration to establish this political concept of RI is both historically motivated and philosophically grounded. Historically, innovation has little to do with technology, let alone with the market. In fact, it initially emerges in Ancient Greece with a political connotation, where it is fundamentally understood as 'introducing change into the established order' (Godin 2015, 5). As such, the history of innovation encourages us to reflect on what a political concept of innovation could mean today, particularly in the emerging context of RI. In doing so, we find philosophical revelation in the work of Hannah Arendt, one of the most influential political philosophers of the twentieth century. Although Arendt does not explicitly talk about innovation herself, her equation of politics with the human capacity to 'begin the unexpected' inspires us to establish a political concept of RI which fundamentally contributes to the public sphere. In this respect, our analysis contributes to the recent call for research to further explore and transform Arendt's theory and concepts in relation to the phenomenon of RI (Cf. Reijers 2020).

As a first step, we account for *why* the formulation of a political concept of RI is urgent. In this respect, we diagnose the RI discourse with a conceptual ambiguity, struggling to serve both private and public interests. In light of this diagnosis, we distinguish between weak RI, which seeks to govern a techno-economic concept of innovation through an applied set of ethical dimensions; and strong RI, which seeks to conceive a political concept of innovation beyond techno-economic ideology and practice (Section 1). Subsequently, we suggest *what* this political concept of innovation consists of. Through conducting a generative reading of Arendt's *vita activa* we establish a political concept of innovation that enhances the human capacity to speak up and take action, inspires radical novelty, and empowers the public sphere (Section 2). Finally, we account for *how* the discourse of RI can operationalize this political concept of innovation. In doing so, we provide a vision of strong RI to be integrated at both substantial and procedural level (Section 3).

The call for a political concept of responsible innovation

Through articulating six main keys – ethics, societal engagement, gender equality, open science, science education, governance – the EU policy discourse on RI imposes a strong

normative view of what constitutes responsibility in innovation processes (European Commission 2020). Even so, the academic discourse on RI demonstrates that there remains a lack of clarity of what RI means for research policy and governance (Novitzky et al. 2020). Among stakeholders, approaches to RI vary between coping with the institutional landscape and pushing to transform it entirely, between implementing practices locally and enforcing objectives globally, and between proposing incremental change and disruptive change (Ludwig and Macnaghten 2019). Moreover, in the very adoption of RI, measures and guidelines are claimed to provide what can amount to little more than a strategic checklist to continue business-as-usual, potentially leaving the innovation discourse to adopt a mere instrumental understanding of its responsibility to society (Blok and Lemmens 2015; Hartley, Pearce, and Taylor 2017; Novitzky et al. 2020). This is reflected, for instance, in the way RI is employed to meet funder requirements which can only serve to legitimize existing research practices (Åm 2019). Similarly, global challenges, such as climate change, are commonly accommodated into RI policies only to reinforce the expertise and solutions of dominant stakeholders while disfavoring a more critical and heterogeneous approach (Ludwig et al. 2022). Analogous to the phenomenon of greenwashing, there are thus increasing concerns about rebranding existing structures and activities under the label of RI without any considerable reform or reflection to genuinely enact RI (De Hoop, Pols, and Romijn 2016).[2]

At the core, however, the idea of RI is not meant to constitute a tick box exercise. Instead, it is originally presented as a holistic approach, underpinned by a philosophical understanding of future-oriented responsibility in terms of 'response-ability', that is, the exercising ability to respond (Jonas 1984; Owen et al. 2013), moving beyond conceptualizations of responsibility that are mainly consequentialist and retrospectively applied after the fact (Grinbaum and Groves 2013; Pellé 2016). In this view, RI it is not merely about what we do not want innovation to do, but rather about what we do want innovation to do, thus shifting from an ethics of constraints to an ethics of construction (Von Schomberg 2019). In doing so, RI accommodates the unpredictability and uncertainty of innovation by means of 'a collective commitment of care for the future through a responsive stewardship of science and innovation in the present' (Stilgoe, Owen, and Macnaghten 2013, 3). On this premise, several RI scholars urge responsibility debates to move beyond consequentialist modes of orientation, focusing on wishful futures rather than on speculative outcomes, thereby enabling more visionary and critical ideas for improving the future (Nordmann 2010; Grunwald 2019). In this respect, RI builds on previous proposals, such as vision assessment (Ferrari, Coenen, and Grunwald 2012), explorative philosophy (Grunwald 2010), and a variety of hermeneutic responses given to the unpredictable nature of emerging technologies (e.g. Van der Burg 2014). Hence, while RI may be vulnerable to questionable tick box implementations, it was originally introduced to express an adaptive and responsive character.

The discrepancy between the ideal of RI and its implementation in practice is arguably the result of a deeper conceptual ambiguity. To unpack this ambiguity, we borrow a philosophical distinction between the ontic level of innovation, which focusses on concrete innovations, and the ontological level of innovation, which focusses on the broader context in which these innovations are situated (Zwier, Blok, and Lemmens 2016). At the ontic level, the question is whether a particular innovation, such as solar energy, is ethically acceptable and societally desirable. In this respect, the RI literature is rich in

critical approaches to innovation in fields ranging from agriculture and medicine to nanotechnology and robotics. Geoengineering (Stilgoe, Owen, and Macnaghten 2013) and synthetic biology (Stemerding 2019) are good examples of where the adoption of RI has been effective. At the ontological level, the question is whether the broader context in which we currently innovate is compatible with the societal purpose of RI. This question builds on earlier explorations of second order reflexivity, in which reflexivity considers how 'society, and modern rationality in particular, work […]. not only a reflection on our own actions […] but a reflection on how the presupposition, the governance principles and the values determine our way of acting' (GREAT 2014, 73–76). As we have also argued elsewhere, the presuppositions in question are predominantly techno-economically oriented, limiting the scope of the RI discourse to an intrinsic relation between technology and the market (Von Schomberg and Blok 2019; Timmermans and Blok 2021). The problem we wish to point to here does not so much reside in the techno-economic ideology of innovation as such – a problem which academic efforts of RI already expressed long-since – but more so in the idea that this ideology can somehow be overpowered through the democratic governance of innovation processes. The failure to do so is illustrated in the ongoing instrumentalization of the RI discourse outlined earlier, where the established keys are turning RI into a tick-box exercise, to the dismay of its founding fathers (Owen, von Schomberg, and Macnaghten 2021). To this end, we believe that RI calls for a political concept of innovation which not only legitimizes innovation practices through democratic governance, i.e. at the ontic level, but fundamentally empowers the public sphere, i.e. at the ontological level.

To be sure, contemporary philosophers of technology have distanced themselves from ontological views of technology, arguing that each technology mediates the human-world relation in its own way (Ihde 1993; Verbeek 2005). However, there is a much more comprehensive resonance to the concept of innovation. When we speak of innovation, we do not merely refer to 'this' or 'that'. We perceive it as virtue, a driving force for success, and the solution to all societal problems. For today's Homo Innovatus not to innovate means to die (Freeman and Soete 1982). Therefore, technology not only mediates but is also itself mediated by this broader phenomenon of innovation. In other words, while we recognize the ontic differences among technologies – e.g. the self-driving car and 3D printing serve different purposes and mediate the human-world relationship in different ways – these technologies remain fundamentally embedded within our age of innovation. To a certain extent, we revive the spirit of classical accounts of the philosophy of technology which also saw an underpinning force at play in the emergence of new technologies. However, unlike such classical accounts, we distance ourselves from the essentialist and pessimistic view that this underlying force is driven by impersonal calculation and constitutes a threat to humanity. Instead, precisely because the meaning of innovation is much broader and more political than the tradition of economic analysis may suggest, we see the potential for technology to be ontologically embedded in the public sphere.

The call for a political concept of RI is further supported throughout the literature (e.g. Van Oudheusden 2014; Owen and Pansera 2019; Von Schomberg and Blok 2018; Reijers 2020; Penttilä 2022). Frameworks of RI emphasize the democratization of innovation processes, aim to 'change the world', and are thus inevitably entwined with the realm of politics. This is especially the case in discussions on global issues like climate

change, where RI is shown to be much more complex and political than usually perceived (Stilgoe 2019). Even so, questions about the politics in and of innovation processes are largely unaccounted for, as critically remarked by Owen & Pansera:

> Are innovation, and responsible innovation, always destined to be bedfellows of a market-based Schumpeterian model of competitive, creative destruction, or can they – and should they – allow space for other alternatives of innovation and responsibility based on other political beliefs, ways of organizing, ways of distributing power, ways of relating to each other and ways of being; a quality deliberation that favors the confrontation of various arguments and conceptions of the good? (Owen and Pansera 2019, 41)

This question provides an opening to reflect on an alternative, political, concept of innovation which safeguards the legitimacy of the values and outcomes RI deems societally desirable (Penttilä 2022).

The above discussion points to an ambiguous position of RI, where the ideal to exceed the market and serve society is summoned to a techno-economic concept of innovation. In light of this diagnosis, we can distinguish between weak RI and strong RI (see Figure 1). Weak RI denotes an application of ethical dimensions to the widely presupposed techno-economic concept of innovation. We consider RI in the form of such an application as weak, for despite good-intentioned efforts to serve the public sphere, its concept of innovation is ultimately oriented towards the private sphere.[3] In contrast, strong RI projects a transformative view of the concept of the concept of innovation itself. It goes beyond mere techno-economic ideology and practice, offering a political view of innovation that genuinely serves the public sphere. As such, strong RI unties itself from the mainstream economic tradition of innovation and does justice to the political ambitions the founding fathers of RI expressed ever since they first introduced the concept into EU policy circles. The two orientations of RI differ with respect to their input, throughput, and output (see Table 1).

Departing from the conceptual ambiguity of RI, this section primarily depicted the techno-economic concept of innovation and exposed its orientation towards the private sphere, thereby pointing to the limitations of weak RI. In turn, the next section is devoted to developing a political concept of innovation oriented towards the public sphere, thereby laying a first steppingstone to establishing a vision of strong RI.

Laying the foundation for a political concept of innovation

In order to develop a political concept of innovation which contributes to the public sphere, we first require an understanding of what constitutes the public sphere. In *The Human Condition*, Hannah Arendt provides us with precisely that. In particular, her

Table 1. Towards a vision of strong RI.

| The Concept of RI	Weak RI	Strong RI
Input	Seeks to govern the techno-economic concept of innovation towards societally desirable outcomes	Seeks to transform the techno-economic concept of innovation towards societally desirable outcomes
Throughout	Applies RI keys to a techno-economic concept of innovation	Operates a political concept of innovation
Output	Primarily serves the private sphere	Primarily serves the public sphere
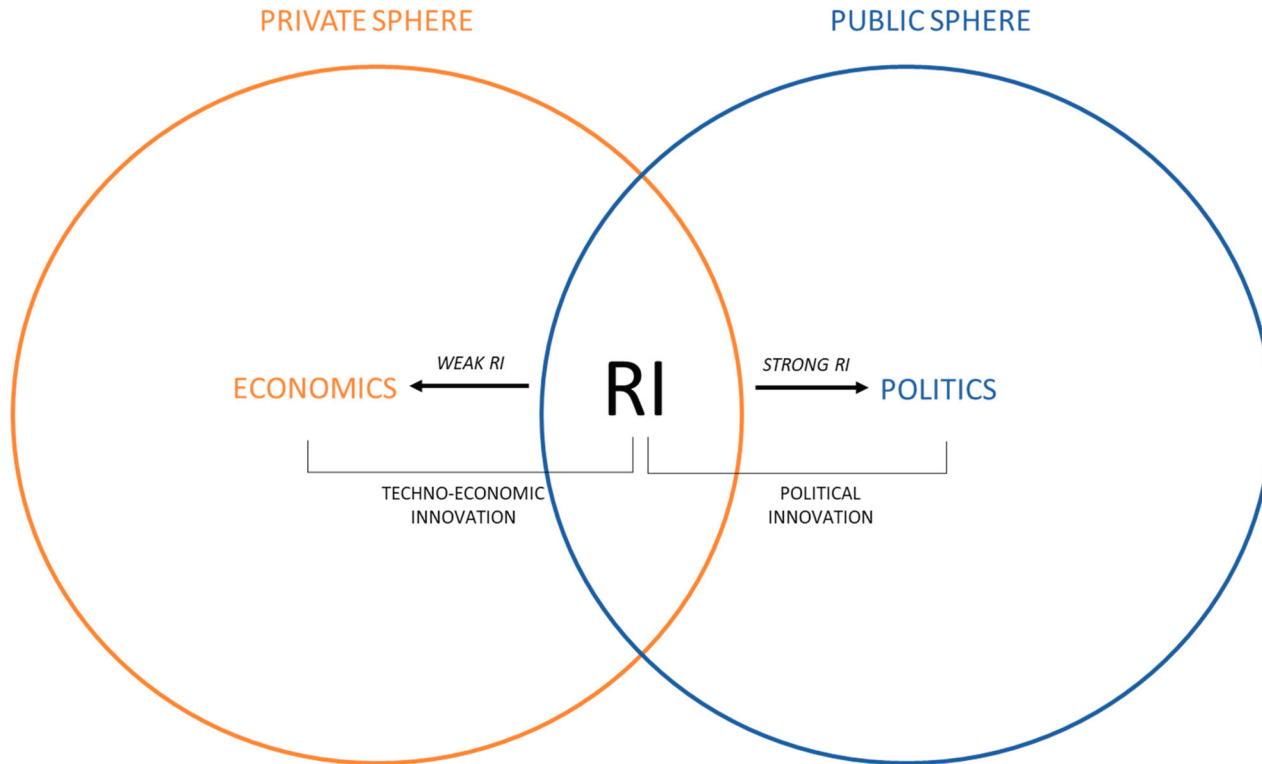
Figure 1. The conceptual ambiguity of RI.

articulation of the *vita activa* sharpens the division between the private sphere, in which life is spent as individuals in the pursuit of private interests, and the public sphere, in which individuals exceed private interests in favor of contributing to the world beyond the self. This distinction enables us to further explore what it means for innovation to primarily serve the public sphere, even if Arendt does not explicitly address the topic of innovation herself. The purpose of this section is twofold. First, after briefly explaining the fundamental categories of the *vita active* – labor, work, and action – we diagnose the category of work with a duality, responding to both the private interests of labor and the public interests of action. Second, through understanding the duality of work and translating it to what we call 'the duality of innovation', we provide concrete criteria for a political concept of innovation as distinct from a techno-economic concept of innovation. This will eventually serve as the foundation of strong RI, to which we turn in the subsequent section.

It should be noted that our reading of Arendt is generative, meaning that we do not aim to take a specific stance either for or against her work. Our primal intention is to explore possibilities of applying her theory to the dynamic of RI, as recently called for in the literature (Reijers 2020).

The duality of work

The *vita activa*, i.e. the active life, comprises of three categories of the human condition which according to Arendt have been overshadowed throughout the history of philosophy in favor of the *vita contemplativa*, i.e. the contemplative life.

The first category of the *vita activa* is labor which can be characterized by the repetitive and cyclical processes that satisfy the vital necessities of life. It corresponds to the existential mode in which we survive. Temporality in labor is marked by the rhythm of day-to-day life, following natural processes like sunrise and sunset, as well as the repetitive nature of biological functions. Work, on the other hand, involves creating and shaping an artificial world, distinct from nature, by producing things of use and value that last over time. It corresponds to the existential mode in which we build. The temporality of work is marked by the linear progression of time and the planning, design, and construction processes involved in creating enduring objects. Lastly, action means taking initiative, which is influenced by unique circumstances and interactions with others, and carries the potential to do the unexpected. It corresponds to the existential mode in which we spontaneously and publicly begin something new through speech and action. Temporality in action can be characterized by its fragility, subject to the inherent unpredictability and contingency of human affairs. For Arendt, action represents the highest realization of political life, reflecting three central features. First, action is conditioned by plurality. Through action we reveal to others who we really are and disclose our uniqueness in doing so. That is, we appear in public and engage with a plurality of others and their respective unique identities. As such, we always act either for or against others. For example, a performance artist acts for its audience, while a revolutionist acts against its oppressor. In both cases action loses its meaning without the presence of a plurality of actors who perceive what is being enacted. Second, action is only possible because of our natality since human life is brought into the temporality of acting anew. By virtue of our birth, we take initiative and begin

something new. In doing so, we introduce radical novelty in the world. Third, as a result of this radical novelty, action is inherently unpredictable; it carries the capacity to do something completely unexpected.

> The new always happens against the overwhelming odds of statistical laws and their probability, which for all practical, everyday purposes amounts to certainty; the new therefore always appears in the guise of a miracle. The fact that man is capable of action means that the unexpected can be expected from him, that he is able to perform what is infinitely improbable. And this again is possible only because each man is unique, so that with each birth something uniquely new comes into the world. (Arendt 1998, 178)

While the position of work in the *vita activa* is arguably more complex, it is clear from Arendt's writings that the three features of action must be understood as counterpoints to the activity of labor. As such, Arendt sharpens the division between the private and public sphere. While the private sphere is concerned with life spent as individuals in the pursuit of private interests, as animal laborans, the public sphere is concerned with life spent as citizens of a political community, as zoon politkon.[4] Arendt argues that the defining characteristic of human beings is their ability to act and to initiate change in the world, and that this ability is expressed most fully in the realm of politics. The political realm is the realm of public life, where people come together to debate, decide, and act on matters of concern beyond the self. In other words, Arendt defines the political realm as a common space of appearance in which we actively appear to each other through speech and action. In doing so, we ultimately transcend private interests and impact the world beyond the self, that is, the public sphere (Arendt 1977).

The activity of work, and how it precisely relates to the private and public sphere, is best understood in terms of two functional distinctions. While the first distinction concerns the separation between labor and work, the second distinction concerns the interdependence between work and action (Markell 2011). The separation between labor and work is marked by three main differences. The first and main difference relates to a classic philosophical distinction between the notions of earth and world. While the former denotes all-natural surroundings, the latter represents human-made constructions.[5] Through this distinction, Arendt argues that through labor we are essentially earthbound, while through work we become world-building. In other words, labor is confined to the demands of our animality, biology and nature, while work violates these demands by shaping and transforming them according to our own plans. In contrast to labor, work is thus a distinctly human activity. Second, work exhibits a form of freedom expressed in the sense of mastery over nature, in contradistinction to labor which is subject to sheer biological necessity. Third, since labor is concerned with satisfying one's own needs, it essentially remains a private matter. Work, on the other hand, contains an inherently public element. For example, the creation of the agora lasts beyond one's own lifespan and is accessible to others, enabling an objective and communal world that stands between people and unites them. In doing so, work provides the conditions for the existence of a political community, where citizens can come together as members of that communal world to participate in speech and action. This in turn illustrates the interdependence of work and action. That is to say, the creation of the agora resulted from the activity of work, while at the same time facilitating a space for plurality to flourish thus providing the necessary conditions for speech and action.

Despite what our reading of Arendt suggests, work cannot be clearly set apart from labor, for its mediative character towards the public sphere is equally so towards the private sphere. To be sure, the activity of work can be identified with a duality, because it refers to both the activity of building a worldly object (e.g. building a table) as well as to the worldly object itself (e.g. a table). In turn, a worldly object, such as a table, enjoys a mediative character towards all three activities of the *vita activa*. Indeed, the worldly object of a table may accommodate private purposes such as book-keeping and administration, thus constituting labor. At the same time, a table may accommodate the purpose of building something new, thus constituting work. Finally, a table may accommodate public purposes, such as parliamentary debates and federal court cases, thus constituting action. While the private and public sphere are constituted by labor and action, respectively, work can thus be understood as a means to accommodate both spheres (see Figure 2).[6] This is also reflected in the way we commonly understand the notion of work, used to denote our daily jobs; we may do our job to earn a living, to contribute societally, and oftentimes for the sake of both (Morse and Weiss 1955).

The duality of innovation

Innovation can be understood as a form of work, particularly in the sense that it constitutes an artificial environment that distinguishes itself from nature. In this respect, our analysis of the duality of work leads us to conceptualize innovation with a similar duality. Similar to how work is both an activity and a durable worldly object that results for this activity, innovation may refer to both a dynamic process and a static artifact that results from this. For instance, we call the artefact of a smartphone an innovation as well as the process that led to this artefact. It is in this dynamic, also referred to as the ontogenetic process (Blok 2021), in which something new may be created and, therefore, where a component of action resides. In this respect, we argue that innovation does not only enable action but can also result from action. That is to say, there is first an unpredictable innovation process which leads to the creation of an innovation artefact, and the innovation artefact in turn enables the possibility of speech and action.

At the same time, the concept of innovation can be said to serve both the private and public sphere. On the one hand, as noted in Section 2, innovation is predominantly driven by a techno-economic orientation and widely presupposed in terms of technological and commercialized innovation. As claimed in the tradition of economic analysis, innovation is characterized by its technological dynamics and primarily directed at delivering value to consumers (Carlson and Wilmot 2006). As such, a techno-economic concept of innovation is based on rule-following logic and efficient means-end patterns (Blok 2021), particularly in response to the private pursuits of labor. Arendt, along with the phenomenological tradition, attributed this calculative logic to the threat of technology, ultimately warning for a victory of animal laborans over zoon politikon (Passerin 2019).

On the other hand, however, the conceptual origins of innovation suggest that innovation has little to do with technology, let alone with the market. Instead, for a large part of history, the concept of innovation had a fundamentally political meaning and was used as a pejorative to denote any change that threatened the established order (Godin 2015).
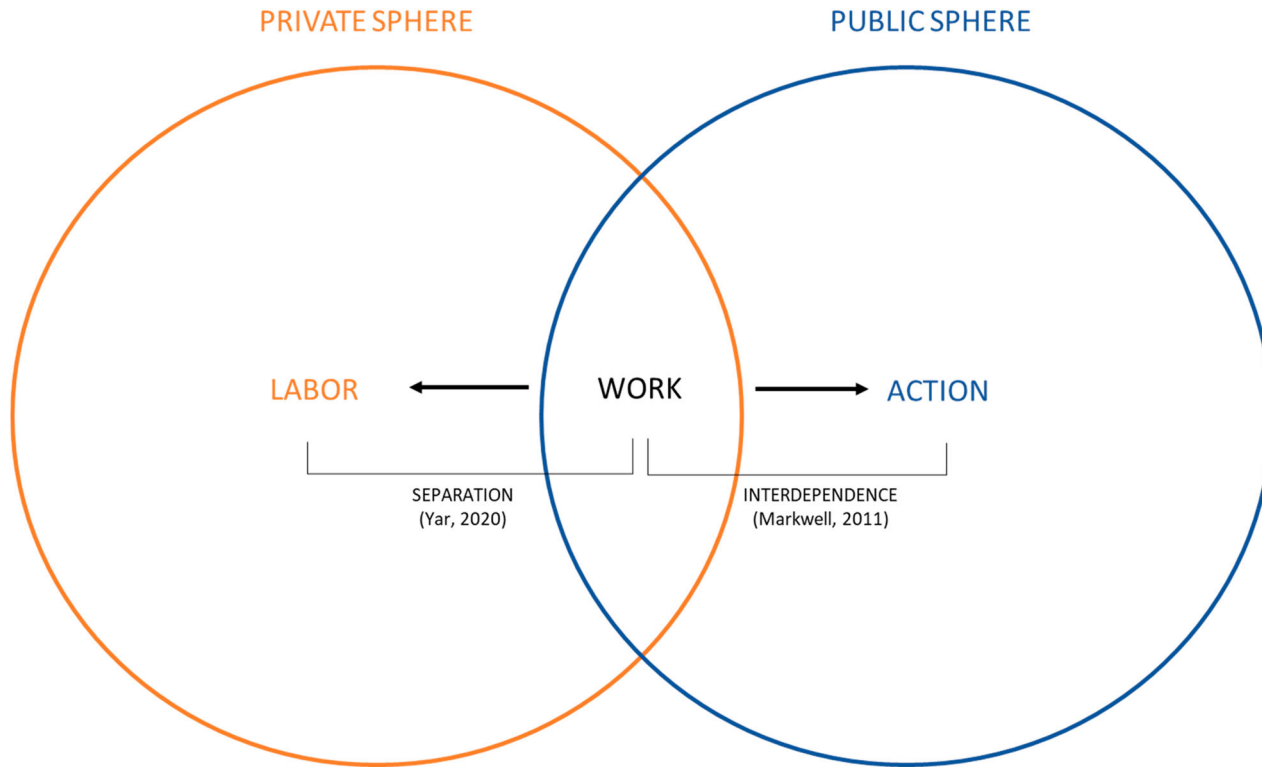
PRIVATE SPHERE — PUBLIC SPHERE

LABOR ← WORK → ACTION

SEPARATION
(Yar, 2020)

INTERDEPENDENCE
(Markwell, 2011)

Figure 2. The Duality of work in the vita activa.

Plato, for example, accused the innovator of seeking to renew the eternal and a priori determined values of truth, beauty, and justice (Blok 2018). In its historical sense, innovation changes 'the rules of the game' and thus differs from a classic conceptualization of technology, which much rather adheres to the rule-governed logic described earlier. With the introduction of the printing press, for instance, Johannes Gutenberg launched a technology which not only served a specific end, but which in effect led to the reformation, undermined the authority of the Catholic church, gave birth to the modern sciences, enabled radically new industries, and even transformed the shape of our brains (Naughton 2019). Remarkably, nobody in 1450 – which is around when Gutenberg's press was invented – could have predicted that printing would transform the world over the centuries to come. In this respect, it brings about an element of unpredictability and contingency, in striking contrast to how technology is classically conceptualized in terms of what we know and are always already familiar with (Heidegger 1977).

Against this background, we may posit a political concept of innovation that enhances the human capacity to speak up and take action, inspires radical novelty, and empowers the public sphere. Contrary to a techno-economic concept of innovation, which focusses much more readily on the further development of marketable technology trends in either incremental, architectural, disruptive or radical forms (Cf. Trott 2017), a political concept of innovation acknowledges its constitutive role in world creation.[7] For example, the steam engine, the compass, and the lightbulb are constitutive of our world (Blok 2022).

The analogy between the duality of work and the duality of innovation, may be understood in the expressive sense of 'it takes two to Tango', where a political concept of innovation inspired by the *vita activa* resides in the interdependence between work and action. As such, a political concept of innovation constitutes an artificial world in which speech and action are brought to flourish; through facilitating both a physical (or virtual) infrastructure and a symbolic space of appearance, citizens are activated to engage with one another. This political concept of innovation in turn provides the RI discourse with an alternative perspective, shifting its focus away from integrating ethical keys into a techno-economic concept of innovation, towards in effect operating a political concept of innovation. The question – to which we will turn in the next section – is how the RI discourse is to do so.

A vision of strong RI

In light of the foregoing, we define strong RI as the operation of a political concept of innovation that primarily serves the public sphere, through which the human capacity for speech and action is actualized in a way that unleashes a plurality of perspectives, values, and possibilities. At the substantial level of RI this means that innovative artifacts and services should prompt citizens to open up, speak their mind, and take initiative. Similarly, at the procedural level of RI, this means that innovation processes should expand their engagement with representative stakeholders to the direct involvement of citizens and allow for plurality to flourish. In the following, we will (1) account for three cornerstones in the actualization of speech and action; (2) show how these cornerstones translate into the operation of strong RI; and (3) illustrate what such an operation looks like at both the substantial and procedural level of innovation.

The first cornerstone constitutes plurality. Concretely, this means that the actualization of speech and action through innovation amounts to both a singular and a plural undertaking. For if to act means to open oneself up through words and deeds, it also means to make an appearance in public and engage with a plurality of others and their respective perspectives, values, and interests. This connection between the singular and the plural is perhaps best captured by what Jean-Luc Nancy calls the 'singular plural of Being' which notes that 'Being cannot be anything but being-with-one-another, circulating in the with and as the with of this singularly plural coexistence' (Nancy 2000, original emphasis, p. 3). In other words, to be ourselves we have to be with others. As such, the assertion of selfhood is not summoned to a collective identity, but rather integrated in a web of plurality. It is by virtue of this interwovenness between the singular and the plural that the individual can act and relate to others in ways that are unique and distinctive. To this end, strong RI articulates a plural mode of engagement, which bases innovation on direct contact with citizens, welcoming and even encouraging their differences. At first glance, strong RI substantiates the wider claim that innovation should not only be for society, but also with society. While this claim is itself not new, this cornerstone provides us with a philosophical justification based on political grounds. At the same time, strong RI opens this claim up, arguing that inclusion in innovation processes should not be limited to 'society' but rather expanded to the 'public'. Notably, aligned with Martin Heidegger's notion of 'Das Man', Arendt criticizes the notion of 'society', arguing that societal conduct and expectations limit the possibility for plurality to flourish. In a similar vein, we point to the need for public engagement rather than stakeholder engagement in innovation processes. In practice, citizens are often represented by stakeholders and only incorporated towards the end of the innovation process. This narrows the focus down to the private interests of the respective stakeholders, particularly in function of receiving their approval. In contrast, by engaging with the wider public early on, strong RI prevents generic deals and instead allows for situational solutions; no one-size-fits-all approach, but one in which a plurality of public interests is also determined at micro-level, e.g. by taking into account the regional culture and socio-economic circumstances.

The second cornerstone constitutes openness. To be sure, the RI literature emphasizes that we should open up our reflections to one another (Owen et al. 2013). While this 'opening up' tends to be conceptualized either in terms of mutual responsiveness (Von Schomberg 2013) or constructive conflict (Blok 2014), the very 'openness' in which we actually can and do open up forms a primary condition for the actualization of speech and action. Therefore, beyond the question of how we should open up, the question is how innovation can enhance and secure a space which ensures that we open up. In what way can RI enable a space for citizens to open up, that is, to speak and to act? Against this background, strong RI safeguards both a literal and symbolic openness in which people are unafraid and even excited to freely engage with one another. A potential successful example can be illustrated by the Catalyst project, which in collaboration with the NEMO Science Museum in Amsterdam proposes an experimental platform of art and science fiction that stimulates citizens to deliberate on how we should envision the city of the future. Such an approach also aligns with ongoing initiatives of 'direct democracy'. In France, for instance, citizen councils are organized to publicly discuss the topic of climate change. Under the sway of strong RI, similar councils could be organized to reflect on global challenges, including those that are 'politically' polarized like

climate change. Precisely because public engagement stimulates different opinions, addresses situational priorities, and may quickly intervene in case of undesirable developments, it ultimately generates political support, even in a polarized climate A recent project that advanced in this direction was the EU-funded Horizon2020 NewHoRRIzon initiative. Through this project, 18 'social labs' were established, bringing together stakeholders from various sectors, including academia, business, non-university research institutes, research funding organizations, policymakers, civil society organizations, and the public (Blok and Von Schomberg 2022). These social labs became collaborative spaces, fostering co-creation of tailor-made pilot actions to promote RI. The uniqueness of these social labs lies in their ability to facilitate social experiments within a practical context. Here, a variety of actors come together to address challenges creatively, free from the constraints of predefined project plans and lists of deliverables. One of the key attributes of this approach is embracing uncertainty, allowing participants to explore uncharted territory without having a fixed roadmap (Hassan 2014). This aligns perfectly with the essence of strong RI, inspired by the Arendtian understanding of action, where outcomes are not predefined but rather marked by the element of 'unexpected'. The social labs methodology offers an innovative and flexible approach to foster RI, promoting collaboration, and encouraging bold experimentation to tackle societal challenges (Timmermans et al. 2020).

The third cornerstone constitutes performative speech acts. In this, speech is not limited to describe a state of affairs, but in effect does or performs something, i.e. it is constitutive (Blok 2017). This conjugation between speech and action can be explained in three respects. First, speech serves as a means to formulate the significance of our actions as well as those of others, e.g. by praising or condemning the emergence of Artificial Intelligence (AI). Second, the sincerity of speech is often evaluated by the corresponding action, e.g. when advocates of solar energy fail or succeed to live up to their promise. Third, speech serves to recognize the inherent infelicity of action, e.g. through a code of conduct (Cf. Blok 2017). On the basis of these three premises, strong RI links responsibility in innovation directly with the performativity of the actors involved. RI discussions on innovations tend to be so abstract that they often result in the exclusion of the perspective of the innovators, as well as those of citizens who employ these innovations. An example that goes in this direction is the Debian Project of Linux, the free and open software alternative to closed and commercial computer systems. As explained by Andrew Maynard and Garbee (2019), Debian enables both developers and users to participate in and contribute to the computer processes and programs that they work with on a daily basis. This Linux distribution has its own constitution, social contract, and policy documents, none of which are regulated or mandated by external policies or organizations. Instead, 'the members of the Debian community take responsibility upon themselves to manage their activities in this way, and democratically create a structure that is deeply embedded in their shared values of transparency, open access, creating robust and dependable code, and contributing positively to the broader Linux community' (Maynard and Garbee 2019, 498). In this vein, strong RI emphasizes the action perspective of actors and their responsibility in innovation practices. This bridges the micro-level with the macro-level and at the same time reduces the feeling of powerlessness among citizens when debates on new developments emerge.

The operation of a political concept of innovation, i.e. strong RI, actualizes speech and action in accordance with the three above cornerstones. This means that strong RI is (1) principally a plural undertaking which guards the plurality of unique voices constituting the public sphere from artificial clusters of 'common stakes'; (2) enables a literal and symbolic openness that genuinely activates citizenry; and (3) engages with performative speech acts. As such, strong RI can be operated at both the substantial and procedural level of innovation. To be sure, the literature on RI clearly distinguishes between these two levels. At the substantial level, RI focusses primarily on the innovation artefact or service and how it is to generate responsible outcomes, e.g. through integrating norms and values into the design (Van den Hoven 2013). In the context of strong RI, this means that innovative artifacts and services should aim for the actualization of speech and action. Parallel to the Debian Project of Linux, the EU policy for Open Science seeks to introduce collaborative technologies that recognize and reward the participation of citizens and end users. More recently, Ethical, Legal and Social Aspects (ELSA) of research and innovation has gained renewed attention in various European funding schemes, with the establishment of ELSA labs. These labs are unique settings focused on exploring ethical, legal, and social aspects of new and emerging technologies, rather than focusing solely on technical design. One instance of such funding is the AI ELSA labs initiative, part of the AiNed program by the Netherlands AI Coalition. The primary goal of this program is to promote responsible and human-centric AI labs throughout the Netherlands. These labs employ strategies to ensure the incorporation of both human values and public values into AI-systems (Van Veenstra, van Zoonen, and Helberger 2021). This includes implementing features such as built-in 'contestability-by-design', where AI-systems are continuously refined in accordance with their inter- action with society. In this respect, the citizens' active engagement in technological advancement may demand a more iterative and less linear approach beyond the initial development phase. For this reason, ELSA Labs dedicated to human-centric AI aim to adopt an 'in-situ' or laboratory-style collaboration fostering a dynamic learning process crucial for the rapid evolution of a technology like AI (Van Veenstra, van Zoonen, and Helberger 2021). There are already 23 ELSA labs set up across the Nether- lands, and there are plans for more to be established in the future, supported by signifi- cant investments from the Dutch government. It is noteworthy, however, that there seems to be a lack of acknowledgment of RI, which could provide valuable support for ELSA research (Ryan & Blok 2023). The concept of strong RI outlined in this paper aligns well with the direction ELSA is taking, and its integration could further enhance the potential of this initiative.

At the procedural level, RI focuses primarily on the innovation process and how it is to be managed responsibly. To this end, particular attention is dedicated to reaching shared strategies and objectives through stakeholder engagement (Gould 2012). However, as noted earlier, such an approach often results in narrow configurations of RI where delib- eration is limited to a small range of mostly internal stakeholders and where 'second- order reflexivity and the political are almost entirely beyond scope, or at least deeply tacit' (Owen and Pansera 2019, 41). Alternatively, under the sway of operating a political concept of innovation, strong RI takes a pluralistic and non-reductive approach of the innovation process, i.e. in accordance with the three cornerstones of actualizing speech and action. It is pluralistic in the sense that it extends the involvement of

stakeholders with merely complementary disparities to the variety of values and interests of the wider public; and it is non-reductive in the sense that it does not reduce such involvement to 'common stakes', but instead aims to provide individuals with an openness for them to articulate their own stance and judgement, according to their own interests and value frames (Van Huijstee, Francken, and Leroy 2007). Moreover, strong RI realizes that inclusion does not de facto lead to societally desirables outcomes, meaning it commits to the promise of creating a better future, but acknowledges the possible inificity in doing so. The aforementioned social lab methodology serves as a good example of integrating citizens in the innovation process. Other examples include the New European Bauhaus and the implementation of the Green Deal, which stimulate conversations beyond usual circles, allowing for citizens to deliver insights concerning the most urgent needs and challenges in architecture and urban planning. To this end, the European Commission has launched a website and is currently exploring other possible tools dedicated to co-design and of co-creation.[8] Contrary to the instrumentalization of the RI discourse, which we labeled as weak RI, strong RI ultimately provides a vision of (1) what it means to include the public in innovation; (2) why it is important to do so; and (3) how this can be operationalized (see Table 2). At the core of this vision resides the choice, freedom, and uniqueness of the individual citizen who partakes in the public sphere, which in turn inspires innovation to break through techno-economic constraints as well as other organizational, disciplinary, and bureaucratic boundaries. At the academic level, strong RI seamlessly aligns with some ideas presented in the broader discourse on RI and the ethics of technology. Notably, Andy Stirling's work in Science and Technology Studies (STS) emphasizes the importance of shifting away from relying solely on expert analysis towards more participatory deliberation, where traditional linear and scientistic views of innovation are giving way to more nuanced and socially situated understandings of technology development (Stirling 2008). Similarly, Ulrike Felt's notion of 'new bureaucracies of virtue' (2017) holds that innovation efforts should not be confined to artificial clusters of shared interests, which thus resonates with our call to actualize a plurality of perspectives beyond representative stakeholders. Likewise, Udo Pesch's recent exploration of innovation imaginaries calls for opening up the implicit normative assumptions within innovation processes to public scrutiny. Parallel to the second cornerstone of strong RI, Pesch (2021) proposes to further democratize innovation processes by facilitating discussions on the desirability and credibility of worldviews and expectations held by technology developers. Also at

Table 2. A vision of strong RI.

Explanation: What?	Justification: Why?	Operation: How?
Both at substantial and procedural level, strong RI aims for the actualization of individual speech and action. It gets citizens to open up, speak their mind, and take initiative.	The actualization of speech and action genuinely enables plurality to flourish (beyond representative stakeholders), thus constituting the public sphere.	The operation of strong RI requires: (1) A plurality of values and perspectives; (2) A physical (or virtual) and symbolic openness that invites and activates plurality; (3) Performative speech acts.

the policy level, our vision of strong RI aligns with the ambitions of Horizon Europe, the EU Framework Program for Research and Innovation that runs from 2020 to 2027, which calls for a mission-driven approach that continues to feature big-picture research targeted at delivering societally desirable outcomes. In this view, 'missions must be bold, activating innovation across sectors, across actors and across disciplines. They must also enable bottom-up solutions and experimentation' (European Commission 2018, 2). On the one hand, strong RI contributes to laying a conceptual foundation for this mission-oriented approach and ultimately enhances the 'boldness' Horizon Europe calls for. On the other hand, strong RI emphasizes that these missions can only be undertaken insofar as they serve a plurality of unique voices beyond what a limited group of stakeholders may define as 'societally desirable'. At this stage, strong RI is mostly conceptually founded and could still benefit from further empirical analysis. While examples like the Debian Project of Linux are promising, they still require a more in-depth assessment. To what extent do they really succeed in actualizing a plurality of unique voices beyond techno-economic constraints? Is this effectively creating a better future for all? Future research still needs to develop a performance measurement system (Cf. Neely, Gregory, and Platts 1995) that uses key indicators to monitor how innovation processes and artefacts effectively enable citizenry, and to what extent doing so exceeds the techno-economic practices.

Also at the conceptual level, the basic assumption that in order for RI to genuinely serve society it needs to exceed economic incentives, could benefit from further critical analysis. From a neoliberal perspective, for instance, it could be argued that economic and societal purposes do not conflict with one another, and that market competition even serves as a driving force for tackling global issues. For example, catalytic converters are improving air quality significantly, while engineered microbes are successfully producing biodegradable plastics. An important nuance here, however, is that while these are not examples of strong RI in the strict sense of enhancing speech and action, they may still very well be forms of responsible innovations. In this respect, the differentiation between weak RI and strong RI is essentially made to denote the absence or presence of a political dimension. While weak RI can still yield responsible innovations operating within the private sphere, strong RI is primarily tasked with integrating innovation into the public sphere. In doing so, strong RI offers a way to address the complexities and epistemic uncertainties of the future, without undoing the societal potential of techno-economic developments.

Finally, the operation of strong RI could be posed with the particular challenge to find a balance between under-inclusion and over-inclusion. While this paper mostly points to the problem of under-inclusion in RI, there are also potential socio-ethical risks with over-inclusion, especially when people foster dishonest and even terrorizing intentions (Popa and Blok 2022). In this respect, it will be a crucial step to discuss and establish criteria for speech and action in a way that enhances plurality and genuinely helps to reveal each other's blind spots and assumptions, while maintaining respect for each other's differences (Cf. Callon, Lascoumes, and Barthe 2009).

Conclusion

In this paper we responded to the emerging call for an orientation shift from a techno-economic concept of innovation towards a political concept of innovation in the context

of RI. In Section 1, we showed that the urgency for this shift is grounded in a conceptual ambiguity of RI, where the ambition to serve public interests is ontologically undermined by a techno-economic concept of innovation. Even though today's global issues urge innovation to go beyond the sole purpose of generating commercial impact – thereby paving the way for RI – the broader context of innovation remains techno-economically oriented – thereby limiting the possibility of RI. For this reason, the call for a political concept of innovation has been made both explicit and urgent in recent literature. This call suggests that RI does not simply entail an application of the 'R' to the 'I' – limiting its contribution to the private sphere – but constitutes the very transformation of the 'I' – fundamentally serving the public sphere.

By drawing attention to the concept of innovation, we comply with efforts such as Blok and Lemmens (2015) and Timmermans and Blok (2021) to help raise self-awareness of the RI community about its biases and preconceptions. It is important to note that our contribution to this discussion does not lie in our focus on the techno-economic ideology of innovation as such, which is already implicit in the concept of RI itself, but rather in our critique of the idea that we can simply overcome this ideology through governance and regulation. This is where the philosophical distinction between the ontic and the ontological has proven to be useful. At an ontic level, RI literature offers numerous critical approaches to innovation in a variety of fields, but at the ontological level, RI remains closely tied to a techno-economic concept of innovation. By highlighting this ontological dimension, we essentially provide an explanation for a tendency to instrumentalize the RI discourse.

In turn, the rehabilitation of an ontological dimension in RI can provide new insights for the philosophy of technology. Contemporary philosophers of technology generally argue that each technology mediates the human-world relation in its own way and have thus taken distance from ontological views of technology. In contrast, we argue that under the sway of innovation – as *the* ontological category of our age – technology does not only mediate but is itself mediated. While we acknowledge that different technologies have different purposes and uses and mediate the human-world relationship in different ways, they are all still ontologically embedded in the age of innovation. In this sense, our approach revitalizes the idea that there is an underlying force driving the emergence of new technologies. However, unlike more classical accounts, we do not see this force as a threat which bounds humanity to a purely calculative logic. Instead, precisely because the meaning of innovation is much broader and more political than the tradition of economic analysis may suggest, we see the possibility for technology to be ontologically embedded in the public sphere.

To this end, in Section 2, we developed a political concept of innovation inspired by the *vita activa* of Hannah Arendt. We argued that, as such, the concept of innovation reflects a mediative character, facilitating both the private and the public sphere. In the same way the activity of work serves as a means to satisfy labor (private) and enable action (public), the concept of innovation is subject to a techno-economic orientation (private) and a political orientation (public). In light of the expressive sense of 'it takes two to Tango', we concluded that a political concept of innovation constitutes the interdependence between work and action. Through creating an artificial world in which citizens actively engage with one another, a political concept of innovation supports speech and action, inspires radical novelty, and empowers the public sphere. Departing from this insight, we opened an alternative path for the RI discourse, shifting its focus

away from merely integrating ethical keys into a techno-economic concept of innovation, towards in effect operating a political concept of innovation.

To a certain extent, our articulation of a political concept of innovation may also be understood as a techno-political concept of innovation. However, a techno-political concept of innovation still excludes the possibility for other forms of innovation, such as social innovation (Howaldt, Kaletka, and Schröder 2021), frugal innovation (Srinivas and Pandey 2019), and educational innovation (Freire 2000) which may equally enhance speech and action, inspire radical novelty, and empower the public sphere. For this reason, the all-encompassing sense of a political concept of innovation, which includes but is not limited to technology, better fits the purpose of RI.

Finally, in Section 3 we accounted for the operation of a political concept of innovation in the RI discourse; an operation we defined as strong RI. As such, we argued that strong RI primarily serves the public sphere through actualizing the human capacity for speech and action in a way that unleashes a plurality of perspectives, values, and possibilities. We considered three cornerstones in the actualization of speech and action through which we denoted that strong RI (1) is principally a plural undertaking which guards the plurality of unique voices from artificial clusters of 'common stakes'; (2) enables a literal and symbolic openness that genuinely activates citizenry; and (3) engages with performative speech. At the substantial level of RI this means that artifacts and services should get citizens to open up, speak their mind, and take initiative. Similarly, at the procedural level of RI, this means that innovation processes should expand their engagement with representative stakeholders to the direct involvement of citizens and allow for plurality to flourish. Ultimately, strong RI politicizes the discourse on RI precisely in the way it was originally envisioned, that is, by making innovation a fundamentally political matter (Owen et al. 2013). In this view, politics is not merely an extension of RI but is itself the condition of RI; it is what enables innovation to genuinely serve the public sphere.

Notes

1. We use the term RI throughout the paper, while acknowledging the use of the terms Responsible Research and Innovation (RRI) by the European Commission. See Owen and Pansera (2019) for a discussion about the overlap and differences in these terms.
2. Notably, in a recent workshop on the challenges of RI, held in Leiden University (2019), speakers discussed 'the mainstream challenge of RI' in which the discourse must decide whether to continue business-as-usual or to take a radical stance against it. In this respect, they pointed to both the conservative force and revolutionary potential of RI. For a summary report of the workshop see: https://app.box.com/s/z1uzybq083u1c3bs18iun7 wi5r019maq.
3. An important nuance to highlight is that the private sphere is not homogenously driven by profit, as evidenced by the emergence of movements like Benefit Corporations and social enterprises. In this respect, we recognize that weak RI can still offer responsible and meaningful innovations. However, this should be distinguished from strong RI, which centers around constituting a fundamentally political concept of innovation.
4. To be sure, Arendt argues that the distinction between labor and work corresponds to a distinction between two types of human beings: the homo laborans, or the worker, who is engaged in the activity of labor, and the homo faber, or the maker, who is engaged in the activity of work. According to Arendt, the homo laborans is not motivated by self-interest, but rather by the need to sustain life and support those dependent on them. The homo faber, on the other hand, is motivated by the desire to create and produce things that serve some

other purpose or goal and may be motivated by self-interest to some extent. Even so, homo laborans may still be considered to constitute the private sphere and clearly distinguishes from zoon politikon which refers to the human being as a political animal constituting the public sphere.

5. It is important to note that certain elements from nature can also contribute to our worldliness. For example, a meadow may not be a direct human-made construction like a building or a bridge, but it can still form part of the relationship with human activities, such as recreation, farming, and ecological conservation. For a more comprehensive exploration of the interplay between the earth and the world, see Blok (2023) who argues that the former in fact constitutes the ground for the latter.

6. In the literature on innovation management, the innovation matrix provides a framework for categorizing different types of innovation (Trott 2017). One classification is incremental innovation, which involves continuously improving existing products or services to enhance value for the current market (e.g. Iphone 8 making place for Iphone X). Another classification is architectural innovation, which occurs when new products or services utilize existing technology to create new markets or reach new consumers (e.g. the smartwatch, which repackages smartphone technology into a wearable device). Disruptive innovation, on the other hand, occurs when a new product or service enters the existing market with novel technology (e.g. the iPad disrupted the market for traditional laptops). Lastly, radical innovation involves the development of new products or services that utilize new technology to open entirely new markets (e.g. the airplane). While the innovation matrix primarily explores the relationship between technology and the market, in our discussion we seek to emphasize a political dimension of innovation and how it serves the public sphere.

7. Note that, contrary to our analysis and that of Reijers (2020), a more general reading of Arendt suggests that action is by and in itself the *diferentia specifica* of the human condition and must be considered in opposition to labor and work altogether (Passerin 2019).

8. https://europa.eu/new-european-bauhaus/index_en

Notes on contributors

Lucien von Schomberg is a Senior Lecturer in Creativity and Innovation at the University of Greenwich. As a scholar in the field of responsible innovation, Lucien leads several research projects and workstreams, and establishes partnerships with organizations across the world. He also plays an active role in a variety of EU-funded projects with a cumulative net worth of £12 million, while driving transformative change through pioneering research and innovative initiatives. His work is published in philosophy journals including *Synthese* and *Philosophy & Technology* and further disseminated through a range of book chapters, conference papers, project reports, whitepapers, webinars, blogs, and podcasts. In addition, he is editorial board member of academic journals *Philosophy of Management* and *NOvation*, and guest editor of a special issue at the *Journal of Responsible Innovation*.

Vincent Blok is Associate Professor at the Philosophy Group, Wageningen University (Netherlands). From 2002 to 2006, he held various management functions in the health care sector. In 2006, he became director of the Louis Bolk Institute, an international research institute in the field of organic and sustainable agriculture, nutrition, and health care. Since 2010, he teaches in the fields of Philosophy of Technology, Responsible Innovation, Business Ethics. He published three monographs with Routledge and over 100 articles in both philosophy journals (*Business Ethics Quarterly, Environmental Values, Philosophy and Technology, Synthese,* etc.) and interdisciplinary journals (*Science, Journal of Cleaner Production, Public Understanding of Science,* etc.)

Disclosure statement

Funding

ORCID

Lucien von Schomberg 🆔 http://orcid.org/0000-0003-2299-8812

References

Arendt, H. 1977. "Public Rights and Private Interests." In *Small Comforts for Hard Times: Humanists on Public Policy*, edited by M. Mooney, and F. Stuber. Columbia University Press.

Arendt, H. 1998. *The Human Condition*. University of Chicago Press.

Åm, H. 2019. "Limits of Decentered Governance in Science-Society Policies." *Journal of Responsible Innovation* 6 (2): 163–178. https://doi.org/10.1080/23299460.2019.1605483.

Blok, V. 2014. "Look Who's Talking: Responsible Innovation, the Paradox of Dialogue and the Voice of the Other in Communication and Negotiation Processes." *Journal of Responsible Innovation* 1 (2): 171–190. https://doi.org/10.1080/23299460.2014.924239.

Blok, V. 2017. "Bridging the Gap Between Individual and Corporate Responsible Behaviour: Toward a Performative Concept of Corporate Codes." *Philosophy of Management* 16 (2): 117–136. https://doi.org/10.1007/s40926-016-0045-7.

Blok, V. 2018. "Towards an Ontology of Innovation: On the New, the Political-Economic Dimension and the Intrinsic Risks Involved in Innovation Processes." In *The Routledge Handbook of the Philosophy of Engineering*, edited by D. P. Michelfelder, and N. Doorn. Routledge.

Blok, V. 2021. "What is Innovation? Laying the Ground for a Philosophy of Innovation." *Techné: Research in Philosophy and Technology* 25 (1): 72–96. https://doi.org/10.5840/techne2020109129.

Blok, V. 2022. "The Ontology of Creation: Towards a Philosophical Account of the Creation of World in Innovation Processes." *Foundations of Science*, https://doi.org/10.1007/s10699-022-09848-y.

Blok, V. 2023. "The Earth Means the World to me: Earth- and World-Interest in Times of Climate Change." In *Handbook of Philosophy of Climate Change*, edited by G. Pellegrino, and M. Di Paola, 1–17. Springer International Publishing. https://doi.org/10.1007/978-3-030-16960-2_105-1.

Blok, V., and P. Lemmens. 2015. "The Emerging Concept of Responsible Innovation. Three Reasons why it is Questionable and Calls for a Radical Transformation of the Concept of Innovation." In *Responsible Innovation 2: Concepts, Approaches, and Applications*, edited by B.-J. Koops, I. Oosterlaken, H. Romijn, T. Swierstra, and J. van den Hoven, 19–35. Springer International Publishing. https://doi.org/10.1007/978-3-319-17308-5_2.

Blok, V., and L. Von Schomberg. 2022. "Introduction." In *Putting Responsible Research and Innovation Into Practice*, edited by V. Blok. https://doi.org/10.1007/978-3-031-14710-4_1.

Böhmer, M., T. S. Saponas, and J. Teevan. 2013. "Smartphone Use does not have to be Rude: Making Phones a Collaborative Presence in Meetings." In: *Proceedings of the 15th International Conference on Human-Computer Interaction with Mobile Devices and Services*, 342–351. https://doi.org/10.1145/2493190.2493237.

Callon, M., P. Lascoumes, and Y. Barthe. 2009. *Acting in an Uncertain World: An Essay on Technical Democracy*. MIT Press.

Carlson, C. R., and W. W. Wilmot. 2006. *Innovation: The Five Disciplines for Creating What Customers Want*. Crown Business.

De Hoop, E., A. Pols, and H. Romijn. 2016. "Limits to Responsible Innovation." *Journal of Responsible Innovation* 3 (2): 110–134. https://doi.org/10.1080/23299460.2016.1231396.

European Commission. 2018. *Mission-Oriented Research & Innovation in the European Union: A Problem Solving Approach to Fuel Innovation Led Growth*. LU: Publications Office.

European Commission. 2020. Horizon 2020: work programme 2018-2020: Science with and for Society. *Resource document*. https://ec.europa.eu/research/participants/data/ref/h2020/wp/2018-2020/main/h2020-wp1820-swfs_en.pdf.

Felt, U. 2017. "Response-able Practices" or "New Bureaucracies of Virtue": The Challenges of Making RRI Work in Academic Environments." In *Responsible Innovation 3*, edited by L. Asveld, R. van Dam-Mieras, T. Swierstra, S. Lavrijssen, K. Linse, and J. van den Hoven. Springer. https://doi.org/10.1007/978-3-319-64834-7_4.

Ferrari, A., C. Coenen, and A. Grunwald. 2012. "Visions and Ethics in Current Discourse on Human Enhancement." *NanoEthics* 6 (3): 215–229. https://doi.org/10.1007/s11569-012-0155-1.

Freeman, C., and L. Soete. 1982. *The Economics of Industrial Innovation*. Cambridge: MIT Press.

Freire, P. 2000. *Pedagogy of the oppressed*. Continuum.

Godin, B. 2015. *Innovation Contested: The Idea of Innovation Over the Centuries*. Routledge.

Gould, W. R. 2012. "Open Innovation and Stakeholder Engagement." *Journal of Technology Management & Innovation* 7 (3): 1–11. https://doi.org/10.4067/S0718-27242012000300001.

GREAT. 2014. Project Deliverable 2.3. Resource Document. www.great-project.eu/deliverables_files/deliverables02.

Grinbaum, A., and C. Groves. 2013. "What is "Responsible" About Responsible Innovation? Understanding the Ethical Issues." In *Responsible Innovation*, edited by R. Owen, J. Bessant, and M. Heintz, 119–142. John Wiley & Sons. https://doi.org/10.1002/9781118551424.ch7.

Grunwald, A. 2010. "From Speculative Nanoethics to Explorative Philosophy of Nanotechnology." *NanoEthics* 4 (2): 91–101. https://doi.org/10.1007/s11569-010-0088-5.

Grunwald, A. 2019. "Responsible Innovation in Emerging Technological Practices." In *International Handbook on Responsible Innovation*, edited by R. von Schomberg, and J. Hankins, 326–338. Edward Elgar Publishing. https://doi.org/10.4337/9781784718862.00031.

Hartley, S., W. Pearce, and A. Taylor. 2017. "Against the Tide of Depoliticization: The Politics of Research Governance." *Policy Politics* 45 (3): 361–377. https://doi.org/10.1332/030557316X14681503832036.

Hassan, Z. 2014. *The Social Labs Revolution: A New Approach to Solving Our Most Complex Challenges*. Berrett-Koehler Publishers.

Heidegger, M. 1977. "The Turning." In *The Question Concerning Technology, and Other Essays*. Harper and Row.

Howaldt, J., C. Kaletka, and A. Schröder, eds. 2021. "A Research Agenda for Social Innovation: The Emergence of a Research Field." In *A Research Agenda for Social Innovation*. Edward Elgar Publishing. https://doi.org/10.4337/9781789909357.00007.

Ihde, D. 1993. *Philosophy of Technology: An Introduction*. Paragon House.

Jonas, H. 1984. *The Imperative of Responsibility: In Search of an Ethics for the Technological Age*. University of Chicago Press.

Ludwig, D., V. Blok, M. Garnier, P. Macnaghten, and A. Pols. 2022. "What's Wrong with Global Challenges?" *Journal of Responsible Innovation* 9 (1): 6–27. https://doi.org/10.1080/23299460.2021.2000130.

Ludwig, D., and P. Macnaghten. 2019. "Traditional Ecological Knowledge in Innovation Governance: A Framework for Responsible and Just Innovation." *Journal of Responsible Innovation* 7 (1): 26–44. https://doi.org/10.1080/23299460.2019.1676686.

Markell, P. 2011. "Arendt's Work: On the Architecture of The Human Condition." *College Literature* 38 (1): 15–44.

Maynard, A. D., and E. Garbee. 2019. "Responsible Innovation in a Culture of Entrepreneurship: A US Perspective." In *International Handbook on Responsible Innovation*, edited by R. von Schomberg, and J. Hankins, 488–502. Edward Elgar Publishing. https://doi.org/10.4337/9781784718862.00043.

Morse, N. C., and R. S. Weiss. 1955. "The Function and Meaning of Work and the Job." *American Sociological Review* 20 (2): 191–198. https://doi.org/10.2307/2088325.

Nancy, J.-L. 2000. *Being Singular Plural*. Stanford University Press.

Naughton, J. 2019. "The Goal is to Automate Us": Welcome to the Age of Surveillance Capitalism. *The Guardian*. https://www.theguardian.com/technology/2019/jan/20/shoshana-zuboff-age-of-surveillance-capitalism-google-facebook.

Neely, A., M. Gregory, and K. Platts. 1995. "Performance Measurement System Design: A Literature Review and Research Agenda." *International Journal of Operations & Production Management* 15 (4): 80–116. https://doi.org/10.1108/01443579510083622.

Nordmann, A. 2010. "A Forensics of Wishing: Technology Assessment in the Age of Technoscience." *Poiesis & Praxis* 7 (1): 5–15. https://doi.org/10.1007/s10202-010-0081-7.

Novitzky, P., M. J. Bernstein, V. Blok, R. Braun, T. T. Chan, W. Lamers, A. Loeber, I. Meijer, R. Lindner, and E. Griessler. 2020. "Improve Alignment of Research Policy and Societal Values." *Science* 369 (6499): 39–41. https://doi.org/10.1126/science.abb3415.

Owen, R., and M. Pansera. 2019. "Responsible Innovation: Process and Politics." In *International Handbook on Responsible Innovation*, edited by R. von Schomberg, and J. Hankins, 35–48. Edward Elgar Publishing. https://doi.org/10.4337/9781784718862.00009.

Owen, R., J. Stilgoe, P. Macnaghten, M. Gorman, E. Fisher, and D. Guston. 2013. "A Framework for Responsible Innovation." In *Responsible Innovation*, edited by R. Owen, J. Bessant, and M. Heintz, 27–50. John Wiley & Sons. https://doi.org/10.1002/9781118551424.ch2.

Owen, R., R. von Schomberg, and P. Macnaghten. 2021. "An Unfinished Journey? Reflections on a Decade of Responsible Research and Innovation." *Journal of Responsible Innovation* 8 (2): 217–233. https://doi.org/10.1080/23299460.2021.1948789.

Passerin, M. 2019. "Hannah Arendt." In *The Stanford Encyclopedia of Philosophy*, edited by E. N. Zalta. Metaphysics Research Lab, Stanford University. https://plato.stanford.edu/archives/fall2019/entries/arendt/.

Pellé, S. 2016. "Process, Outcomes, Virtues: The Normative Strategies of Responsible Research and Innovation and the Challenge of Moral Pluralism." *Journal of Responsible Innovation* 3 (3): 233–254. https://doi.org/10.1080/23299460.2016.1258945.

Penttilä, L. 2022. "Is Responsible Innovation Possible? The Problem of Depoliticization for a Normative Framework of RI." *NOvation: Critical Studies of Innovation*, 107–126.

Pesch, U. 2021. "Imaginaries of Innovation: Turning Technology Development Into a Public Issue." *Science and Public Policy* 48 (2): 257–264.

Pfotenhauer, S. M., and J. Juhl. 2017. "Innovation and the Political State: Beyond the Myth of Technologies and Markets." In *Critical Studies of Innovation*, edited by B. Godin, and D. Vinck, 68–94. Edward Elgar.

Popa, E. O., and V. Blok. 2022. "Responsible Innovation in the age of Science Conspiracism." *Journal of Responsible Innovation* 9 (3): 398–418. https://doi.org/10.1080/23299460.2022.2116804.

Reijers, W. 2020. "Responsible Innovation Between Virtue and Governance: Revisiting Arendt's Notion of Work as Action." *Journal of Responsible Innovation* 7 (3): 471–489. https://doi.org/10.1080/23299460.2020.1806524.

Rodríguez, H., A. Eizagirre, and A. Ibarra. 2019. "Dynamics of Responsible Innovation Constitution in European Union Research Policy: Tensions, Possibilities and Constraints." In *International Handbook on Responsible Innovation*, edited by R. von Schomberg, and J. Hankins, 167–180. Edward Elgar Publishing. https://doi.org/10.4337/9781784718862.00018.

Ryan, M., and V. Blok. 2023. "Stop Re-inventing the Wheel: Or How ELSA and RRI can align." *Journal of Responsible Innovation* 10 (1). https://doi.org/10.1080/23299460.2023.2196151.

Srinivas, K. R., and P. Pandey. 2019. "Indian Perspectives on Responsible Innovation and Frugal Innovation." In *International Handbook on Responsible Innovation*, edited by R. von Schomberg, and J. Hankins, 455–473. Edward Elgar Publishing. https://doi.org/10.4337/9781784718862.00041.

Stemerding, D. 2019. "From Technology Assessment to Responsible Research and Innovation in Synthetic Biology." In *International Handbook on Responsible Innovation*, edited by R. von Schomberg, and J. Hankins, 339–354. Edward Elgar Publishing. https://doi.org/10.4337/9781784718862.00026.

Stilgoe, J. 2019. "Shared Space and Slow Science in Geoengineering Research." In *International Handbook on Responsible Innovation*, edited by R. von Schomberg, and J. Hankins, 259–270. Edward Elgar Publishing. https://doi.org/10.4337/9781784718862.00026.

Stilgoe, J., R. Owen, and P. Macnaghten. 2013. "Developing a Framework for Responsible Innovation." *Research Policy* 42 (9): 1568–1580. https://doi.org/10.1016/j.respol.2013.05.008.

Stirling, A. 2008. "Opening up" and "Closing Down": Power, Participation, and Pluralism in the Social Appraisal of Technology." *Science, Technology, & Human Values* 33 (2): 262–294. https://doi.org/10.1177/0162243907311265.

Timmermans, J., and V. Blok. 2021. "A Critical Hermeneutic Reflection on the Paradigm-Level Assumptions Underlying Responsible Innovation." *Synthese* 198 (S19): 4635–4666. https://doi.org/10.1007/s11229-018-1839-z.

Timmermans, J., V. Blok, R. Braun, R. Wesselink, and RØ Nielsen. 2020. "Social Labs as an Inclusive Methodology to Implement and Study Social Change: The Case of Responsible Research and Innovation." *Journal of Responsible Innovation* 7 (3): 410–426. https://doi.org/10.1080/23299460.2020.1787751.

Trott, P. 2017. *Innovation management and new product development*. 6th ed. Pearson.

Van de Poel, I. 2013. "Translating Values Into Design Requirements." In *Philosophy and Engineering: Reflections on Practice, Principles and Process*, edited by D. P. Michelfelder, N. McCarthy, and D. E. Goldberg, 253–266. Springer Netherlands. https://doi.org/10.1007/978-94-007-7762-0_20.

Van den Hoven, J. 2013. "Value Sensitive Design and Responsible Innovation." In *Responsible Innovation*, edited by R. Owen, J. Bessant, and M. Heintz, 75–83. John Wiley & Sons. https://doi.org/10.1002/9781118551424.ch4.

Van der Burg, S. 2014. "On the Hermeneutic Need for Future Anticipation." *Journal of Responsible Innovation* 1 (1): 99–102. https://doi.org/10.1080/23299460.2014.882556.

Van Huijstee, M. M., M. Francken, and P. Leroy. 2007. "Partnerships for Sustainable Development: A Review of Current Literature." *Environmental Sciences* 4 (2): 75–89. https://doi.org/10.1080/15693430701526336.

Van Oudheusden, M. 2014. "Where are the Politics in Responsible Innovation? European Governance, Technology Assessments, and Beyond." *Journal of Responsible Innovation* 1 (1): 67–86. https://doi.org/10.1080/23299460.2014.882097.

Van Veenstra, A. F., E. A. van Zoonen, and N. Helberger. 2021. ELSA Labs for Human Centric Innovation in AI. *Resource Document*. https://nlaic.com/wp-content/uploads/2022/02/ELSA-Labs-for-Human-Centric-Innovation-in-AI.pdf.

Verbeek, P. 2005. *What Things Do: Philosophical Reflections on Technology, Agency, and Design*. Pennsylvania: Penn State University Press.

Von Schomberg, R. 2013. "A Vision of Responsible Research and Innovation." In *Responsible Innovation*, edited by R. Owen, J. Bessant, and M. Heintz, 51–74. John Wiley & Sons. https://doi.org/10.1002/9781118551424.ch3.

Von Schomberg, R. 2019. "Why Responsible Innovation?" In *International Handbook on Responsible Innovation*, edited by R. von Schomberg, and J. Hankins, 12–32. Edward Elgar Publishing. https://doi.org/10.4337/9781784718862.00006.

Von Schomberg, R. 2020. "In Memory of Karl-Otto Apel: The Challenge of a Universalistic Ethics of Co-Responsibility." In: *Social Science Research Network*. https://papers.ssrn.com/abstract = 3515173.

Von Schomberg, L., and V. Blok. 2018. The Turbulent Age of Innovation. In: *Synthese*. https://doi.org/10.1007/s11229-018-01950-8.

Von Schomberg, L., and V. Blok. 2019. "Technology in the Age of Innovation: Responsible Innovation as a new Subdomain Within the Philosophy of Technology." *Philosophy & Technology*, https://doi.org/10.1007/s13347-019-00386-3.

Zwier, J., V. Blok, and P. Lemmens. 2016. "Phenomenology and the Empirical Turn: A Phenomenological Analysis of Postphenomenology." *Philosophy and Technology*. https://doi.org/10.1007/s13347-016-0221-7.