


BOOK SYMPOSIUM

Power, luck, and scholarly responsibility at the end of the world(s)

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Abstract

This contribution argues that the concept of protean power opens a space to think about the limits of control and knowledge about catastrophic possibilities such as nuclear war. To do so, it offers the first distinctive definition of nuclear luck, which has long been acknowledged by policy and military leaders but remains unaccounted for in scholarship. It further shows that the nuclear realm is defined by two key unknowables. However, it argues that protean power perpetuates a survivability bias which has characterized scholarship so far, before suggesting ways to overcome that bias and modify scholarly ethos to acknowledge such catastrophic possibilities.

Keywords: nuclear weapons; luck; scholarly responsibility; collapse; existential threats

The power that the madmen hold is power of an order that the sane alone know that they are not sane enough to use. But the madmen do not want us to know that this power is too absolute, too godlike, to be placed in any human hands: for the madmen dandle the infernal machine jauntily in their laps and their hands eagerly tremble to push the button.

Lewis Mumford, 'Gentlemen you are mad', *Saturday Review of Literature*, 2 March 1946, 5–6

Protean Power is a long-awaited contribution to International Relations (IR) theory, which makes three salutary interventions in the field. The authors first challenge assumptions of controllability and predictability, even when they are unacknowledged or denied. Conceptually, modes of reduction of uncertainty to risk lie at the heart of the problem they identify and tackle in the book: for too long in mainstream IR, power has been only treated as 'control power' conceived in a probabilistic world of calculable risk and bounded possibilities.¹ Instead, Lucia Seybert and Peter Katzenstein introduce 'protean power' as a way of engaging with uncertainty,

¹The authors acknowledge that what is true for 'conventional' IR scholars is not for theorists of power (Seybert and Katzenstein 2018, 6). Here, one needs to acknowledge that critical and post-structural understandings of

as a productive force and as an effect of interactions among actors. Second, they note that IR scholarship tends to overlook imagined futures and invite imagination as a faculty shaping horizons for action.² In other words, protean power incorporates imagined futures as constitutive of our horizons of possible action in the world. Third, it challenges the founding inter-*national* dimension of the discipline of IR which singles out the problem of international anarchy and opens a space for rethinking the planetary and the global in a historical perspective. In doing so, Lucia Seybert and Peter Katzenstein and their co-authors modify the requirements of a scholarly ethos.³

This welcome call appears in a very particular context of increasingly possible existential disaster and terrible track record of social sciences to anticipate large scale collapses and disasters.

Earth system scientists have identified nine planetary boundaries within which humanity can safely live. Attached to each of them is a process which may affect the habitability of Earth: climate change, ocean acidification, stratospheric ozone depletion, fresh water use, deforestation and other land system change, biodiversity loss, chemical pollution, particle pollution in the atmosphere, and biogeochemical flows. In 2009, these scientists had asserted that we had crossed three of those boundaries (CO₂ emissions as the essential proxy for climate change, biodiversity loss, and biogeochemical flows). In a 2015 update published in *Science*, they argued that a fourth boundary had been crossed (disruption of the cycle of phosphorus).⁴ In 2017, 15,000 scientists from 184 countries published a second ‘warning to humanity’ in *Bioscience*, 25 years after the Union of Concerned Scientists’ original call to curtail rampant environmental destruction that was likely to affect the prospects of humankind’s survival on planet Earth.⁵ In this letter, they show that fresh-water resources per capita have been rapidly declining and acidification of the oceans has been increasing to a concerning degree between 1960 and 2016.⁶ In 2019, the International Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), an independent body established by United Nations member states, released its first assessment regarding biodiversity since 2005. In it, scientists argue that around 1 million animal and plant species are now threatened with extinction, many within decades, more than ever before in human history.⁷

Beyond these planetary boundaries, our condition when it comes to the possibility of thermonuclear war has been deteriorating as well. In January 2020, the *Bulletin of the Atomic Scientists* set the doomsday clock at ‘100 seconds to midnight’, which is the closest we have ever been to annihilation in their

power within IR have avoided that flaw for a long time. From a conventional IR standpoint, they may appear as political theorists outside of IR. See Harrington 2016 and Chaloupka 1992, 130–31.

²Seybert and Katzenstein 2018, 12.

³They write that ‘the purpose of “power analysis” is to think about responsibility’ (Katzenstein and Seybert 2018c, 292).

⁴Steffen *et al.* 2015.

⁵Almost 6000 additional scientists have signed the document since its publication in October 2017 (<http://scientistswarning.forestry.oregonstate.edu/additional-signatories>). Last consulted on 4 May 2019.

⁶Ripple *et al.* 2017.

⁷<https://www.ipbes.net/news/Media-Release-Global-Assessment>.

assessment.⁸ The Trump and Putin administrations have pulled out of the Treaty on Intermediate-Range Nuclear Forces. The prospects of negotiations to extend the so-called New START Treaty signed in 2010 and due to expire in 2021 are slim. The point is not to say that the cancellation of arms control treaties will open the floodgates to a new nuclear arms race but rather that all existing nuclear weapons states are already committed to 'modernize' their arsenals so that they could keep them until 2080, which is almost as long as nuclear weapons have existed on the planet. For most nuclear weapons states, the period between now and 2080 is much longer than the period between now and their acquisition of nuclear weapons. The omnicidal potential of one single thermonuclear war, either accidental, inadvertent, or deliberate, which would not require the use of all the 13,000 nuclear weapons present on the planet today, as well as other forms of collapse or tipping points that would make parts of the planet uninhabitable, invites us to interrogate one specific category of events: the unexpected, unprecedented, and unrepeatable.⁹ Here, unrepeatable means that it cannot be tolerated more than once because there may simply not be enough people left to make the event equally meaningful a second time.

On the other hand, over the last 30 years, the world has experienced a series of collapses of all kinds which were meant to be predicted by social sciences and were not: the collapse of the Soviet bloc, which had been a structuring component of international politics since the end of World War II, was not anticipated by IR at a time when prediction was one of its key ambitions and the 2008 financial crisis was not considered possible either by mainstream economics or by criminology applied to the sector.¹⁰ It has even been convincingly argued that mainstream economics produced blindness to climate change.¹¹ If one considers the Anthropocene (or capitalocene or eurocene) as an era defined by multiple self-inflicted disasters in the making, IR is extremely ill at ease with it: those who engage with it within IR disagree about almost everything except the need to move beyond IR as a discipline and modify its concept of power.¹²

In such a context, it is interesting that the set of case studies which is offered in the book does not include a case of catastrophic existential possibility for humanity. I deliberately do not call it risk, contrary to the commonly accepted notion, because that would be tantamount to falling for the very confusion and obfuscation between uncertainty and risk which is the main intellectual target of the book. Such a possibility would certainly be uncertain and unexpected and, as such, fall under the remit of the volume. This is all the more surprising that two interesting chapters

⁸I fully realize the problems associated with taking the 'doomsday clock' as an accurate assessment of the danger of nuclear war. One crucial problem is the inability of the clock to account for short-term danger. For instance, the Cuban Missile Crisis, one of the most dangerous events in the history of the nuclear age, took place at a time of declining risk according to the doomsday clock.

⁹Social sciences usually think about frequent events and protean power does not entirely escape that bias (Clarke 2008, 669).

¹⁰Lebow 1994, Katzenstein and Nelson 2013, Blyth and Matthijs 2017, de Maillard 2011, chs. 9 and 10.

¹¹Pottier 2016.

¹²Booth 2007, 2, 396–98 as an exception with his notion of 'the great reckoning'; Burke and Fishel 2016, Burke and Fishel 2019, Chandler *et al.* 2018, Deudney 2018, Fishel and Burke. 2018, Grove 2018, Taylor 2018.

are devoted to climate issues and nuclear weapons, but only from the perspective of international negotiations and power dynamics within them.

This will be the focus of this intervention. How does the concept of protean power help us understand catastrophic existential possibilities? Could the concept be mobilized in further studies of such cases?¹³ Does our knowledge about catastrophic existential possibilities help us understand better the contribution of protean power and its limits? What does that tell us about scholarly responsibility? To do so, I will focus on one catastrophic existential possibility that would only happen once, in a short amount of time, and which would already be intolerable: global thermonuclear war.¹⁴

Not controlling and not knowing: *protean power* as an antidote to overconfidence?

The concept of protean power opens up a space to understand inadvertent and accidental outcomes, the role of ‘luck’ in the non-catastrophic outcome of nuclear crises so far, as well as the paths towards and dangers of overconfidence in the way we scholars relate to them.¹⁵

The role of luck has been evoked by political as well military leaders in the USA and the Soviet Union, including Robert McNamara, Secretary of Defense during the 1962 Cuban Missile Crisis, Dean Acheson, special envoy of President Kennedy dispatched to France at the time, Nikolai S. Leonov, head of Cuban affairs in the KGB at the same time, and Gerard C. Smith, chief US delegate to the Strategic Arms Limitation Talks. Among post-Cold War figures, one can cite former head of the US Strategic Air Command and Strategic Command (1991–94) General George Lee Butler and US Secretary of Defense William Perry.¹⁶

Surprisingly, scholars of nuclear politics at best mention it in passing but only few actually take it seriously and try to account for it.¹⁷ When they do, it is mostly through either epistemic inconsistencies or practical inconsistencies. In other words, after acknowledging limits of safety they then either reduce the realm of what was possible to what is measurable, or reintroduce the idea of manageability

¹³Katzenstein and Seybert 2018c, 268, invite further case studies.

¹⁴In his introduction to this symposium, Jacques Hymans engages briefly with the nuclear weapons realm by connecting protean power to the revolutionary decision of starting a nuclear weapon programme. Hymans, this symposium. Here, we engage with other revolutionary nuclear possibilities whether or not they connect to an isolated decision that can be identified. For an open-minded effort at outlining catastrophic existential possibilities and paths to human extinction, see Leslie 1998, 3–14.

¹⁵Katzenstein and Seybert 2018c, 278.

¹⁶Acheson 1969, 76; Butler 2016, 172; Smith 1996, viii; Perry 2015, ch. 1. Robert S. McNamara: ‘In the end, we lucked out. It was luck that prevented nuclear war’. Nikolai S. Leonov: ‘One mistake at the wrong time in October 1962, and all could have been lost. I can hardly believe we are here today, talking about this. It is almost as if some divine intervention occurred to help us save ourselves, but with this proviso: we must never get that close again. Next time, we would not be so lucky, as you put it’. Cited in Blanton and Blight 2002, 7.

¹⁷For mentions of the role of luck or good fortune in the noncatastrophic outcome of nuclear events in security studies scholarship, see, *inter alia*, Booth 2007, 406, Sagan 1993, 31, 154, Rendall 2007, 530, Lebovic 2013, xii, and Leitenberg 2018, 249. For early attempts at grasping luck in the nuclear weapons realm, see Pelopidas 2015a, 14–17; 2015b, 173–75; 2017.

as the inevitable outcome of policy-relevant research.¹⁸ These problems in the field of security studies are well pointed out in chapter 2.¹⁹

In mainstream nuclear scholarship, power is too often reduced to control power and the environment is accounted for in terms of risk. And risk thinking is desire for control and faith in that control.²⁰ This reduction makes the role of luck and of any factor that would not fall within the realm of practices of control unthinkable. This is a consequential problem insofar as one can think about multiple paths towards desired nuclear outcomes that cannot be reduced to the practice of control power. Those outcomes can happen *independently* from any control practice; *in spite of* and not because of practices of control; *because of the failure* of control practices. This heuristic potential of protean power as a category appears, when Lucia Seybert and Peter Katzenstein write that: 'it's about being in the right place, at the right time'.²¹ Those are exactly the words of Colonel Stanislav Petrov in reaction to the praise he received for being 'the man who saved the world'. Petrov disobeyed when he waited too long to report what he saw on his radar screen on that night of 26 September 1983. With protean power, scholars now have a category to direct their empirical investigation of the limits of nuclear controllability. Against the retrospective illusions of safety and control, protean power opens a space that forces analysts to take the possibility of uncontrolled escalation to global thermonuclear war seriously. It reminds us of the fundamental material vulnerability that has been ours since the coupling of thermonuclear weapons with intercontinental ballistic missiles. Such openings are important because they allow us to grasp the enormity of the bets on the future that underpin the massive nuclear weapons modernization programmes which are currently ongoing in all nuclear weapons states as acceptance of continued vulnerability for almost as long as the nuclear age.

Most interestingly, the concept of protean power opens up a space for thinking about the possibility of thermonuclear war and makes certain scholarly practices of denying this possibility more difficult.²² The authors' rejection of the goal of more accurate predictions²³ points to the power effects of not knowing in the age of global nuclear vulnerability, which connects to the fruitful suggestion to remobilize the imagination and its constitutive effects on the present.²⁴ Indeed, instead of 'assuming away the unknown'²⁵ as we too often do, we should acknowledge the fundamental unknowability of the time and effects of the first nuclear war as a defining feature of our condition and age. Bernard Brodie is frequently quoted as summarizing the nuclear condition as follows: 'Everything about the atomic bomb is overshadowed by the twin facts that it exists and that its destructive power is fantastically great.'²⁶

¹⁸Pelopidas 2017, 248–51.

¹⁹Katzenstein and Seybert 2018b, 42–47.

²⁰See also the chapter by Mendelsohn 2018, 207.

²¹Seybert and Katzenstein 2018, 15.

²²Protean power goes against retrospective illusions of understanding and validity and the law of small numbers. See Kahneman 2011, chs. 10, 19, and 20.

²³Katzenstein and Seybert 2018b, 56.

²⁴Seybert and Katzenstein 2018, 12, Katzenstein and Seybert 2018b, 44, 47; 2018c, 292–97.

²⁵Katzenstein and Seybert 2018a, xii.

²⁶Brodie 1946, 52.

I would contend that there is another set of twin facts. They are two known unknowables: we do not know, cannot know and will never know in advance *when* exactly nuclear war will happen and *whether* humankind will survive it.²⁷

This is all the more important as the nuclear discourse often ignores the first unknowable (the question of when) and mischaracterizes the second one (the question of survivability) as a knowable entity. The latter mischaracterization produces two opposite biases: a survivability bias and an extinction bias, both premised on an overstatement of what can be known for sure, neglecting the role of imagined futures, value judgments and memories of the past in the construction of such knowledge. On the one hand, the survivability bias is an explicit or implicit conviction that we can know in advance all the effects of a nuclear war and this knowledge should lead us to realize the species will survive. The 'limited nuclear war' tradition, from Herman Kahn and Albert Wohlstetter to Kier Lieber and Daryl Press through Colin Gray and Keith Payne, has argued that most explicitly. The labelling of nuclear war and of the end as 'unthinkable', which is frequent in the field, also suggests this survivability bias.²⁸ It starts from the known effects of individual explosions but neglects possibilities of unanticipated escalation, overreaction, and climate effects, which open a space of radical uncertainty and unknowability about the prospect of survival. On the other end of the spectrum, we find an extinction bias. The extinction bias is a claim to know that once nuclear war has started, it will be waged until extinction. It could derive from folk belief that any nuclear explosion means the end of the world or from the claim that the amount of devastation caused by the first strikes alone will trigger a drive for revenge that will prevent any form of further restraint.²⁹ Stances in the nuclear weapons policy debate may be aware of the unknowability of the survivability question but tactically operate as though we knew and therefore fall in the survivability or extinction bias in practice, if not in theory.

Extinction and civilizational collapse as boundary possibilities for protean power?

While the critique of control power opens a space for the possibility of luck and accidents, the binary approach between control power and protean power, worlds

²⁷This fundamental unknowability has been with us since the early years of the nuclear age and is well captured in the exchange that took place at the US Strategic Air Command headquarters in Omaha, Nebraska on 12 December 1960 after RAND analyst William Kaufman was giving a counterforce briefing. Opposing what he saw as restraint, General Thomas Power, then head of SAC, interrupted to say: 'At the end of the war, if there are two Americans and one Russian, we win!' Kaufman snapped back: 'you'd better be sure that they're a man and a woman' (Kaplan 1983, 246). This is not the case at all for the problems described above regarding planetary boundaries. See for instance Oreskes and Conway 2010. An important research programme is currently trying to go beyond Kaufman's intuition to identify the minimum viable population size. I do not enter this discussion here.

²⁸One has to acknowledge that the label unthinkable was most famously thematized by Hermann Kahn, an early theorist of limited nuclear war, who wanted to stigmatize the opposite tradition (Kahn 1962). German philosopher Gunther Anders was deeply concerned about human's inability to grasp the nuclear condition and the possibility of self-inflicted extermination. He called this problem 'inverted utopianism' (Anders 1962, 496–97).

²⁹Rose McDermott and her colleagues offer very interesting insights from psychology about the role of revenge in guaranteeing nuclear retaliation (McDermott *et al.* 2017).

of risk and worlds of uncertainty, seems to overlook the second known unknowable mentioned above and the possibility of extinction and/or civilizational collapse.

Protean power suffers from a survivability bias. Let's take three of its definitions: 'Protean power responds to and deepens unanticipated change and is often a response to crises that catch everyone by surprise'; 'the core of protean power lies in agility and the circulation of power potentialities'; 'Protean power rests in the ability to find channels of possibility where established means of control fail'.³⁰ In all those definitions, there is a world after. This may be most explicit in the following definition: '[Protean power] arises either through direct relations between actors or indirectly in the follow-on effects that *reconfigures* complex systems'.³¹ In his chapter on the revolutions in rights, Christian Reus-Smit illustrates this point as he engages with the notion of collapse. He writes that: 'today's global system of sovereign states is the product of several waves of imperial collapse [...] Post-1945 decolonization was the most momentous of these waves: not only did multiple empires collapse but so too did the institution of empire'. But he adds 'after the war, most imperial powers reasserted their commitments to empire' so that the phenomenon he describes ends up looking more like a process of reconfiguration and change of political form than like a collapse.³² The mobilization of the concept of 'resilience' operates according to the same assumption of survivability.³³ Similarly, if I am not mistaken, the word 'survival' appears only four times in the book, either describing a political strategy which succeeded or a threat, and the notion of extinction is not mentioned at all.³⁴

In that respect, the path to extinction exceeds the dichotomy between control power and protean power. Indeed, control power will have failed and produced such massive, fast, and irrepressible forms of violence that there will not be channels of possibility left. The implicit certainty that control and protean power cover the whole spectrum of power makes omniscidal nuclear war unthinkable *a priori* and does not take the second unknowable seriously. It is written as though we knew that we would survive or as though we should act as if we will. This survivability bias is characteristic of the discipline of social sciences and, surprisingly, much less present in the general public.³⁵ It still implicitly maintains that existing power structures are compatible with and possibly responsible for the survival of our civilization and species.

My invitation to readers and students of protean power would be to adopt its effort at mobilizing imagined futures in a way that makes luck and accidents

³⁰Katzenstein and Seybert 2018a, xii, xv; 2018c, 274.

³¹Seybert and Katzenstein 2018, 10.

³²Reus-Smit 2018, 60.

³³Katzenstein and Seybert 2018c, 296.

³⁴Katzenstein and Seybert 2018a, 38, 100, 119, and 191.

³⁵In a survey conducted in June 2018 among 7000 citizens of France, the UK, Belgium, Germany, Italy, the Netherlands, Poland, Turkey, and Sweden aged 18–50 and representative in terms of age, gender, and level of education, we found that when asked, 'if a nuclear war happens, which of the following would be the most likely consequence?' 61.8% of them respond either 'it would be the end of humankind' or 'it would not be the end of humankind but it would be the end of civilization as we know it' and only 11.4% respond: 'I don't think a nuclear war will ever happen'. This survey was funded by the French National Research Agency (ANR) under the VULPAN project.

thinkable and extend it one step further to the possibilities of civilization collapse and extinction which, so far, remain beyond the remit of our field. In other words, avoid a survivability bias.

Scholarly responsibility at the end of the world(s)

The unknowability of the timing of nuclear war and its effects makes it possible that thermonuclear war will end the species before this paper goes to print but also that we avoid it until the death of the sun. In this context, claims of knowing and scoping possible nuclear futures appear as the ultimate acts of power.³⁶ As suggested by the authors, scholarly responsibility no longer lies in predicting; expert power does. As scholars and educators, we are uniquely placed to recreate expert accountability and expose what the available bets on the future are, instead of reproducing overconfidence in our survivability. This can be done on behalf of our fellow-community members, whatever the scale of the community, future, past, or present.

Exercising this responsibility would start with identifying the sources of overconfidence in the controllability and predictability of those futures as well as relabelling the claims of knowing the future as bets.³⁷ Such bets are underpinned by lessons of the past, imagined futures, specific meanings embedded in the categories used, sociotechnical assemblages and value choices. Picturing them as certainties is certainly inadequate because it underestimates how limited and contested existing knowledge about past nuclear crises is, it obfuscates the value choices on which those supposed certainties are based and it assumes that the effects of the policies preferred by those experts will work perfectly and that we can know that for sure in advance. In doing so, it removes space for political judgment, deliberation, and choice without taking responsibility for such a move.

Protean power, its critique of control power and predictability and invocation of the constitutive effects of imagined futures help us think about the possibility of unprecedented accidents and push back against institutional claims of control over the present and the future.³⁸ It also helps us avoid the temptation of presentism, which commonly distorts our thinking about responsibility.

This effort of imagination should move one step further and take seriously the possibility of collapses and ends of humanity as well as radical change of power structures along the way. Indeed, protean power does not seem to have yet overcome that survivability bias which has been present in the field. It connects to a discourse of resilience which simply negates the possibility of an end and makes the condition of vulnerability unproblematic.³⁹

This effort of imagination invites us to re-engage with normativity and utopia.⁴⁰ Asserting a form of scholarly responsibility requires us to reflexively assert the

³⁶In the 1960s, for instance, a series of intellectual moves have entrenched the idea that nuclear weapons were 'here to stay'. See Pelopidas 2020. Another instance would be the deployment of the rhetorical veto player of NATO as a 'nuclear alliance' since 2010. See Egeland 2020.

³⁷Pelopidas 2015b.

³⁸For an important contribution in that direction in the field of nuclear studies, see Sylvest and van Munster 2016, ch. 5.

³⁹Pelopidas and Weldes 2014.

⁴⁰This expands on Pelopidas 2016, 331–33.

fundamental normative underpinning of scholarship associated with existential dangers as opposed to convoluted obfuscations in the name of detachment and objectivity. Moreover, in the nuclear weapons realm, given the potential for devastation of this technology, the radical unacceptability of catastrophic failure of nuclear deterrence and the leap into the future that modernization programmes are asking us to make, we cannot escape utopia: we can either bet on nuclear weapons technology never failing or only failing in non-catastrophic ways in the next seven decades or on radical measures of nuclear disarmament and the possibility to invent new ones down to levels under the nuclear winter threshold, before nuclear war happens.⁴¹ There is no third alternative. While often portrayed as a repetition of the past 70 years of successful nuclear control, the current bet on another 70 years of absence of unintended nuclear explosion should be called a technological utopia given that such a record of control of nuclear weapons technology has not been achieved. This becomes clear as soon as one takes lucky cases seriously and realizes that the public record of such cases is incomplete. The second utopia would mean dismantling a smaller number of nuclear warheads than we have during the 10 years between 1986 and 1996 but, as we get to low numbers, challenges of trust and stability may intensify to the point that pessimists call it utopian.⁴² As a result, there is no non-utopian course of action if utopian means unusually challenging or unprecedented.⁴³ In that respect, protean power would be an apt concept to study the ongoing attempts at inventing nuclear disarmament.⁴⁴

Thinking and making space for the possibility of an end is not impossible: it is exactly what the futurologists managed to do after World War II even though the discomforts of doing so introduced negotiations away from it.⁴⁵ From this standpoint, we would construct timescapes in the shadow of possible ends in which we could re-allocate responsibilities.⁴⁶ Only then will we be able to assess whether ‘the power that the madmen hold is power of an order that the sane alone know that they are not sane enough to use’.

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⁴¹To be clear, ‘bet’ should not be understood as probabilistic calculation but rather as political and ethical judgment.

⁴²Zia Mian and Moritz Kütt have shown that the dismantlement of existing arsenals is technically possible within 10 years in light of what has been achieved so far (Mian and Kütt 2019).

⁴³Calls for ‘realism’ in nuclear weapons policy are the other name of managerialism and calls for status quo. They hope to delay the moment when we have to confront the challenges I have just outlined and overestimate their ability to deliver on their promise as discussed above (Meyn 2018). Scholars who conceptualize nuclear realism such as Sylvest and van Munster are doing so in an attempt to reclaim the notion of realism. I do not think they would disagree with what I presented as a utopian imperative. They would simply call it realism.

⁴⁴Ritchie 2019, Ritchie and Egeland 2018.

⁴⁵Andersson 2018, 17.

⁴⁶Science and Technology Studies offer an important concept: socio-technical imaginary. See Jasanoff and Kim 2015.

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