A Normative Understanding of Innovation

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ABSTRACT

Commentators have bemoaned the absence of a clear conceptual understanding of innovation both generally and within responsible innovation (RI). Much of our thinking about innovation is fragmented into separate categories such as "business," "social" or "technological" innovation with no clear understanding of the term these adjectives modify. In addition, RI discussions focus overwhelmingly on technological advances delivered through the marketplace, which are only a portion of the innovation story. Clearly, we need to develop a stronger account of the concept of innovation. What criteria must be satisfied for a contribution to the world to qualify as an innovation or, more simply, what is an innovation? This article will contend that innovation is inescapably normative, and that we can construct an understanding of innovation by elaborating on its normative elements and their implications. Innovation, I will propose, is *ethical change that delivers substantial applied value to beneficiaries of a domain.* After developing this account, I will show how it can reframe our understanding of innovation's relationship with technology and the marketplace, the innovator's understanding of technology, who gets to innovate, and why the various categories of innovation may be more diverting than helpful. I will also reflect on how the account of innovation offered here can refine our understanding of RI.[1]

INTRODUCTION – CHALLENGE AND OVERVIEW

Commentators have bemoaned the lack of a clear conceptual understanding of innovation both generally and within the framework of responsible innovation ("RI") (von Schomberg & Blok, 2018). As Blok (2021) notes, innovation is "nowadays self-evidently understood as the commercialization of technological inventions". By this understanding, how are we to understand the contributions that are: technological but not commercial, such as Merck's donation of a drug to cure river blindness (Merck, 2021); commercial but not technological, such as business model innovation (Johnson, 2018); or neither, such hospice care (Parkes, 2008)?

Gaglio, Godin & Pfotenhauer (2019) describe (without endorsing) the profusion of innovation categories as "X-innovation" – social, technological, industrial, organizational, open innovation, and so on. But how are we to understand *innovation* – the term that the X terms modify? The lack of a more general understanding of innovation may help explain the proliferation of these domain- or method-dependent understandings of the term. Is there something that all innovations – technological, social, commercial, or otherwise – have in common? A *unified* understanding of innovation may show these X categories to be more distracting than helpful, and keep us from narrowing our search for solutions before we begin.

The phrase "responsible innovation" is hardly immune from conceptual concerns. Does the adjective "responsible" imply that "innovation hitherto has been irresponsible, or at least not explicitly responsible" (Gaglio *et al.*, 2019, p. 13)? The anomaly disappears when we are reminded of RI's tendency to associate innovation with technological change,[2] which renders the term "responsible" anything but redundant given the risks posed by new technologies. But, as noted, not all innovation is technological and, as a review of the patent records will affirm, not all technological change is innovation. Thus, RI needs to be grounded on a deeper understanding of innovation – the term that "responsible" modifies. The concerns are not merely semantic: a constricted view of innovation is hardly the strongest foundation for expanding participation and exploring the full range of innovation opportunities and risks, two of RI's ambitions (Baur, 2021; Robinson, 2020).

Clearly, we need to develop a stronger account of the concept of innovation. (Blok, 2018). Although innovation could be thought of as a process (for example, von Schomberg, 2013, p. 63; Tidd & Bessant, p. 19), questions of process presuppose

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

an understanding of the *goal*, which is our focus here. This article asks what criteria must be satisfied for a contribution to the world to qualify as an innovation or, more simply, what is an innovation? The term "innovation" has been appropriated for a variety of purposes through the decades (Gaglio *et al.*, 2019), and my objective is not to catalogue or reconcile the term's varied use. Instead, I will propose that we understand the term "innovation" in a particular way, roughly akin to what Stevenson called a "persuasive" definition (Boisvert, 2021). I am hopeful that the understanding I propose here will clarify and help to unify our understanding of the term and have important implications for innovation practice and for RI.

Innovation, I will contend, is *ethical change that delivers substantial applied value to beneficiaries of a domain* (hereafter, the "proposed understanding," "account" or "definition"). In the sections that follow, I will develop this account, elaborate on its elements, and explore its implications. The article will begin with a discussion of why innovation is best understood as change that makes the world *better*. Because "better" is a normative concept, I will next turn to the nature of normativity and its various dimensions. I will draw on "fitting accounts" of value to explain why value is not only a referendum on what persons desire, but also on what they are warranted in desiring. I will explain why innovation delivers *applied* values and reflect on the interpretive range of that term. The article will next consider ethics, distinguishing it from "value" and explaining why delivery of value is a necessary but not sufficient condition of innovation. Ethics, I will argue, provides more than a post-delivery critique of our innovation efforts; it is a condition of innovating in the first place.

The article will next examine the nature of innovation change, exploring the concepts of domains and beneficiaries, introducing "suboptimal states" to consider the types of value that innovators can deliver, and explaining why change that qualifies as innovation must also be substantial. Next, I will consider the challenge of "delivering" value, offering a conception of technology well beyond the highly engineered artifacts that are widely associated with the term. After developing the proposed account of innovation, I will explore its relation to the various categories of X-innovation – suggesting that the proposed account can help us unify our understanding of innovation. The article will then discuss how the proposed account can deepen and refine our understanding of RI.

A BETTER WORLD

Innovation has been a buzzword for nearly half a century (Gaglio *et al.*, 2019). One explanation for the widespread use is its association with the idea of novelty: the term innovation has been defined as a "new idea, method or device: novelty," or "the introduction of something new" (Merriam-Webster). Novelty is far from the whole

story, however. We would not characterize a change as an "innovation" if it delivered nothing of value or if it made things worse. Innovation holds a special, almost revered place in our thinking because it ranks among the most important of our human capacities. We have the power to transform our own world, and innovation is our expression of that capacity. We prize the new not as an end in itself, and not for amusement, novelty or to display our ingenuity, but for its capacity to improve our world.

In the "social" innovation setting, the notion that change should advance a social value is generally a part of the definition (e.g, Tidd & Bessant, 2018, p. 536). But in the business or industrial setting, some may view this notion as idealistic or beside the point. Businesses innovate for strategic advantage – increased market share, to establish a niche, to gain market leadership, to stave off competition – and ultimately for profit (Tidd & Bessant, 2018, pp. 9-10). Unsurprisingly, some have defined the term innovation around these or related goals.[3] Thus, some might argue that business innovation and (what is often taken as its close kin) technological innovation[4] are not motivated by a desire to improve the world but are ultimately about profit. Although we may choose to deliver change into the world for a variety of reasons, whether we have *innovated* turns not on our motive but on whether what we have delivered has changed the world for the better. Moreover, the Environmental, Social, and Corporate Governance (ESG) movement increasingly aligns shareholder investment with genuine value (Goedhart & Koller, 2020; Henderson, 2020, p. 132). Of course, some companies may nonetheless deliver change that increases competitive advantage or profit regardless of whether it improves the world.[5] That, however, is why we should reserve the term innovation for those changes – commercial or otherwise – that create value in the deepest sense.

THE NORMATIVE (PART I): VALUE

As the foregoing suggests, innovation is not simply change or novelty: it is change that improves the world. The innovator moves the world from its current state to a better state, from *is* to *ought*. As a result, innovation is inescapably *normative*, a term

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[3] For example, "Innovation is the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace" (Baregheh 2009, p. 1334).

[4] Again, to the extent that innovation is associated with the commercialization of technological advances, the objections raised here and the responses that follow apply with equal force to "technological innovation". One understanding of the latter term emphasizes scientific knowledge that is translated into useful outcomes or products "through the marketplace" (Gaglio, Godin & Pfotenhauer 2019, p. 7).

[5] As von Schomberg and Hankins (2019) note, "RI reflects an economic paradigm that acknowledges that that market innovations do not automatically deliver on societally desirable objectives."

that "is concerned with what ought to be the case" (Wedgewood, 2010, p. 445). The normative can be parsed into four elements: the evaluative, the "reason giving," the deontic and the fitting (Cuneo, 2020). By exploring these concepts and their interrelation, we can deepen and delimit our understanding of what it means to innovate.

The evaluative is concerned with what we value or favor. Words like good, better, best are a part of our evaluative arsenal, and signal our approval. Our approval can take varied forms, however, as a taxonomy of the ways we use the term "good" reveals. *Goodness of a kind* (or attributive good) claims that something is good at what it purports to do – for example, a good chess player or a good chess clock. Alternatively, something might be *good for* another; for example, medicine is "good for" persons. *Good simpliciter*, a third variety, claims that something is good in a way that transcends their goodness "for" or "of a kind" – for example, friendship, beauty or knowledge (Schroeder, 2016, 1.1). We can also distinguish instrumental from intrinsic goods, the former valuable for what they bring about, and the latter for their "own sake" (Rowland, 2015, p. 203).

Although the terms "value" and "good" are often used interchangeably, here I will generally use the term "value" or "values". For example, when we say that medicine is "good for" a person, we are implicitly claiming that it provides something of value for that person – in this case, health. Likewise, with goodness of a kind: when we say that Louise is a good artist, we are makings claims about how her work aligns with what we value in paintings – a certain handling of light and perspective, for example. I will refer to the variety of things that we favor in any setting as the "values" in that setting.[6] This will enable us to itemize and compare what is worthy of approval without referring in each instance to "things that are of value" or a similar formulation. The use of the term "values" rather than "goods" will also help avoid confusion with the everyday use of the term "goods" as "items for sale" (Cambridge Dictionary). In using the term "value", however, I am not referring to the *degree* of worth we ascribe or to market or exchange value.

Our next question is whether the good or values are anything more than subjective? A "dispositional" view holds that the good is whatever normal persons in normal circumstances deem it. When we characterize something as good, however, there is a sense in which we are offering more than a report on the reaction of others. The strongest account of this "more" is "robust realism," which holds that "values exist independently of human responses to them" (Jacobson, 2011, Introduction). This view

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[6] A similar use of the term "values" can be found in value-sensitive design, where it is understood that designs can "produce or reproduce" a variety of "values" (Dignum *et al.*, 2016).

strays too far from the practical goals of innovation, however, by rendering irrelevant the response and sensibility of the innovation's intended beneficiaries.

The "fitting attitude" approach fuses both standards and provides the best account of the value that innovators must deliver. This approach insists on both beneficiary approval and that their approval be fitting – that, is warranted, correct, appropriate, or the like. Critically, however, a fit attitude is not a *moral* claim; it is a claim about whether our approval is appropriate. Fitness is what we "ought" to value (Jacobson, 2011, Section 1). Suppose, for example, that Mary's fans deem her a good singer even though she is invariably off key. In suggesting otherwise, we are not claiming that her fans' approval is immoral, but that it is unwarranted. Thus, on the account proposed here, change that meets with the approval of those to whom it is delivered would qualify as valuable only if that approval is also fitting.

Philosophers have offered rich alternative conceptions of what makes an attitude fitting. One widely discussed account of the good has been coined the "buck passing" account by T.M. Scanlon. It holds that for something to be good (or bad) is for it to have properties that constitute reasons to have pro (or anti) attitudes towards it (Scanlon, 1998, Chapter 3). The buck-passing account has arguably emerged as the majority view that "varieties of value, and in fact other properties such as wrongness, oughts, and fittingness, should all be understood in terms of normative reasons for pro-attitudes or actions" (Orsi, 2020, p. 653). Although the "reasons" that are cited are natural or psychological facts about the world, whether they warrant the conclusion of good or valuable has an "open feel" (Scanlon, 1998, p. 96).

That open feel calls on our practical judgment about the reasons on offer – even for goodness of a kind, where the kind seemingly supplies its own standards. Scanlon writes:

> [F]or example, a good thermometer might be thought to be one that controls a furnace in such a way as to maintain a set temperature. This would simply be a claim of physical fact. But something would not be a good thermostat if it were the size of the Empire State Building, or took as much energy to operate as the furnace itself. The "purposes" or "interests" relative to which we judge something a good thermostat include a variety of more specific considerations, and such a conclusion about goodness requires a judgment about the proper balance between these considerations. (Scanlon, 2011, p. 446)

Innovation often dwells in these "more specific considerations" and the practical judgment about their value. What Scanlon calls "purposes or interests" would be "values" on our schema. As an agent of change, the innovator invites us to reconsider how well these values are delivered, and perhaps to reset the balance between them, or even expand the variety of values associated with the "kind" in question.

What makes a thermostat good? In the decade since Scanlon penned those words, innovators have delivered thermostats that: determine whether we have left

the home, adjusting the temperature accordingly; use machine learning to make inferences about our temperature preferences; can be set remotely; and rethink the user interface and physical appearance of the device. These various technologies (a term we will explore below) each purport to deliver some value: remote sensors gather information that will help deliver *location-specific temperatures*; machine learning delivers *time saving, convenience, reduced energy consumption, cost savings*; and design delivers *elegance and ease of use*. Perhaps all of these values were a part of our earlier understanding of the thermostat, and the innovator has simply found ways to deliver them substantially better. On the other hand, the aesthetic appeal of the device could be understood as a *new* value for those who have never reflected on appearance in a thermostat.

As our thermostat example suggests, a change can improve on the delivery of multiple values. It is also possible that a change could implicate a choice *between* values – for example, a device that saves time by translating voice into commands but collects user communications to enhance performance. Assuming that the privacy concern is better understood as a disvalue than as an ethical breach, the question is by what criterion we can evaluate the proposed device given that convenience and privacy are arguably incommensurable – that is, they share no common scale for assessment. On some accounts, however, we can and do make choices between incommensurable values, and do so for *reasons* (Sunstein, 1994, p. 809-810). While the particulars of these accounts are outside our scope, I will assume here that the complex and potentially incommensurable range of values implicated by a change does not foreclose an assessment of whether they deliver substantial improvement.

"Value" on the proposed account includes whatever we fittingly favor. Innovation is change that improves the world, and our understanding of value is as expansive as that notion. That, in turn, suggests that the commonplace association of innovation with commercial or marketplace efforts noted by von Schomberg and Blok (2018, p. 6) vastly underestimates the varieties of value that innovators can deliver. Moreover, while market acceptance certainly amounts to approval, we must also ask whether that approval is fitting.

Innovation differs from a great new idea, theory, explanation, symphony or work of art. Scientific breakthroughs and artistic masterworks are profoundly valuable in their own right; in fact, knowledge and beauty are widely understood as basic goods (for example, Finnis, 1980). Despite their profound importance, however, we have more apt terms for those basic contributions. We consider Einstein's relativity theory a seminal advance in our knowledge, not an "innovation." By contrast, we consider GPS navigation devices an "innovation," even though the understanding provided by Einstein's relativity theory was essential in making the devices accurate (Dijkgraaf,

2017). Innovation takes place at the applied level, where we hope to effect practical, palpable improvements in the lived world – and thus the proposed definition insists on *applied* value.[7]

Of course, there is ample room for disagreement about whether a value is "applied." For example, we might consider a vast improvement of the beauty and elegance of a device an "innovation," while the term seems inapt (and insufficient) to describe an artistic masterpiece. To complicate matters further, technological innovations often power scientific advances (in addition to the reverse path described above). And, of course, knowledge and applied advances are often inextricably linked: for example, Claude Shannon's application of Boolean algebra to computation and his theory of information advanced our understanding at a fundamental level while enabling radical advances in computation and data transmission, respectively (Soni & Goodman, 2017). Despite the healthy room for interpretation, however, an emphasis on "applied" values helps to cabin the concept of innovation by emphasizing the practical improvement it seeks to deliver.

THE NORMATIVE (PART II): THE ETHICAL

Another element of the normative domain is the moral, which addresses "ought" not in the sense of what we ought to favor, but in terms of duties owed to others. Regardless of one's position on the relationship between the good and ethical, I will contend here that innovators must not assume alignment between change that delivers value and its ethicality. Innovation, as argued earlier, requires change for the better. The implications are twofold: innovation entails the *ethical* delivery of value; and value and ethics are distinct inquiries.

Agents of change often work to deliver values that are best understood as "goodness of a kind" or "goodness for" others, categories explored earlier. It is important to distinguish this goodness from an ethical claim. For example, the "good" in goodness of a kind is not the greater good or an increase in general welfare but a standard based on the values addressed by the object in question. Imagine an encryption tool that is nearly unbreakable. Surely, the tool is good at what it purports to do and might be fittingly favored or be said to deliver value for that reason. Some have raised ethical concerns about these tools, however, because they may facilitate unlawful behavior (Bay, 2017). These ethical concerns are categorically distinct,

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[7] Andrew Maynard defines innovation as "the translation of creative ideas into products and processes which provide sufficient value to others that they are willing to invest in them." He emphasizes the applied, practical nature of innovation, which is "focused, targeted, purposeful change, rather than undisciplined creativity and undirected invention" (2020, p. 118).

however, from the tool's goodness of a kind: the encryption tool poses ethical concerns, on this critique, *because* it does its job so well.

One could argue that we should redefine the purpose of the object to include ethical criteria in assessing "goodness of a kind" or "good for". But a sweater is not good because it purports to increase general welfare or satisfy deontological concerns but because it satisfies the criteria or values of its kind – say, its warmth, attractiveness, comfort, ease of cleaning, and so on. If the sweater is made under unfair labor conditions, we would not say that those workers made a "bad" sweater, but that the sweater (however good) was unethically sourced. A similar concern attends the category of "goodness for". The claim of value is directed at a beneficiary and does not purport to address the world as a whole. As a result, a claim of "goodness for" makes no claim of alignment with ethical considerations.

Agents of change might mistakenly assume that the creation of value is the sole measure of whether they have made the world a better place. A change might deliver benefits or "values" to some, however, without addressing the harms created in delivering that value. Ethical inquiry, by contrast, is not limited to those who benefit from the change; it can be understood as the duties we owe to others – *tout court*. As a result, innovation must deliver value *and* do so ethically. Simply put, change that is not ethical is not innovation. And it should not be delivered into the world.

THE VARIETIES OF ETHICAL, VALUABLE CHANGE

We can now develop a simple taxonomy what constitutes valuable, ethical change. We will begin by defining terms. Change implies an initial and new state of affairs. That, in turn, implies a *domain* in which the initial and new state of affairs occur. Domains are the artifacts, activities, institutions, groups, communities, regions, or any other setting or category that is the subject of the innovator's efforts to deliver change. Domains can range from the local to the universal, and whether one has innovated does not depend on the size or reach of the domain. The change within those domains must deliver value, however, and therefore innovation domains have *beneficiaries*, i.e., those who will benefit from the change.[8] We will refer to those who are not the intended beneficiaries of the change but are nonetheless affected by it as "third parties."

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[8] The would-be innovator's proposal may or may not be accepted by the beneficiaries. In order to constitute an innovation, however, the change must, inter alia, be embraced by the beneficiaries and their approval must be fitting or warranted.

Now that we have introduced the notion of domains and beneficiaries, we can examine the idea of *valuable change* more closely. A doctor who routinely performs a lifesaving surgery is delivering profoundly valuable outcomes, but we would not consider her surgical efforts an innovation. By contrast, we would consider the lifesaving surgical *method* she deployed an innovation when it was introduced. As von Schomberg and Blok (2018, p. 9) note, "innovation does not refer to the simple introduction of new music but to the introduction of a new way of making music." When we use the domain's pre-existing knowledge and methods to deliver valuable outcomes for others, we are not introducing change into the domain, we are practicing its methods. The surgical method, by contrast, delivers a change into the domain, and change of this kind would constitute innovation if the other elements of the definition are satisfied.

Change can deliver degrees of improvement, which raises the question of whether all improvements, no matter how modest, qualify as innovation. An expansive understanding in part explains the use by some of qualifiers such as "routine" and "radical" to differentiate innovations (Pisano, 2019, p. 31). But if every improvement, no matter how slight or incremental, is considered innovation, we lose sight of why innovation holds a revered place in our thinking. Innovation promises to improve our lives substantially, and this is why we are committed to learning its methods and practicing its art. Admittedly, by reserving the term innovation for change that delivers "substantial" value, the normative challenge is redoubled – we must now reflect on questions of value *and* degree. But innovation is ultimately a normative enterprise, and these questions are best embraced rather than defined away for want of simplicity or algorithmic answers.

The innovator therefore moves us from an initial state to a substantially improved state within a domain – from "is" to "ought". The would-be innovator sees the initial state as suboptimal (which I will term a "suboptimal state" or SOS), where "optimal" signifies what might within practical reason be addressed rather than the ideal. Of course, we typically do not know in advance whether the gap can be closed; as a result, the "ought" in the suboptimal state frames the target for the innovation journey. Innovation on this account is thus the curing of a suboptimal state.

Suboptimal states can take two forms – "functional" and "value". A functional SOS is a substantial gap between a *current* value in the domain and its optimal state. It is a claim, in other words, that one or more of its current values can be delivered substantially better; the gap is in the *functionality* not the value. This is how we might understand Atul Gawande's introduction of the checklist into the surgical rooms of developing countries, radically improving medical outcomes (Gawande, 2010). The value – healthy surgical outcomes – was already a goal of this domain. The critical

change was in introducing a method into the domain to substantially improve *delivery* of that value.

Functional gaps are often the easiest to recognize because we are quickly frustrated when our expectations are not met. Suboptimal states are not modest deficiencies, however, or their resolution would lead only to incremental change. For example, software users are quick to identify ways in which a program might operate a bit more effectively. But solving programming bugs or adding minor program features is not innovation. By contrast, while cars have long sought to keep their occupants safe, the annual death and injury statistics suggest a substantial gap in delivering that basic value. If self-driving cars substantially reduce auto deaths and injuries, they will resolve a functional SOS, and qualify as an innovation.

A *value* suboptimal state, by contrast, is a gap between the current values of a domain and those important values one suspects it *could* deliver. The value SOS is not resolved by the improved delivery of a current value; it is the delivery of an important new value or value emphasis within the domain. For example, Tesla made the environmental benefits of its electric automobile a central part of its story in addition to the car's performance on more traditional automobile metrics (Tesla, 2019). When restaurants began emphasizing locally grown food on their menus, they presented a distinctive and new value for customers. Sometimes, new values will attract new beneficiaries to a domain: for example, some libraries have re-envisioned their role as helping the members of the community to build skills. Once again, however, we are remitted to judgment in determining whether the change qualifies as an innovation: the new value or value emphasis must be important if we are to distinguish incremental improvements from innovation.

A value suboptimal state can also be understood by what we hope to *eliminate* from a domain, i.e., a "disvalue." Here, we are not speaking of new values that we would like to introduce into the domain, but the presence of something we have reason to disfavor and therefore reduce or eliminate. For example, if machine learning delivers biased decision-making, that bias is a disvalue that an innovator might seek to eliminate. For simplicity, we will treat the addition of value and the elimination of disvalue as the delivery of value to a beneficiary in our definition.

For all its importance, the delivery of substantial, fitting value is a necessary but not a sufficient condition of innovation. Change that delivers value, no matter how substantial, is not innovation if it treats the beneficiaries or third parties unethically. As a result, ethics is not solely an after-the-fact constraint on innovation efforts; it is a critical element of the innovation process itself. By addressing both the value and ethical dimensions in the innovation process, the innovator reduces harm and the

need for subsequent interventions that can prove more costly and challenging after the fact.

The proposed understanding brings into bold relief the potentially fraught relation between values and ethics for the innovator. Changes often deliver substantial value to beneficiaries while posing risks to beneficiaries who *may* have consented and third parties who likely have not. The proposed understanding encourages innovators and the public to see these not simply as "benefits and costs" questions but as "values" and "ethics" questions, inviting a richer discussion of whether the values in question are substantial and fitting while accommodating utilitarian, deontological (and other) ethical assessments of whether and how they should be delivered.

THE DELIVERY OF VALUE – TECHNOLOGY RECONCEIVED

As we have seen, valuable change can take the form of substantially improved delivery of a current value within a domain or the delivery of an important new or revised value into the domain.[9] In either instance, the innovator must find a way to *deliver* something of value into the domain. The term "deliver" is intended to evoke the practical, real world outcomes expected of the innovator: he/she must bring about or effect a palpable change in the domain. The proposed understanding does not identify or prioritize any particular *type* of delivery, however; instead, it seeks to accommodate the vast and varied means of delivering value. This understanding, in turn, has important implications for our understanding of the term "technology" – a term so widely associated with innovation (Gaglio *et al.*, 2019) that it warrants closer inspection here. How *does* technology relate to innovation, and equally important, how should an innovator understand that term?[10]

We can begin with Brian Arthur's definition of technology as, "A means to fulfill a purpose: a device, or method, or process" (2009, p. 29).[11] To refine that formulation, we might add the term "tools" which we tend to see as distinct from devices. Because "process" and "method" by and large capture the same notion, we will use only the latter term. We might add "materials," since they too deliver functionality and are commonly distinguished from means and tools in everyday parlance (for example,

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[9] This discussion also applies to the substantial reduction of disvalue in a domain, since it too requires some means of effecting the chosen outcome.

[10] The nature of technology has been the subject of inquiry from a variety of disciplinary perspectives, such as philosophy, sociology, and engineering. Here, the question is directed only at how we might understand technology in light of the proposed understanding of innovation.

[11] Pitt (2000) also offers an instrumental account of technology, characterizing it in a shorthand account as "humanity at work" or more formally as "the deliberate design and manufacture of the means to manipulate the environment to meet humanity's changing needs and goals" (p. 30-31).

Brownell, 2017; Tibbits, 2021). Of course, these terms overlap: tools and materials instantiate methods; and devices, methods and materials could be understood as tools, since they seek to effect some purpose or goal. Nonetheless, the categories provide a taxonomy of the ways that technology enables us to innovate within a domain. Thus, from an innovator's perspective, technology might be understood as "tools, devices, methods and materials" that deliver something of value into the world.[12]

This understanding of technology suggests the vast range of sources that innovators can draw on in delivering change into a domain. Many associate innovation with highly complex technologies such as machine learning, blockchain or the gene-editing tool, CRISPR. These are immensely powerful tools that auger vast and valuable change. But simpler methods also have stunning change power when applied in the right setting. Consider the simple checklist mentioned earlier that Atul Gawande introduced into the surgical rooms of the developing world, substantially improving outcomes; or reforestation to reduce global warming (de Groot, 2019).

Von Schomberg and Blok (2018) have documented the widespread association of innovation with emerging technologies. That belief has been reinforced by the extension of Stuart Kaufman's concept of the "adjacent possible" to the innovation setting, whereby "[e]ach new combination opens up the possibility of other new combinations" (Planing, 2017). While emerging technologies are profoundly important,[13] they hardly exhaust the means of delivering values – even for technology as traditionally understood. Consider "exaptation" or the repurposing of technologies to create valuable change. Gutenberg's repurposing of the wine press into a printing press offers a seminal example. As Johnson (2010, p. 153) notes, "An important part of Gutenberg's genius… lay not in conceiving an entirely new technology from scratch, but instead from borrowing a mature technology from an entirely different field, and putting it to work to solve an unrelated problem".

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[12] One might question this instrumentalist understanding of technology given the various accounts of technology that emphasize its human experience, ethical or value implications (for example, Verbeek, 2006; Winner, 1978). The proposed understanding does not deny the claim that technology once deployed is fraught with these implications; it is premised on that claim. Technology, as understood here, is the means to deliver normative outcomes. In seeking to cure suboptimal states, however, the innovator must attempt to decouple the instrumental elements of a technology from its currently deployed normative elements if only to ask whether it can ethically deliver the values that she hopes to deliver. Once the innovator has forged a connection between means (technology) and ends (values), she must engage in the analysis of its value and ethical implications before delivery into a domain, an inquiry that can be deepened by RI's commitment to anticipatory and reflexive innovation of RI (for example, Stilgoe et al., 2013) and value-sensitive design's efforts to "intentionally embed desired values into technologies" (Simon, 2017).

[13] Some new technology may advance the state of art and qualify as an invention, but inventions may or may not deliver the substantial value required of innovation, as the patent rolls will affirm.

Repurposing, in turn, suggests a distinction between *technology advances* and *advanced technology*. Expertise is typically necessary to advance the state of art by developing new and complex technology. Conversely, the capacity to reflect on domains and values may prove more important than expertise in seeking ways to repurpose technology that is already developed – even when it is advanced. As discussed earlier, whether an innovator is addressing a functional or value gap, the degree of change that ultimately matters is in the *value state* of the domain, a change that may or may not require substantial technological advances.

Technology for the innovator also includes methods that are not traditionally associated with the term, such as ways to structure social settings to deliver values, roughly akin to the expansive understanding proposed by Pitt (2000). For example, Jane Jacob's proposal to make urban neighborhoods safer – such as mixed uses, and people and eyes on the street (Jacobs, 1961) – could be understood as a technology for an innovator, like any other method that delivers values into world. So too could the subscription business model that enables some local, organic farms to survive (Neumark, 2017); the "nudge" of changing the default from opt-in to opt-out to, among other things, increase retirement investment (Thaler & Sunstein, 2008); or a ranked-choice voting method that reduces polarity (Kambhampaty, 2019). While this more expansive understanding of technology does not accord with common usage, it invites would-be innovators to draw on the widest array of means to deliver values into a domain.

A broad understanding of technology may help to correct the tendency of some to favor highly engineered solutions either without warrant or without addressing the cultural and social barriers to their adoption (Toyama, 2015). When we understand that behavioral, sociological, and cultural methods (to name only a few) are also "technologies" in the sense that they deliver value into domains, we are more likely to draw on the right means or combinations of means in crafting solutions. New, complex, and highly engineered artifacts are profoundly important, of course, but they are one of the many ways to deliver change. Innovators should draw on a vast palette of tools, methods, devices and materials – from the simple to the complex, to the old and new – to deliver valuable change.

RELATION TO X-INNOVATION AND RI

A profusion of adjectives attempts to categorize innovation paths. Terms like "technological," "industrial," "social," "open" or "sustainable" innovation have prompted Gaglio *et al.* (2019) to describe the phenomenon as "X- innovation." Although these categories can help organize efforts around shared methods and goals, they also pose concerns. If, as argued here, improving the world is the *raison detre* of innovation, then

our efforts may be best oriented around questions of *value*, which may lead us across business, social, technology, and other boundaries. Likewise, while funding to develop and sustain any innovation is essential, what funding mechanism is best – commercial, nonprofit, public support, donation, or other – may *depend* on the innovation breakthrough rather than *inspire* it. Likewise, the emphasis on technology innovation, while often helpful as an organizing principle, risks prioritizing the selection of means over goals, which can narrow the range of value delivered. The proposed understanding invites us instead to see innovation not as a variety of predetermined paths, but as the movement toward substantial value – with funding and means as elements that emerge in time.

Responsible Innovation differs from other forms of X-innovation. It does not prescribe a singular path, but instead can be understood as a framework to promote "collective stewardship" of innovation (Stilgoe *et al.,* 2013, p. 1570). The term "responsible" has varied meanings, but the dictionary definitions "trustworthy," "sensible," "morally principled," and "ethical" (Oxford English Dictionary) suggest something of its intended role in RI. A critical question, therefore, is why qualify the term "innovation" with "responsible" if "innovation" (as understood here) already incorporates these normative notions? One explanation, of course, is that we have long struggled to agree on a definition of innovation and, as discussed earlier, many associate innovation with change – often technological change – decoupled from normative elements. The "responsibility" qualifier is warranted if we see innovation through this narrow gaze.

But how are we to understand RI if we accept the understanding of innovation proposed here? The proposed understanding orients innovation around the ethical delivery of substantial (and fitting) value but it does not tell us *how* to accomplish this. RI's vast collection of practices – including, for example, anticipation, reflection, participation, and responsiveness (Stilgoe, Owen & Macnaghten 2013) – can be understood as the means to satisfy the normative elements of innovation. Understood thus, RI's importance stems not from the misconception that innovation, *per se*, is agnostic on questions of value and ethics, but *because* innovation, properly understood, entails these commitments. RI offers a framework for implementing this understanding.

Moreover, the proposed understanding can provide theoretical grounding for RI's varied practices and continued development. For example, RI "places a premium on inclusive participation that allows the setting of research and innovation goals" (Owen & Stigloe 2012, p. 754). The proposed understanding helps explain why the discovery of "suboptimal states" (and therefore innovation goals) is the province of everyone who is attuned to the workings of a domain and why those goals need not

be solely commercial. In addition, the proposed understanding holds that change must ethically deliver fitting value in order to *qualify* as innovation, which helps explain RI's emphasis on incorporating its responsible practices *into* the innovation process rather than relegating them to post-delivery critique (Bauer *et al.*, 2021).

Third, RI envisions that the public serve as an "active player that can contribute with innovative ideas" (Robinson *et al.*, 2020, p. 3). Under the proposed understanding, the functionality that delivers value into a domain need not be new or complex, and the repurposing of even complex technologies requires far less expertise than the underlying advances that made them possible. In addition, innovation may result from the delivery of new or remixed values into a domain rather than new or complex technology. Thus, the understanding proposed here supports RI's expansive vision who can and should *innovate*.

Owen and Pansera have observed that "most academics working in the field [see RI's initiatives as]" a set of policy agendas and action lines which structure a work program of the EC, rather than a coherent and intellectually robust discourse" (2019, p. 38). It is, of course, difficult to build a conceptual understanding of RI without an understanding of the concept of innovation. Once we embrace the normative reach of innovation, we can begin to build conceptual bridges to RI's varied commitments. This may prove an important line for future scholarly work.

CONCLUSION

Innovation is inescapably a normative enterprise, and we can construct an understanding of the term by exploring its normative elements. Innovation is best understood as ethical change that delivers substantial applied value to beneficiaries of a domain. Value on this understanding is not only what we favor but what we have *reason* to favor. Innovators change the value state of a domain, moving it from is to ought. They cure "suboptimal states" by substantially improving the delivery of current values in a domain or by delivering important new or remixed values into a domain. But the delivery of substantial applied value is not enough. *Ethical* delivery of that value is an additional condition of innovation, requiring the innovator to address the risks posed to beneficiaries and third parties by the proposed change.

This value-centered understanding of innovation suggests much about the nature and role of technology. For the innovator, technology is best understood as *any* tool, device, methodor material that delivers value. The functionality that delivers value can range from the simple to the complex, the old to the new.

What's in a definition? A great deal it seems. If we see innovation as simply novelty or change, we miss the principal reason for innovating – to improve the world.

When we see innovation as only what creates market value, we conflate approval with fitting approval, dismiss the vast array of value that may not be captured through exchange mechanisms, and forget that value and ethics, *together*, are the *sine qua non* of innovation. If we see innovation as principally the product of highly complex technology advances, we overlook myriad other ways to deliver valuable change and unduly limit the values we might deliver.

The understanding proposed here invites us to unify our understanding of innovation rather than characterizing it by method or domain. When instead we see innovation through social, technological, business, or similar lenses, we may find that our change efforts refuse to respect our prefigured categories. While these categories offer administrative guidance, they risk limiting our search for suboptimal states and the means to solve them before we begin.

We can also deepen and refine our understanding of Responsible Innovation. The proposed understanding grounds our understanding of innovation in its normativity. RI can be understood, in turn, as an effort to operationalize those normative elements: it can help us determine the values worth pursuing, the ethical risks to be addressed, and the means by which they are pursued. Moreover, the broad understanding of change methods described here can broaden RI's approach to innovation and who is seen as a prospective innovator. The foundation for a sound conceptual framing of Responsible Innovation lies in the normative nature of its object – innovation.

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