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Theme issue editorial

Valuation and Critique in "The Good Economy" part 1

Kristin Asdal and Liliana Doganova

A good economy?

This two-part theme issue of *Valuation Studies* is the result of an invitation to investigate economic situations where we can observe how practices and instruments are working to combine the pursuit of profit with other forms of good, and the more overarching question of how the economic and the non-economic are in different ways entangled in the manufacturing of economies. The notion of "the good economy" proposed in earlier research (Asdal 2022; Asdal et al. 2023) was made to denote this double entendre.

The objective of the theme issue is twofold. First, it aims to explore the relations between the field of valuation studies and the notion of the good economy. Second, it focuses on the issue of critique: what becomes of critique when the economy purports to be good? If, as argued in a previous editorial of *Valuation Studies* (Doganova et al. 2014), studying valuation is already a form of critique by other means, how can this eventually be put to work in investigating good economies? What is "the good economy"? How is it composed and manufactured? By which means does it construct and reconstruct

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economies? What are the "valuation struggles" (Pallesen 2016) involved, the tensions it brings about, and the effects on economic goods?

The idea of "the good economy" was proposed as a conceptual as well as an investigative and empirical move to study how economies and "versions of the good" are entangled. It was proposed as an investigative endeavor, verging toward a form of diagnostic, a diagnostic in conversation with other notions that focus on how economies are, and have always been, entangled with the non-economic in different ways. In this editorial to the first part of our theme issue, we situate "the good economy" in its broader scholarly landscape, delineate a set of key entanglement and "good economy" elements that make the good economy stand apart as a scholarly intervention, and engage with contributions that make up this double theme issue and also the different versions of the good economy that are being brought about.

"There is always a moral economy alongside the real economy of material exchange," writes Marion Fourcade (2017: 661), arguing that moral economies, most of the time, are "silently woven into everyday life, as a background condition of economic order." The notion of a moral economy which Fourcade follows is very well known and appreciated by a range of scholars who have used it for different empirical and analytical purposes, for instance as a way of understanding knowledge production, as a form of gift and sharing economy (Kohler 1991), or as a way of understanding how quantification, empiricism, and objectivity in science are, largely, constituted by a moral economy (Daston 1995). Yet, for many of us, it first and foremost evokes E.P. Thompson's (1971) iconic study of English peasants who, based on their own experiences and moral convictions of what prices and economy should have been like, rioted against what was understood to be an immoral market economy with no sense of fairness and justice.

The understanding of the market as an amoral force, though naturalized as its own form of truth, is a strong one. It evokes not only Thompson's work, but also Michel Foucault's (2008) notion of veridiction, where the market and its prices become their own form of truth, replacing the morals that used to be intimately linked up with economic exchange. Alongside such understandings runs scholarly work that reasons somewhat otherwise. We can highlight Max Weber's (1930) study on how a particular version of a Protestant ethic conditioned the emergence of capitalism as we know it. We can point to Adam Smith (1759) and his theory of moral sentiments that was the corollary and a condition of necessity to his laissez-faire market economy. We should also not forget Viviana Zelizer (1994), who demonstrated the moral work that was involved in the struggle to put a price on life, which eventually led to the invention of life insurance.

As Zelizer's study shows, normativities may run silently in the background, but they may also be highly vocal and take the form of critique, tense controversy, and struggle.

In fact, in recent years we have seen the emergence and indeed proliferation of a series of quite explicit articulations of intermingling between normativities and the economy. Barman (2016) has proposed the term "caring capitalism" to account for the phenomenon of impact investment. Frankel et al. (2019) write about "markets for collective concerns" to grasp economists' own ideas and visions for designing markets while also using critical scholarship to encourage the re-examination of markets and how they can be manufactured. Geiger et al. (2014) use the term "concerned markets" to address how markets and the various ways of designing them are intimately implicated in matters of concern. Chiapello and Engels (2021) examine "the fabrication of environmental intangibles" as a critique of how intangible environmental goods are translated, or fail to be translated, into the economy in ways that enable the solving of environmental problems. Notions like "the green transition," "the circular economy," "the bioeconomy," and "impact finance," which are frequently in play and used by actors themselves, point to the same contemporary ambition and struggle, namely that of manufacturing and organizing an economy that is directed at caring and doing good to the nature upon which it ultimately relies and from where it is based and often extracted.

There is an important ambiguity to terms such as "caring capitalism", "concerned markets," "markets for collective concerns," "moral economies," and "the good economy." On the one hand, they aim to describe an empirical phenomenon. On the other hand, they modify the empirical reality they are observing. Some elements that may alter what we see and understand as economic and economies may become foregrounded. Our very methods carefully act upon the empirical reality they interrogate. A part of this is how they point us in somewhat different directions and signpost different sites and issues of interest.

The notion of concerned markets comes from Callon's (1998) theories of framing and overflowing and highlights how an economic situation, for example a particular exchange, is framed in a particular way, limiting what is taken into account. The production of overflows, which stems from such socio-technical framings, in turn produces reframing efforts that seek to respond to concerns that were not initially reckoned with. The task of the market studies scholar is to act as a market civilizer and help to identify overflows and speak on behalf of those concerned.

While sounding relatively similar, the notion of "markets for collective concerns" works from a somewhat different angle and questions the potential of the market civilizer. Instead, the focus is on a

particular type of practice: the economist as a market designer and someone who takes as their task and area of expertise the repair, design, or engineering of markets. The notion of "markets for collective concerns" then draws attention toward how these practitioners re-problematize and transform concerns. An important element here is how markets are made into instruments for policy. The notion of the "good economy" may direct our attention toward the inverse movement: how the good becomes an instrument for economic actors and hence how good-economy relations emerge and modify economies.

What is there to say then when it comes to the empirically new and different which the good economy both brings about and observes in its take on economic practice? What is there, eventually, that makes it stand out in comparison, for instance, to moral economies as we have come to know and describe them? For Zelizer, a good economy as such might perhaps not mean that much, as to her economic action is already thoroughly relational: it is seen to consist of relational work. This is also the case for Weber. His analysis rather worked to specify the particular Protestant ethic that in his argument spurred and shaped modern capitalism. At the same time, these works cast light on one of the key reasonings behind the concept of the good economy in the first place: how the economic and the non-economic are, and have always been, entangled in economic formations. The analyst's role becomes that of figuring out "the how" of these entanglements. In doing this, we can observe different *versions* of economization.

Another side to the concept of the good economy is how it focuses on an often quite explicit demand and an effort to justify economic exchange beyond its contribution to surplus and market success (which can then be allocated to good purposes). An explicit articulation of a good economy contrasts the silent articulations that run alongside the market (Fourcade 2017), outside the market (Thompson 1971), or as the underpinning for surplus (Weber 1930). The good economy is often about the loudly claimed more than the silently woven. As an investigative tool, the good economy is also less about what Fourcade calls the background conditions of economic practice, and more about how the good is being *foregrounded* as an active and prominent feature in practices across different domains, thus possibly reworking economies but also political and bureaucratic offices and practices.

When valuation principles collide or differ, this is sometimes related to the context of valuation. In Fourcade's (2011) example, where she investigates the economic techniques used in court to price and thus assess the worth of nature, the differences between French and American cultures with regard to putting a monetary value on nature are shown to influence the choice of valuation techniques and ultimately their outcome. In fact, we can see this as an example of the

way in which a moral economy resides in the background and becomes activated and intermingles with the very tools and procedures at play. In other words, different moral economies that normally reside silently in the background may take part in the creation of good economies.

Yet, the good economy is neither about a particular feature or element *within* capitalism (such as caring capitalism for the phenomenon of impact finance) nor about a market phenomenon as such. The good economy as a conceptual approach is designed to be moveable across what we take to be the domains of the market and toward practices playing out in offices of public administration, in strategy and innovation programs, in technical and regulatory documents and procedures and, of course, at sites where different elements of these are intermingled.

Good objects

Key to the notion of the good economy is its objects. As this double theme issue of *Valuation Studies* shows, this is an opening, complexifying and multiplying move: good economies are object-dense economies. These objects create their own worlds that demand our close attention. An important endeavor then is to delineate and to interrogate these good-economy relations.

One of the situations through which the notion of the good economy was initially empirically developed was in relation to the notion of bioeconomy – a version of the good economy enacted as a particular good economy understood as environmentally friendly. Through this analysis, it was observed how "the bio" was, and often is, presented as good in and of itself. The "bio" becomes a form of guarantee and the backbone to a good economy. Broadly speaking, the good economy often seems to be involved in and evolve around the issue of sustainability. Put differently, the notion of the good economy evokes the issues of sustainability and the modes of valuations through which the environment is made integral to the economy. Many of the articles in this double theme issue are demonstrations of this more overarching point: that the good economy is simultaneously also a nature-made economy (Asdal and Huse 2023), and so the issue becomes that of carefully investigating the tools by which it is manufactured and the nature–economy compositions that emerge from it.

The articles in this double theme issue bring our attention to the wide array of objects that populate the economy and that, notably, are very often related to the issue of sustainability and thus are taken to be, or are becoming, good objects. That the economy is object-fueled and densely object-populated is of course not new in itself. However, the good economy concept helps zoom in on and foreground this side

to the economy. Many of the articles in this double theme issue ask what the objects are that purportedly can enact, underpin and manufacture a good economy. Can a mine, asks Tobias Olofsson in the first part of this theme issue, or a road, asks Roman Solé-Pomies in the second part, be good? Focusing on a very diverse set of objects, these articles also address the ways in which objects take part in, are linked, glued to, and thus co-modified (Asdal and Cointe 2021) with the economy; for example, by a politics of subtracting (see Marie Widengård's article in the second part of this double theme issue), by a politics of adding (see Daniel Frantzen's article in the first part), by comparing (see Tobias Olofsson's article in the first part) or by offsetting and making things not the same, but distinguishable (see Kamilla Karhunmaa's article in the first part).

Surely, then, the good economy is not solely focused on ideas about the economy. It is also about objects and actions involved in ascribing, manufacturing, and practicing good objects. Good economies act upon the objects toward which they are directed and vice versa. Linking good economy and valuation studies may serve to multiply the field's engagements with the objects (and their agencies) through which the economy is populated. Good economies are thoroughly relational affairs. They modify the very situations in which they intervene. This becomes all the clearer when we consider the links between the notion of the good economy and the field of valuation studies. Like valuations more broadly (Dewey 1939; Muniesa 2011), enacting good economies is about practical actions and accomplishments – as well as their failures (Frankel, Ossandon, and Pallesen 2019). And, following Dewey (1939), the good economy is about valuations through which versions of good economies are enacted, observable and traceable.

The problem of valuation in the good economy

The notion of the "good economy" was explicitly oriented toward the field of valuation studies. Asdal et al. (2023) argued that while valuation studies were thoroughly concerned with the devices by which the economy is constructed, the turn to examining valuations in this field had predominantly been, so to speak, value-neutral. With a few notable exceptions (see for example Heut and Mol's (2013) "good tomato"), less concern has been directed toward which forms of value or, in other words, which forms and qualities of goods and which economies were enhanced and in development.

Another intervention vis-à-vis valuation studies was to suggest a move to interrogate not only the tools, but also the patterned versions of economies that come with or through these tools. Surely, good economies come in the plural, so what versions of good economies can we delineate through our analyses? Inspired by Çalışkan and Callon's (2009) notion of economization, we may want to trace and observe the "versions of economization" (Asdal and Huse 2023) that different

valuation arrangements and struggles bring about. In this way, economies also become a matter of different versions and registers of good economies, brought about by their, sometimes quite different, valuation tools and procedures.

The problem of valuation, then, is at the heart of the good economy. First, a good economy is about activities and practices oriented toward valuations: in order to become good, the good economy is dependent upon the valuations that move the economy toward the direction of good. What we can observe is how new forms of valuations are experimented on and new forms of value (the value of the social, of nature, the bio, and the green) are worked upon to make them translatable and integral to the economy-as-usual. Notably, economic value is produced out of and alongside them. One of the key valuation struggles in the good economy is precisely about efforts to value the initially non-economic in ways that allow, force or invite the non-economic to be made integral to the economy-as-usual – or integral to politics – and bureaucracy-done-differently, sometimes with the articulated ambition and justification of transforming economies for the better, thus making them good.

And, as pointed out above, valuations, even economic valuations, do not only happen in and through markets. Valuations do not only or always involve economic principles, nor is valuation solely or exclusively about economic expertise. Valuations may be about justifying, modifying, appreciating, acknowledging, and rewarding through different forms of expertise by a series of different means. In the example of Fourcade which we discussed above, the site of valuation is not the market, but the court. Moreover, even when the site of valuation is a market, this is not always about actual markets. Contingent valuation refers to a market that does not exist but is imagined, and the question that is asked is: assuming that there was a market (for undistorted nature), what would you be willing to pay (for it to remain so)? It is no coincidence that valuation cases like these attract the attention of scholars of valuation interested in the means by which good economies are best or most frequently, and sometimes troublingly, being practiced.

The tools of valuation in the good economy

The Deweyan pragmatist philosophy, to which a large part of the field of valuation studies is indebted (Asdal, Doganova, and Fochler 2024; Dewey 1939; Muniesa 2011), was not so much oriented toward material or technical means of valuation. Following Dewey, valuation is an ongoing activity; we are constantly involved in valuations; this is an ongoing, observable, everyday practice.

Somewhat different from Dewey, contemporary valuation studies have been much more oriented toward the material and the semiotic

(Muniesa and Ossandon 2023) and the means, devices, and tools of valuation, and this is more indebted to the field of Science and Technology Studies (STS). Similar to the way that laboratory studies in STS were oriented toward the inscription devices which made up the laboratory and equipped the scientists (Latour and Woolgar 1979), STS-inspired studies of markets have been oriented toward the devices which make up markets and render things economic (Callon, Millo, and Muniesa 2007). Market devices have also been of interest for studies of valuation. For example, Doganova and Karnøe (2015) show that the entanglement of economic and environmental valuations in regulatory and entrepreneurial attempts to make "clean" technologies valuable generates tensions that devices such as lists of "best available technologies" try to reconcile. The actors involved must find ways to manage valuation tensions, and we, as scholars, must find accurate ways of observing how they perform, while simultaneously unpacking and interpreting them. Valuation scholars have done this by broadening the focus on market devices to include the manifold "valuation devices" that intervene in valuation practices (Doganova 2019), in markets, and beyond (see, for example in this journal, studies of valuation devices in the Australian market for land (Langford 2021) and in a Danish children's hospital (Hauge 2016)).

The term "little tools of valuation" was introduced to the good economy as a form of companion-device (Asdal and Huse 2023; Asdal et al. 2023). It emphasizes that valuations are not simply about market instruments or devices, but span across markets, policy and bureaucracy, and their respective sites, procedures and tools. Documents, such as white papers, propositions and public reports may act as little tools of valuation: they may make valuations by calculative procedures, but may also do so by assessing, acknowledging, providing estimations, judging, praising, enhancing, etc. Conversely, they may also de-value, downplay, and criticize. This is how Dewey (1939) (see also Muniesa 2011) traced the etymology of the notion of price, addressing how its roots span across the quantitative and the qualitative – such as praising and prizing – and thus very concretely across the economic and the social, and also across economics and sociology. Analytical concepts like the good economy and tools of valuation thus expand concepts like "economy" and "markets" and add to studies which demonstrate their political, material, and related dimensions (Geiger et al. 2014; Frankel, Ossandon, and Pallesen 2019). Perhaps economies have always been about versions of the good? Then the task is not so much to delineate the one from the other, but rather to use theories such as the good economy to reconceptualize and re-analyze what the economy is all about.

"Little," when related to little tools of valuation should not be considered insignificant, as little tools may, in principle, have large and lasting effects. Also, little tools do not act alone. Their effect and

valuation strength are often due to how they are linked up in larger valuation arrangements. For instance, a grade which documents your accomplishment or failure enacts strength due to being linked up in a more encompassing valuation arrangement of comparison, sometimes sanctioned through law, and often through quite strictly regulated procedures and particular forms of expertise. This example illustrates how tools of valuation are both material and semiotic: they are both a material entity linked up in a particular production apparatus (a digital document for instance is the result of a different production apparatus than a piece of paper) and oriented towards meaning-making through visual characters, words, sentences, numbers, and narratives. Are there then specific tools of valuation that are used to shape and characterize the good economy? In that case, what are these tools of valuation? Are they old tools repurposed for the good economy, or new tools designed to perform manifold valuations that produce the good in new and perhaps surprising ways? How do they eventually combine different forms of valuation: are these different forms juxtaposed or translated into one another (Doganova and Karnøe 2015), added or subtracted (see Daniel Frantzen's article in the first part of this double theme issue, and Marie Widengård's article in the second part)? How do tools of valuation perform critical operations in and for the good economy? How do they interfere, create dissonance, or critique the economy-as-usual? How can they sometimes, in different cases and at different sites, invite and attract new actors?

Such questions are precisely what the notion of the good economy invites us to explore. The notion of the "good" does not by necessity imply morally or normatively better. Nor does it mean unproblematic, easy, or accomplished. Enacting good economies is not any easier or less troublesome than enacting economies-as-usual or economy as we hitherto thought we knew it. Hence, examining good-economy relations is what we are after.

The articles in the first part of the theme issue

All of the articles in this double theme issue explore good economies through empirically grounded analyses.

Can the economy become good by *adding* features to it, asks Daniel Frantzen in his article "Water Plus What? On the Politics of Addition in the Good economy of Climate Adaptation," which reports on a study of water management policies enabling adaption to climate change. Zooming in on the case of the "WaterPlus" campaign initiated by the Danish Ministry of Environment, Frantzen questions what the "plus" means and entails. Examining a wide range of documents dealing with "added value" in climate adaptation in urban planning, he shows how the management of rain is rendered good through being

added with other goods: by managing water more efficiently (that is, in a less costly way) than before, producing pleasure and "recreational value," and creating spaces for fun and play. Combining the perspective of the good economy with Boltanski and Thévenot's (2006) analysis of orders of worth, the article argues that the politics of addition results in the production of "compromises" between different versions of the good which are materialized in "composite objects" such as specific climate adaptation projects and the tools used to evaluate them.

In her article "Good Economies of Carbon Offsetting: The Cyclical Dynamics of Valuation and Critique in Voluntary Carbon Markets," Kamilla Karhunmaa delineates not only the construction of a market for carbon, but that which is often meant to follow, namely the economies of carbon offsetting. Contrary to previous studies of carbon markets that have emphasized processes of commensuration and "making things the same" (MacKenzie 2009), she highlights the importance of differentiation. She outlines three instantiations of a good economy of carbon offsetting – focusing respectively on the internalization of externalities, the production of additional "co-benefits," and the realization of "climate impacts" – which are characterized by the valuation practices and tools used to manage the tension between commensuration and differentiation. The move from one good economy to another, she argues, is triggered by moments of critique which lead to the development of new valuation practices and tools, thereby giving rise to iterative cycles of critique and reform.

José Ossandón, Trine Pallesen, Peter Karnøe, and Susse Georg's article, "Making Good Economies with Bad Economic Instruments: A Brief History of Wind Power's Changing Economies", shows even more concretely how tools of valuation and versions of good economies go together. Through a historically oriented study on wind power development in Denmark, the article shows how the good is intimately entangled with instruments of valuation, or put differently, how different good economies are supported through the relevant tools. Applying a semiotic analysis to policy instruments, inspired by actor-network theory and Greimas's actantial categories, the authors explore the changing status of wind power in the good economies outlined in three support schemes introduced to foster the development of wind power in Denmark. The roles of wind as a resource tied to an *oikos*, a commodity supporting a local industry, or a national energy resource and an asset, are also closely tied to the "objects of value" that organize these different good economies: Denmark's energy independence, economic sustainability, or energy security and sustainable economic development.

The bioeconomy is the focus of the article by Oscar Krüger and Alexander Paulsson entitled "Bio-Efficiency: On the Valorisation of Innovation in the Bioeconomy." Combining an online ethnographic

observation of funding events with an analysis of project documents, the authors focus on the allocation of resources in the Swedish bioeconomy and explore how innovation projects are made worthy for funding. They argue that the bioeconomy becomes a good economy not only through the alignment of the "bio" with the "good," but also through other virtues that this economy is seen to enact, namely those of innovation and efficiency. Bio-efficiency is a concept put forward to account for the kind of efficiency observed in the context of bioeconomic innovation: efficiency here is seen not as a characteristic of a process, but as the object that is valued itself.

Can a mine be part of a good economy, asks Tobias Olofsson in the article "Making Mining Good: Tracing the Semiotics of Justification in Mineral Exploration and Mining"? This article sheds light on the justifications produced by mining companies to support their exploration projects. Moving beyond the "worlds of worth" outlined in the work of Boltanski and Thévenot (2006), Olofsson focuses on the justifications themselves and examines them via an analysis inspired by Piercean semiotics. The analysis of the Swedish mining industry's "claims to goodness" found in a variety of empirical materials, including interviews, ethnographic observations, and mining lease applications, reveals how justifications emphasize certain values over others and claim that certain mines do more good than others. Comparison – of costs and benefits, of mines today and mines in the past, of mines in the global north and mines in the global south – is central in this endeavor. Overall, the article sheds light on how an environmentally "bad" industry attempts to be part of the good economy and produces its justification through being comparatively better than other practices, versions, and sites of mining.

Negotiations over goodness can be based on the different qualities of objects. The articles in the first part of this double theme issue explore how the qualities and thus the goodness of an object (be it water, carbon, wind, a bioeconomy, a mine) intermingle with particular valuation tools, and how such co-modifications shape versions of good economies. Anna Brueckner Johansen, Susi Geiger, and Sarah Wadmann's article, entitled "Temporal Layering: How Past, Future and Present Intersect in the Valuation of Pharmaceutical Innovation," shows that there are also other qualifications at play. Introducing a temporal dimension in the analysis of valuation practices, the authors show that valuation involves the negotiation not only of the qualities of an object but also of which temporalities and moments in its trajectory come to count. Examining how the pharmaceutical industry, as an instantiation of the good economy, is troubled by the extremely high price of a novel gene therapy, the article shows that the goodness of the good is built through what the authors call "temporal layering": the mobilization of past experiences and future expectations with regard to the value of a drug. A good economy rests on what there is

to come, but also on which goods were there previously and how these performed in the past.

The final article in the first part of this double theme issue turns to finance. Can a "black swan" be turned "green" and become part of a good economy? A black swan is an event which is very unlikely to happen, but when it does, it may transform the economy and our understanding of it. In her article "On Green Swans and Catastrophic Futures: Climate Change as Risk and Uncertainty," Stine Engen shows how the uncertainty stemming from climate change is reconceptualized in the figure of the "green swan" and becomes a mode of critique directed at financial models due to their lack of capability to take a future climate crisis into account. The article focuses on a document published in 2020 by the Bank for International Settlements and Banque de France called "The Green Swan." Combining the claimed uncertainty of the future with the implicit certainty of the climate crisis, the document operates as both a tool of critique and a tool for valuing the climate anew – and, as the author suggests, as a way of partly escaping the problem by mobilizing the good economy as a moral horizon.

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Theme issue contribution

Water plus What? On the politics of addition in the good economy of climate adaptation

Daniel Nordstrand Frantzen

Abstract
In this article, I trace the transformation of climate adaptation in Denmark into a *good economy*. Empirically, I explore a shift in rainwater management from building sewers underground to making cheaper solutions on the surface. Moreover, these solutions are expected not only to handle rainwater but also to "add value," particularly recreational value. I call this approach the *politics of addition*, emphasizing that it entails a specific set of principles for doing good while adapting to climate change. Theoretically, I relate this politics of addition to the concept of the good economy. By drawing on the *orders of worth* perspective, I emphasize how good economies are compromises between multiple versions of the good and that these compromises need to be stabilized through so-called composite objects. Relying mainly on document material supplemented by interviews, I identify several composite objects in climate adaptation, including tools of valuation as well as specific projects. By analyzing these composite objects, I describe how the politics of addition compromises several versions of the good in climate adaptation, eventually promising that adding value will ease "the battle for space" in cities by composing economic, technical, and recreational value into the same facilities.

Keywords: climate adaptation; rainwater management; added value; the good economy; compromise; composite objects

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Introduction: Adding together different versions of the good

> [W]hen you have to spend much money on climate adaptation, you might as well think in added value and get urban development on top of that. (Realdania 2015).

Nowadays, adapting to climate change is a necessity. Nevertheless, some actors may try to turn this necessity into an opportunity. This article explores a concrete attempt to transform necessities into opportunities, as observed in climate adaptation in Danish rainwater management during the 2010s.[1] Around 2010, several damaging heavy rain incidents occurred in Denmark, including one in the summer of 2011, which flooded parts of Copenhagen and resulted in damage with an estimated value of DKK 6 billion (Fritzbøger 2018). This highlighted to experts and policymakers that the sewage systems were no longer properly dimensioned for rainfalls that are getting more extreme due to climate change. Moreover, it was also clear that adhering to business-as-usual by extending the sewers to accommodate more rain would be immensely costly. For that reason, solutions that handled rainwater on the surface instead of underground came to be valued due to their significantly lower costs. Yet, surface-based solutions were also favored for another reason, as they posed an opportunity to create "urban development" by "adding value" to the climate adaptation projects, as the quote above states.

The quote is not just any quote, but a pivotal statement from a campaign initiated by the Danish Ministry of Environment in collaboration with two influential charitable foundations (Realdania and Lokale- og Anlægsfonden). This campaign, aptly named WaterPlus (VANDPLUS in Danish), was an important step toward promoting climate adaptation on the surface with added value. This article delves into the "plus" by asking what kinds of value were added together with rainwater in this campaign and in Danish rainwater management per se.

Pursuing added value in practice is not straightforward. Previous research has highlighted that in order to make climate adaptation on the surface, new collaboration across sectors and professions is needed – mainly between engineers with expertise in handling rainwater efficiently and landscape architects with a very different kind of expertise, namely, in making room for rainwater as part of aesthetic and recreational projects such as parks (Meilvang 2019; Kvamsås 2021). This article asks what has motivated actors to undertake this collaboration even though it may be tedious. Hence, I explore the

[1] The term "climate adaptation" usually refers to a broader range of initiatives to adjust to a changing climate than rainwater management. However, in this article, I use it as shorthand for climate adaptation in rainwater management.

promises and ambitions that have been assembled around the notion of added value in climate adaptation. By doing so, I excavate what I dub a *politics of addition,* consisting of a particular set of principles, aspirations, and morals influencing how climate adaptation is undertaken in Denmark, pushing it to convey more value than merely handling rainwater.

I find that a central principle of the politics of addition is to bring together qualitatively different forms of value. As indicated by the brief introduction to WaterPlus, the campaign aimed to integrate the technical value of handling rainwater, the economic value of keeping expenses down, and then something more: urban development. This bringing together of different value systems resonates with a central topic in valuation studies, namely how multiple principles of valuation become entangled (Doganova and Karnøe 2015). It also speaks to a slightly different type of entanglement: "[H]ow economies and versions of the good are entangled" (Asdal et al. 2023: 1), to which the key topic, the good economy, of this theme issue draws attention. In that respect, this article traces the dawn of a good economy of climate adaptation – one where different versions of the good are added together through a specific politics of addition. However, I argue that telling the story of actors striving to turn climate adaptation into a good economy can be aided by drawing on the orders of worth perspective introduced by Boltanski and Thévenot (2006). Boltanski and Thévenot have identified a range of incommensurable value systems or "orders of worth." Yet, they have also drawn attention to how the tensions between these orders can be set aside by composing compromises that are stabilized through composite objects. Hence, I suggest that good economies can be assembled and sustained through *composite objects*, and I use the notions of compromise and composition to guide my analysis of how different versions of the good are brought together in the politics of addition.

In the next section, I elaborate on this dialogue between the good economy and orders of worth, arguing that good economies are compromises that need composite objects. After this, I introduce my empirical material, consisting mainly of documents supplemented by interviews. The following analysis is structured in three sections, each focusing on a specific part of my document material and each adding to the exploration of the good economy of climate adaptation and the politics of addition that it entails. First, I describe how the aforementioned WaterPlus campaign came about, paying particular attention to how it used the term added value in a novel way, extending its meaning from surplus to composing different forms of value. Next, I explore how this compromise was consolidated by tools for evaluating climate adaptation projects, focusing on one specific tool called the WaterPlus accounts. This tool foregrounds the making of "double functions" as essential for adding value. In the third section,

I move to concrete climate adaptation projects, exploring how actors describe and justify their double functions as making cities more "fun" while easing "the battle for space." The article ends with a concluding discussion that summarizes the politics of addition and discusses it in relation to the concepts of the good economy and compromise.

Composing the goods of good economies

In this section, I further describe how the orders of worth perspective can contribute to the concept of the good economy, emphasizing that good economies are compromised economies reliant on composite objects.

The good economy concept draws on the economization agenda that focuses on market devices (see e.g., Muniesa et al. 2007). Yet, it is proposed that economization "… leaves little space for exploring if and how there might be other dimensions at stake than the economical" (Asdal et al. 2023: 6). Hence, it is suggested that economization may come in many different "versions" and that each of these relates to versions of the good in its own distinct way that needs to be traced empirically (Asdal and Huse 2023; Asdal et al. 2023). To capture that valuation comes in many versions, rather than focusing narrowly on market devices, attention is drawn to the notion of tools of valuation, which captures a broad range of valuative modes from the calculative to the qualitative and narrative (Asdal and Huse 2023: 40). The good economy, hence, draws attention to how the economy "… is in need of justification beyond its contribution to surplus and on top of its eventual success at the market" (Asdal et al. 2023: 7). The concept thus stimulates critical explorations of how economies seek to "insert" themselves into society in ways that are justified as being good. As the good economy needs justification beyond the economic realm and works through a broad range of valuations, I propose to explore the notion of the "good economy" from the orders of worth perspective that offers a framework for analyzing justifications and compromises between different versions of the good.

Through empirical studies of critiques and justifications, Boltanski and Thévenot (1999) have proposed that there is a finite set of moral grammars or orders of worth in play in our society – each with its own distinct version of the common good. Eight of such orders of worth have been identified: inspired, domestic, civic, opinion, market, industrial (Boltanski and Thévenot 2006), green (Lafaye and Thévenot 2017), and the projective order of worth (Boltanski and Chiapello 2005). The eight different orders of worth are each dependent on their own mode of evaluation for "testing" the worth of beings (both human and non-human) that depend on their contribution to the common good (Boltanski and Thévenot 1999: 367, 2006: 76). Tests

rely on specific tools and equipment for evaluating worth (Boltanski and Thévenot 2006: 131). These tests can take various forms; sometimes, they are highly calculative, sometimes more qualitative. Hence, they align well with the breadth of the notion of tools of valuation.

According to Boltanski and Thévenot, orders of worth are in tension with each other as their notions of the common good are incommensurable. Yet, compromise between two or more orders can be achieved, suspending their conflicts and rendering them compatible (Thévenot 2001). In a compromise, the beings, objects, and value principles of multiple orders of worth are brought together in arrangements that tend to be fragile due to tensions between the participating orders of worth (Boltanski and Thévenot 1999). Because of these fragilities, compromises require consolidation in the form of "composite objects" that enjoin and coordinate aspects from the different compromised orders (Boltanski and Thévenot 2006: 278). Composite objects may take many forms including contracts, procedures, physical objects, and institutions (Thévenot 2001). Composite objects are "indivisible" because "one cannot challenge the compromise without destroying them" (Boltanski 2012: 58).

The orders of worth framework is often criticized in the field of valuation studies for being too rigid and deductive, spurring its users to identify the already defined orders of worth in new empirical settings rather than exploring in detail the specific valuation processes taking place (Heuts and Mol 2013; Kornberger et al. 2015). Yet I find that Boltanski and Thévenot's work provides important insights into how different value systems or "valuation cultures" (Stark 2009; Lamont 2012; Zuiderent-Jerak and Van Egmond 2015) come to relate and clash and may thus add to previous work in valuation studies on how different kinds of value become entangled (Doganova and Karnøe 2015). Hence, I propose that the concepts of compromise and composite objects can help to describe how multiple versions of the good are integrated into good economies. In line with these concepts, I use the verb 'composing' to denote the work of adding together different value systems in composite objects. Furthermore, like Thévenot (2002: 64), I label such composite objects as "compromised", not meaning that they are damaged or suspect, but simply that they are the objects of compromises.

Equipped with these concepts, good economies can be viewed as compromises between an economic value system and other value systems from outside the economic realm. Furthermore, through the orders of worth perspective, one would expect such compromised good economies to be fragile and prone to critiques if not supported by composite objects that could stabilize compromises between different value systems. Hence, tracing such composite objects can be one avenue for studying how good economies are emerging and being

sustained. I will suggest that some of the tools of valuation that Asdal et al. (2023) analyze through the good economy lens could be seen as composite objects since they consolidate different value systems. One example of this is their analysis of OECD's Ocean Economy project, which seeks to include the value of the oceanic ecosystems in economic calculations of the growth potential of the ocean economy. Hence, the usual opposites of economic growth and environmental regulation are made to work together here: what is good for life in the oceans is good for the economy, constituting what is promoted as a "win-win economy" (Asdal and Huse 2023: 47). Building on this, in the analysis I will identify and analyze the composite objects of climate adaptation, asking what politics of addition they convey; that is, how they integrate several versions of the good.

Tracing composite objects: Methods, empirical material, and analytical approach

This article is part of an ongoing exploration of the politics of addition in climate adaptation in Denmark and draws on several types of empirical material collected over two periods. The first ran from 2018 to 2019, during which a wide range of documents about added value in climate adaptation were collected and analyzed. In the next phase of empirical collection, in 2022–2023, I conducted five expert interviews with actors in climate adaptation to contextualize my document-based data.

Most of my document material is written by and for professionals working with climate adaptation and urban planning. Hence, this material offers a view of how professionals have communicated and justified added value in climate adaptation. The documents gathered can be categorized into three groups, each corresponding to a part of the following analysis.

The first group of documents concerns climate adaptation in general and was analyzed to trace how surface-based climate adaptation with added value has been introduced historically as a viable answer to heavy rain. This will be described in the first section of the analysis, where I trace the advent of a good economy of climate adaptation back to 2012–2013, when several important things happened, including the launch of the WaterPlus campaign and its proposed compromise between different value systems through the notion of added value.

Apart from these general documents, I came across two distinct types of documents. Borrowing from Asdal and Huse (2023: 111), these could be termed "document species" to emphasize that they come with specific ways of ascribing value and ordering realities. The first of these species is comprised of a series of documents that have been made to help professionals working in municipalities or utility

companies to evaluate climate adaptation projects – not just on their technical capacity and price but also on the added value they provide. As such, these documents can be understood as what, in Asdal and Reinertsen's (2022) method for document analysis, are called "document tools." In my case, these tools were made to guide the professional in assessing climate adaptation projects. Some of these tools are pamphlets, while others are preformatted Excel sheets to be filled out when evaluating projects. I identified seven of these tools and have analyzed them by reading their instructions and trying to use them as the tools they are. This allowed me to explore them as composite objects that coordinate several ways of evaluating climate adaptation projects. In the second part of the analysis, I will focus on one of these tools, the WaterPlus accounts, to explore the operations that go into forging compromises between different value systems, including the making of double functions, which are given central importance in this tool.

I explored the link between added value and double functions in more depth in the third part of my document material, which consists of another document species: catalogs or online collections of examples or "best practices." It is widespread among professionals in urban planning to assemble and distribute best practice examples to frame urban problems and their solutions (Bulkeley 2006; Blok 2012). This means that example collections entail their own mode of valuation, justifying projects as particularly good and relevant for others to learn from. For that reason, I found such collections to be interesting sites for identifying projects which were justified as having added value. I sampled ten relevant example collections in which at least some of their examples were climate adaptation projects. After having sampled the collections, I went through them to identify climate adaptation projects for which it was highlighted that they conveyed some added value. Using this method, I identified 77 climate adaptation projects with added value. I collected statements about each project and its kinds of added value from as many of the partners involved in the project as possible. Inspired by Broto and Bulkeley (2013), I gathered information about each project by systematically examining material available online including documents and videos. Based on these documents, I explored the 77 projects as composite objects and coded the kinds of added value conveyed by the projects according to the project members. Further, I coded and analyzed statements where actors narrated how the added value was achieved – not least through double functions. In the analysis, I delve into three of these 77 projects, which highlight recurrent patterns in making and justifying such double functions.

Introducing the "plus" and extending the meaning of "added value"

In order to commence the analysis of the politics of addition in climate adaptation, I start in a park – Rabalderparken in Roskilde. Yet, Rabalderparken does not resemble most parks since it contains a large rainwater reservoir. However, it is more than a reservoir. It is a curvy concrete reservoir shaped to be used for skateboarding and other forms of physical activity when not filled with rainwater. Rabalderparken was completed in 2012, making it one of the first projects combining rainwater management on the surface with other functions, such as the possibility of skateboarding. This novelty was praised at the inauguration of Rabalderparken, where Ida Auken, minister of environment at the time, delivered a speech:

> I had never imagined that climate change could be so much fun. (…) I'm proud to live in a country with people as creative as you. You have thought positively and solved the problem of the effects of climate change in a way that brings engineering, the environment, and people together. (Ida Auken in Kimer 2012).

The speech could be seen as a brief "moment of valuation" (Hutter and Stark 2015) in which it was made clear that engineering and technical solutions were no longer enough for climate adaptation to be satisfactory. At the least, it would be considered more valuable if the technical solutions for managing rainwater were creatively linked to the needs of humans. As hinted in the quote, this infrastructure was to be assessed not only on its ability to manage rainwater but also on its ability to generate fun for the people skateboarding and playing in it.

Figure 1: Rainwater and a child on a scooter in Rabalderparken.
Source: Photo by the author.

The minister's appraisal of Rabalderparken was no coincidence since the Rabalderparken project exemplified what could be achieved with a new law proposed in 2012 and passed in 2013, allowing local utility companies in charge of building and maintaining sewers to finance climate adaption on the surface if these solutions were "cost-efficient" (Naturstyrelsen 2013: 11). The principle of cost-efficiency meant that utility companies were allowed to construct surface-based solutions when they were cheaper than making or extending sewers while keeping the same "service level" or efficiency that sewers could provide. The law meant that utility companies could now co-finance projects of municipalities or private actors that contributed to rainwater management.

To promote the possibilities of the new law, the Ministry of Environment, along with two influential charitable foundations (Realdania and Lokale- og Anlægsfonden), in 2013 launched the campaign WaterPlus. Through four demonstration projects, WaterPlus aimed to show how rainwater management could be combined with aesthetic and recreational qualities to create what was termed

merværdi (added value) within the campaign. In common Danish, *merværdi* denotes the adding of economic value. Hence, the way it was used in WaterPlus was an extension of the word's initial meaning on two levels. First, the notion of value was enlarged from economic value to encompass more qualitative kinds of value, e.g., recreational value. Second, *merværdi* was used not only to describe the mere addition of value; rather, it denoted the joining of different kinds of value at once, e.g., the technical, the economic, and the recreational.

The WaterPlus campaign was launched not long after the inauguration of Rabalderparken, where the minister had praised the facility for being "fun." In one of the early press releases on the WaterPlus campaign, Ida Auken almost echoed her speech from Rabalderparken, stating that:

> We now have many tools and financing options for efficient climate adaptation in Denmark. However, it is even better if climate adaptation not only protects us against cloudbursts, but also creates new opportunities in the cities and perhaps provides more space for play, sports, culture or completely different experiences for citizens. (Ida Auken in Realdania 2013).

The quote encapsulates the shifts in making climate adaptation that occurred at the time and which launched what I call a politics of addition: as it became possible for utility companies to finance cost-efficient climate adaptation on the surface, this entailed an ambition that climate adaptation should do more – it should add value – in its new extended meaning. From these early efforts to promote added value, it is evident that at least three types of value were to be compromised and composed in climate adaptation: economic value by keeping expenses down, technical value by ensuring efficient rainwater management, and then the value of new opportunities for urban dwellers in the form of recreational facilities, etc.

Adding value in the WaterPlus accounts

Despite there being a clear ambition to add together economic, technical, and recreational value in climate adaptation around 2012–2013, it was still relatively unclear how these different kinds of value should be compromised and, as a result, exactly how the politics of addition should unfold. One way in which this compromise was consolidated in the following years was through the composite objects of document tools for evaluating the added value of climate adaptation. Though I identified seven of these tools, in this section I will focus on one of them: the WaterPlus accounts (VANDPLUS 2015a), which were developed in connection with the four demonstration projects of the WaterPlus campaign. Analyzing this

particular tool allows me to delve further into how exactly this influential campaign promoted added value.

Figure 2 shows the final version of the accounts for one of the WaterPlus projects located in the municipality of Frederiksberg. It is evident from this figure that the accounts use a bar chart to compare the costs of two types of climate adaptation projects: A "WaterPlus project above ground" benchmarked against a "Traditional project underground." I have not encountered such comparisons between a novel kind of project with added value and a so-called traditional project in the other document tools studied. This makes the WaterPlus accounts a particularly interesting site from which to view the politics of addition, since it quite vividly distinguishes surface projects from business-as-usual solutions placed underground.

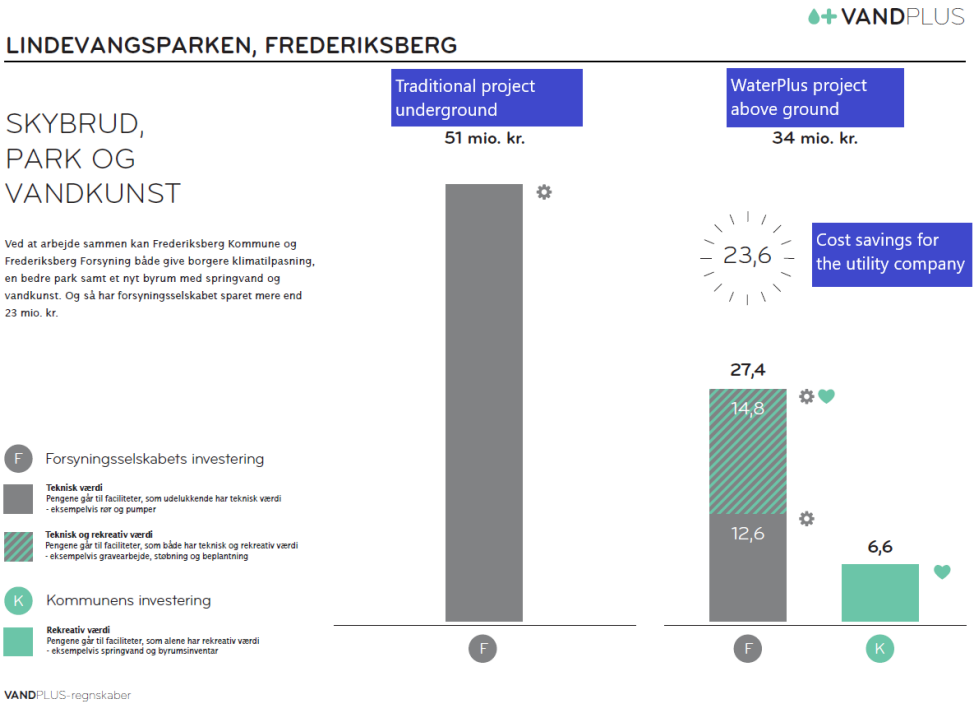

Figure 2: WaterPlus accounts for the project Lindevangsparken.
Source: (VANDPLUS 2015a, 3). Reprinted with permission from Realdania. Selected parts (in blue boxes) of the account are translated into English.

I will now analyze the particular WaterPlus account seen in Figure 2 by paying close attention to the differences that the figure establishes between the WaterPlus project and the "Traditional project underground." This analysis is further supported by a background document (VANDPLUS 2015c) explicating the calculations behind the WaterPlus accounts.

The first difference in the account is a difference in cost: the bars in the figure indicate that the WaterPlus project has cost DKK34 m, while a comparable "traditional" would cost DKK51 m. This is based on

calculations from the local utility company summarized in the background document (VANDPLUS 2015c: 2). Here, the costs of the WaterPlus project are computed, while the cost of a fictitious project that handles the same volume of rainwater in "one large basin underground" is estimated. By imagining such an underground basin, the account demonstrates that moving climate adaptation facilities to the surface is cheaper. This first value that is added is thus an act of subtracting costs.

Yet, costs are not just subtracted; they are also divided: In the "traditional project," the investment is solely undertaken by the utility company (emblematized by an "F" in the grey circles in Figure 2). In the WaterPlus project, another actor is added: the municipality (emblematized by a "K" in the green circles in Figure 2). As the municipality is shown to undertake part of the investments, it is highlighted in the figure that the utility company saved DKK23.6 m by making the project above ground compared to the traditional project underground. Displaying that the utility company is saving money through the operations of subtracting and dividing costs is particularly important due to the legal demand that utility companies can participate in surface-based solutions as long as they are cost-efficient, as mentioned in the previous section.

Though the increased cost-efficiency of moving climate adaptation seems to be an important aspect of the politics of addition, it does not encompass all the aspects of adding value that the WaterPlus accounts show. With the introduction of the municipality into the WaterPlus accounts, a new distinction between two qualitatively different types of value is also added: technical value and recreational value. In Figure 2, technical value is symbolized by a grey cogwheel, whereas recreational value appears in the form of a green heart. It is evident that the municipality has only invested in recreational value (indicated by the green bar representing DKK6.6 m), while the utility company has made investment of solely technical value (indicated by the grey bar representing DKK12.6 m) or of a combined technical and recreational value (indicated by the grey and green bar representing DKK14.8 m). The WaterPlus account provides short explications of these three value categories. Technical value indicates that "the money is spent on facilities of solely technical value – e.g. pipes and pumps." Facilities that solely have recreational value are exemplified as "e.g. fountains or urban furniture," while it is noted that "digging, casting and planting" are investments that may convey both technical and recreational value (VANDPLUS 2015a: 3). The background document designates these investments of double value as a result of the municipality's influence:

> Through the joint project, the municipality (...) has had the opportunity to influence the design of the technical part of the facility and, thus, large parts

> of the utility company's investments (...) in a recreational direction. (VANDPLUS 2015c: 2).

Hence, the WaterPlus accounts point to the possibility of using investment from the utility company as a lever for making recreational facilities if one can manage to "influence" the technical solution. The WaterPlus accounts do not mention specific instances of this, but other documents that describe the facilities of the particular project of Figure 2 do so: for instance, a stage in concrete for activities like dancing that at the same time works as a rainwater basin is highlighted to be of both technical and recreational value, while most expenses including digging out and casting concrete have been paid by the utility company (VANDPLUS 2015b: 24 f.). Such instances of joint recreational and technical value were also termed "double functions" within the WaterPlus campaign. In the introduction to the WaterPlus accounts their importance is also emphasized: The key to success lies in double functions. A big part of the utility company's money goes to facilities that can both accommodate rainwater and activities. That way, we get more for our money. (VANDPLUS 2015a: 2).

Thus, multiplying functions of the facilities is at the core of adding value, according to the WaterPlus accounts. Though neither the accounts nor the background document mention it, there is a special incentive for multiplying the value of technical facilities, giving them a recreational value as well. According to the legal regulation of utility companies, they can only invest in amenities that handle rainwater (Naturstyrelsen 2013) So, while the facilities financed by the utility company may have a recreational aspect, they must also have a technical element. Hence, with double functions, one can get more for one's money, as stated in the quote, not least because the utility company is paying for them.

This reading of a specific WaterPlus account and its connected documents has offered a view of how the new extended meaning of added value, described in the previous section, has been composed and stabilized in a tool. The tool emphasizes that value can be added when shifting from "traditional projects underground" to projects on the surface. The composition of the WaterPlus accounts shows how the politics of addition entails a wider range of arithmetic operations, including dividing expenses, saving money (subtraction), adding together different types of value, and multiplying value through double functions. Hence, this range of operations supports the composition of economic, technical, and recreational value. While the accounts emphasize the importance of double functions, they say little about how they are achieved apart from suggesting that they result from the municipality's influence. As I find double functions to be a central part of the politics of addition, I will focus on their composition in the following section.

Composing and justifying "double functions"

In this section, I turn to the other species in my document material – that of best practice examples – to explore how the making of double functions is described and justified in connection with these examples. I focus on three pertinent project examples, which together show the most recurrent ways of making and justifying double functions across the 77 projects examined. To start this journey through best practice examples, I return to where the analysis started: Rabalderparken, which was appraised for its fun character by the minister of environment at its inauguration due to its incorporation of skating facilities into a rainwater reservoir.

According to the documents I have assembled about Rabalderparken, this double function was not envisioned from the start as the original plan was to make a purely technical facility of water canals traversing a park and leading to an egg-shaped reservoir. However, this plan inspired local skaters as they thought: "… it looked like what we had seen in video clips from the USA, where you skate in drainage canals when it doesn't rain," as one skater put it (Bærentzen 2012: 27). This resemblance gave rise to an idea, and the skaters contacted the local utility company to influence the technical solution by suggesting that the canals and the reservoir should be covered in concrete, which is more suitable for skating than the cheaper asphalt that was first planned as surface material. The developer agreed to this. This brief story of actors realizing that several types of value could be compromised in Rabalderparken entails two aspects of making double functions that I have found in many of the best practice examples. First, ideas are brought in from outsiders, such as skaters. Next, a material component is introduced, which supports composing the added value with the technical value of the rainwater facility. In this case, concrete plays this role as it can accommodate both rainwater and skating.

However, more effort was put into composing the technical and the recreational in Rabalderparken, as an architect and skater with experience in designing skating facilities was engaged to work the egg-shaped reservoir into a skating bowl. In a video clip (Meloni 2013), the architect explained how the overall shape and dimensions "were given in advance" so that his task was to "… come up with a form that's fun to skate and connects with this egg shape. And it is really complicated to make this work while taking into account that this bowl has to be able to contain a specific amount of water." Hence, the architect described how making double functions requires continual negotiation between very different demands – making shapes that are fun to skate while sticking to the fixed shapes and dimensions that are demanded for rainwater management. Yet, a potential tension between the differing demands is downplayed – the main message is that both technical and recreational value can be achieved in harmony through

creative composition. Hence, the architect added various bumps, ramps, and curbs to enhance the fun of skating in the reservoir. Making these interventions in the original egg shape "… gives this double function in an otherwise boring water management project," the architect (in Meloni 2013) further noted. I find that this way of talking about double functions as something that "gives" without taking anything from the technical facilities and their capacity for handling rainwater, is recurrent among actors making added value. Along with this playing down of any potential tensions between the technical and recreational value systems, a clear distinction is also added between boring technical projects and projects with double functions, which are justified as fun.

That double functions can transform boring technical solutions into something fun is not only stated in connection to Rabalderparken. For instance, I also encountered it in the project POP-UP, which is a climate adaptation solution proposed by the architectural firm THIRD NATURE. According to THIRD NATURE, "POP-UP solves three challenges at once" since it places a public park atop a parking facility located below ground within a rainwater reservoir. During heavy rain incidents, rainwater "fills the underground reservoir and the parking structure will pop up in the cityscape." According to one of the architects behind the project, the park and parking facility popping up gives "completely new types of experiences back to the city's users" (THIRD NATURE n.d.). Hence, through the material composition of POP-UP, the technical rainwater solution is turned into a spectacle. However, the triple function of POP-UP is also justified in another way, as indicated in the following quote from a consultant at Rambøll, who has assisted with the project:

> There is a battle for urban space. Often the choice comes down to financials and open spaces lose to developments. By combining several solutions into one, POP-UP enables cities to ensure the economic vitality of the city whilst becoming resilient. (THIRD NATURE n.d.).

Hence, integrating several functions on top of each other is proposed as a truce in the battle for space. If several functions are not composed on the same plot of land, the consultant fears that economic interests in profitable building developments would trump the need for spaces for recreation and climate adaptation solutions. However, making double (or triple) functions is justified as relaxing tensions between these otherwise opposing interests.

Apart from placing functions atop each other, rainwater plays a special role in POP-UP as it creates a new experience for urban dwellers when it lifts the park. Putting the rain to use is another recurrent way of making the double functions that I have traced among the examples. As noted by Meilvang (2021), there has been a

shift among climate adaptation professionals from seeing rain as a risk to perceiving it as a resource for urban development as well. This "resourcification" (Hultman et al. 2021) of rain goes beyond using rainwater for recreational experiences. This is clear if one turns to another example: The Climate Road in Hedensted municipality, where rainwater is utilized to produce heating.

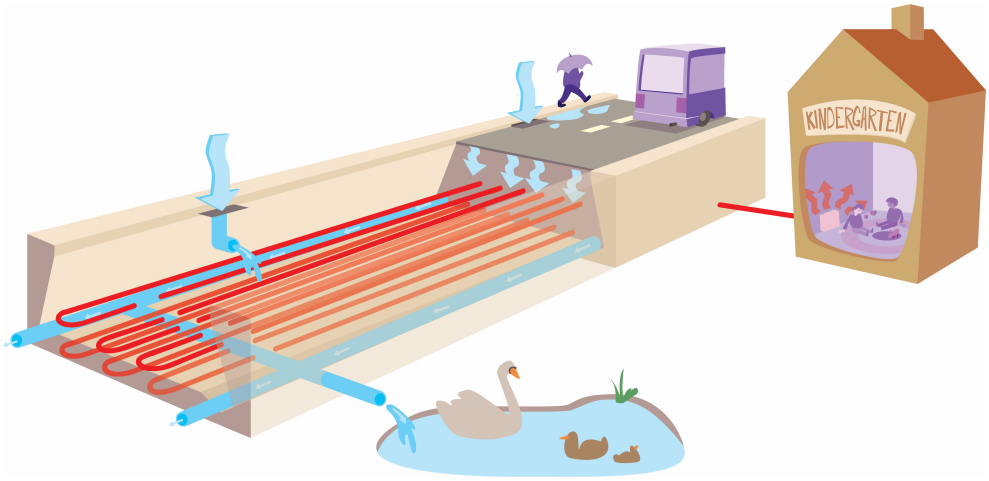

Figure 3: Drawing of the climate road showing how rainwater passes through the geothermal pipes (colored in red).
Source: VIA University College.

As in the two previous examples, the Climate Road has a playful element: It is referred to as "the magic road," especially by children in a neighboring kindergarten. The magic of the road is that it absorbs water as it is made of permeable asphalt. However, the road contains more tricks. According to one of the researchers from VIA University College, who collaborated with the municipality on building the road, from the beginning there was an awareness of the "battle for space" in urban areas. Consequently, it was thought that "We need some added value in this [project]" (Interview A). This was achieved by treating rainwater as a resource in geothermal energy production:

> We have learned that the moister the soil is surrounding the geothermal pipes, the more they produce. And hence, it intuitively made sense to combine a climate adaptation solution that handles a lot of water with an energy solution. (Interview A).

So, the idea was to integrate pipes, used to extract geothermal energy, into the roadbed below the permeable asphalt, allowing rainwater to increase the efficiency of the pipes (see Figure 3). Now, this solution provides heating to the neighboring kindergarten. When

testing the Climate Road, researchers realized that rainwater not only contributes to wetness but also to a bit of heat that is transferred to the geothermal pipes. This further supports the framing of rainwater as a resource that should be exploited instead of going to waste in the sewer. Due to its emission-free energy production, the Climate Road has been justified as one way "that we can contribute to a better global climate" (Hedensted Kommune, n.d.), as stated by a member of Hedensted City Council. Apart from its combination of climate adaptation and mitigation, the road is also valued for contributing to the local environment: when rainwater travels through the roadbed it is also cleaned, and is subsequently led to a small lake in order to improve its water quality. The Climate Road hence composes climatic and environmental kinds of value, which have not been previously encountered in the analysis. Based on my analysis of all 77 projects from the example collections, I contend that economic, technical, and recreational value are at the center of the politics of addition. However, it is important to acknowledge that certain actors experiment with composing other types of value into climate adaptation. When summarizing the Climate Road's composition of functions and types of value, the researcher stated:

> Well, if we now show that we can create a climate adaptation solution where we can handle a large quantity of water (…) If we can also extract energy from it and at the same time show that the roadbed can actually clean the water to a certain extent, then you have – what to say – an added value there. So, it's about making it probable why this is a really, really good idea. (Interview A).

It is thus hinted that adding value by creating double functions is also a tactic for increasing the attractiveness of climate adaptation projects. This aspect of added value is further reflected in a quote from an employee at Realdania – one of the foundations participating in WaterPlus:

> Well, sometimes I think that the division between what is the value and what is the "added" in reality can be a little blurred. It is dependent on the angle from which you look at a project. When politicians make decisions on many of those climate adaptation *projects… They* may actually not be climate adaptation projects to them, because they are in reality a new park or a new playground, or a new football field. If these projects provided none of these more recreational kinds of value to the citizens, they may not have been realized at all. The added value is actually the climate adaptation underneath. (Interview B).

As the quote indicates, the added recreational value, rather than the climate adaptation, tends to be most important to local politicians.

Hence, composing different value systems materially – sometimes by utilizing rainwater as a resource – in double functions could be seen as a means of making space for climate adaptation in cities. At least that is how they are justified: as canceling out the battle for space by making "boring" technical facilities "fun."

Concluding discussion: A politics of addition to replace tensions with harmony?

In a reading of Weber's work, Asdal (2022: 851) has suggested that the good economy with its focus on "doing good with money" is replacing another version of economization that is mainly concerned with the rational allocation of "scarce resources," making sure that "no penny is spent in vain." The politics of addition, described in this article, cuts across these two versions of economization: it is obsessed with the scarcity of funds, seeking to do efficient climate adaptation as cheaply as possible on the surface. Nevertheless, actors are not satisfied with this – they also want to do good with their scarce investments, making recreational added value and urban development while sometimes also contributing to a better environment through climate adaptation projects.

In this article, I have proposed that this peculiar configuration of saving money while adding value can be understood as a compromise between different value systems, especially the technical, the economic, and the recreational. In doing so, I have tried to bring the notions of orders of worth and the good economy into dialogue, emphasizing that good economies are compromises and because compromises are fragile, good economies need composite objects. Hence, identifying and analyzing its composite objects has been proposed as a way of describing a specific good economy.

In my analysis, I turned to two kinds of composite objects: the document tools for evaluating climate adaptation and the specific projects from collections of best practice. Delving into these helped to uncover the politics of addition, which I find is sustaining the good economy of climate adaptation. Based on the analysis, I find that this politics of addition seeks to connect different stakeholders, as it will lead to sharing project costs (cf. the WaterPlus accounts), while bringing in new ideas (e.g., the municipality influencing the technical facility in the WaterPlus accounts, or the skaters' suggestion to turn Rabalderparken into a skating facility). The promise is that these new ideas will make boring technical facilities more fun if realized in double functions that comprise technical and recreational value systems. Hence, creative engineers or architects who manage to compose various functions materially – sometimes by utilizing rainwater as a resource – are considered important beings in the politics of addition. I have found that double functions are justified

economically as a means of obtaining more value for one's money (cf. the WaterPlus accounts). However, they are also frequently justified as replacing the tensions that usually lead to a battle for space with a state of harmony, as it is promised that many interests can be realized at once. Hence, on a more overarching level, the politics of addition promises that it is able to convert the necessity of climate adaptation into an opportunity for adding value, thus making cities more fun and harmonious.

According to the orders of worth perspective, compromises are made to resolve the tensions between different versions of the common good. However, something more is at play in the politics of addition: here, making compromises is considered inherently good since it adds value and realizes different forms of worth at once, so to speak. In this respect, the politics of addition resonates with studies drawing on the orders of worth perspective describing how the compromises of corporate sustainability strategies are often framed as "win-win" arrangements of worth in both the market world and the green world (Nyberg and Wright 2013; Demers and Gond 2020). Quite similarly, but relying mainly on the field of valuation studies, Ariztia and Araneda (2022: 124) have identified how circular economy businesses are valued through a "win-win formula" where "economic and environmental gains reinforce each other." However, all three studies conclude that these win-win arrangements are made one-sidedly in terms of generating economic value. Does the politics of addition also prioritize economic value over the other forms of value it compromises? When the WaterPlus accounts justify double functions as a means of getting more for one's money, it could indicate that the politics of addition is yet another instance of prioritizing economic value. However, rather than prioritization, I find mutual dependency between the value systems: economic concerns may be a big reason for moving climate adaptation to the surface, but justifications beyond that seem to be needed. As the analysis indicates, having double functions may make projects more appealing to politicians. Thus, adding recreational value may be the ticket to the surface areas for climate adaptation. While the analysis showed multiple justifications stating that double functions can put the battle for space to rest, another way to interpret such statements is that purely technical rainwater facilities are generally not considered worthy of taking up space in dense urban environments and thus would not withstand the battle for space. Instead, added value is incorporated to make climate adaptation more justifiable and attractive to urban dwellers and may thus act as a preemptive measure against possible criticism. Hence, making double functions conveys a certain power – in that it may keep climate adaptation out of the battle for space, allowing it to be implemented smoothly.

The Danish case of promoting added value in rainwater management can be seen as part of a global trend in urban planning of making climate adaptation with so-called co-benefits, which may include elements as diverse as improvement of air quality, nature conservation, and new recreational spaces while adapting to a changing climate (Alves et al. 2019). Therefore, co-benefits also tend to be promoted as win-win arrangements. However, this does not necessarily mean that everyone will win through such arrangements. A critical strain of literature has criticized that co-benefits are being appraised "acritically" in both practice and academia (Anguelovski et al. 2020: 1748). Hence, it remains in the shadows that projects with co-benefits may lead to depoliticization, gentrification, and marginalization of certain groups, which this critical literature argues is often the case (Anguelovski et al. 2018; Finewood et al. 2019). Based on this literature, one could ask for whom added value is being made and if the politics of addition reinforce certain inequalities and disempower specific groups. Though this is an important question, it is beyond this article's scope to answer. Yet, while this literature suggests that co-benefits are "acritically" being promoted and comprise an instance of depoliticization, this article has foregrounded another perspective: how making projects with added value (as a specific instance of the broader co-benefits) is indeed a political endeavor of its own; one that entails adding together and justifying different versions of the good, which I have sought to capture in the notion of politics of addition.

Last, I will remark that this politics of addition has moved from climate adaptation to other issues in Denmark. Quite recently, it was proposed by landscape architects that the green transition would be done more smoothly if "energy landscapes," especially solar parks, were made with added value, hence making facilities that produce renewable energy while benefitting biodiversity and local communities (see e.g. Korsnes and Grunkin 2021). It is too early to say if this move will reduce local opposition toward renewable energy facilities and calm the battle for space in rural settings. Nevertheless, it points to a more general tendency of turning the necessities posed by climate change into an opportunity through the politics of addition.

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Theme issue contribution

Good Economies of Carbon Offsetting: The cyclical dynamics of valuation and critique in voluntary carbon markets

Kamilla Karhunmaa

Abstract
Voluntary carbon markets are based on the idea that the carbon credits sold in markets are both the same, or climatically equivalent to one another, and different, reflecting how, when, where, and by whom they have been produced. This article examines how market actors deal with this tension and value units that are both commensurate and differentiated. Based on existing literature, interviews, and document analysis, I identify and present three instantiations of a good economy of carbon offsetting from the 2000s onwards. Each phase shows how valuation processes iterate between commensuration and differentiation. This is achieved through the development of elaborate sets of complementary valuation practices and tools, such as methodologies for valuing co-benefits, impact scores and overcompensation factors for securing climate impacts, and carbon removal crediting methodologies. While critique is central to driving the move from one good economy to another, this article also shows how the valuation practices of voluntary carbon markets appear locked into repetitive cycles of critique and reform, with recurrent disputes emerging over what to weigh and value and how. This poses new questions concerning how to critique such markets and their valuation practices.

Keywords: carbon offsetting; voluntary carbon markets; valuation; economization; tools of valuation

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Introduction

Voluntary carbon markets work on the assumption that the markets can and should produce units of exchange or carbon credits whose impacts are deemed climatically equivalent to one another. The production of equivalence and the interchangeability of carbon credits works to justify voluntary carbon markets as a good solution to climate change (e.g. Forest Trends' Ecosystem Marketplace 2021). However, units sold in voluntary carbon markets are rarely monetarily valued as the same, but instead differentiated from other seemingly similar units sold and traded in markets. This creates an interesting question for valuation studies to examine: how can carbon credits be valued differently while maintaining that they are producing the same effect on the climate? What creates difference in such units and how is that difference established and valued?

I examine these questions by focusing on voluntary carbon markets, or the unregulated markets where individuals, organizations, businesses, and states may produce, trade, and purchase carbon credits.[1] Voluntary carbon markets are examples of ones to which strong and often clashing expectations and moral underpinnings are ascribed (Ehrenstein and Valiergue 2021; Dalsgaard 2022). From one perspective, voluntary carbon markets can be viewed as examples of a "concerned market" (Geiger et al. 2014) that brings together interested actors to address a public problem that has not received sufficient attention via existing policies and institutions. At the same time, voluntary carbon markets have been discussed as contested markets that do not directly address emission reductions, but allow for polluting actors to continue emitting greenhouse gases (GHGs) (Lohmann 2006; Böhm and Dahbi 2008). As both aspects are evident in voluntary carbon markets, Ehrenstein and Valiergue (2021, 2022) argue that contestation and concern can be understood as two sides of the same coin in a reflexive market.

Voluntary carbon markets function through baseline-and-credit schemes that do not have an upper limit or cap on emissions imposed from outside. Instead, carbon credits are produced by conjuring a hypothetical baseline scenario of how emissions would have evolved without the offset project (Ehrenstein and Muniesa 2013). Offset projects have generally been split into three categories: installing renewable energy technologies (e.g. biogas) to replace fossil fuels,

[1] I use the general term 'carbon markets' when I do not consider it necessary to distinguish between compliance and voluntary carbon markets, and more specific terms when I do find it relevant to make the distinction. Market actors speak of voluntary carbon markets in both the singular and the plural. I have chosen to refer to voluntary carbon markets in the plural, as this better captures the fuzziness and variety of markets where credits generated from voluntary carbon projects are utilized. Credits may be utilized in voluntary, regional, and compliance-based markets as well as over-the-counter trading and broker-led trading (see also Frankel 2018).

implementing energy efficiency measures (e.g. switching to more efficient technologies), or removing carbon dioxide from the atmosphere through carbon sequestration (e.g. improving forestry practices). Offset projects result in purchasable carbon credits once they have passed through a process of monitoring, reporting, and verification that aims to assure the additionality and veracity of the projects' climate impact. Most carbon credits on the market are certified by voluntary standards, the largest being Verra (formerly Verified Carbon Standard) and Gold Standard. Carbon credits have mainly been purchased by corporations (84.5% between 2006 and 2015 (Forest Trends' Ecosystem Marketplace 2017)), which use the credits in order to make claims related to carbon neutrality, climate positivity, or net zero.

Carbon markets in general and voluntary carbon markets in particular have received substantial attention from science and technology studies (STS), political ecology and critical geography, and economic sociology. Several studies have been concerned with market construction, or deliberate and coordinated actions to create a market for trading carbon credits (Callon 2009; MacKenzie 2009). These have shown the substantial scientific, technical, and administrative work going into establishing tonnes of carbon dioxide equivalent (tCO_2e) as authoritative and credible units of exchange (Paterson and Stripple 2012; Cooper 2015). Mackenzie (2009) has argued that creating tCO_2e as a unit of exchange requires 'making things the same' or producing an equivalence between different forms of emitting, avoiding, reducing, and sequestering GHGs. However, this process not only makes different GHGs the same, but it also makes them commensurate with distinct socio-ecological practices, temporalities, geographies, and intangible assets, as scholars of carbon markets have demonstrated (Agarwal and Narain 1991; Knox-Hayes 2013; Dalsgaard 2016; Carton et al. 2021).

In contrast, Doganova and Laurent (2016, 2019) analyse two European initiatives unrelated to carbon markets – the Integrated Pollution Prevention and Control (IPPC) Directive and the Renewable Energy Directive (RED) – both of which adopted a market construction strategy of 'keeping things different' or not producing equivalence between the units traded in markets. In these initiatives, ensuring the circulation of multiple goods in multiple markets becomes a desirable goal, justified as producing results while maintaining flexibility and variance in markets. Doganova and Laurent (2019) contrast this market construction strategy to that of 'making things the

same' in compliance carbon markets,[2] which depend on the circulation of one specific good (an emissions permit) that is detached from its origin as well as its production method. However, as I will discuss in this article, in voluntary carbon markets these two market construction strategies – of making things the same and keeping things different – are not as easily kept apart and viewed as distinct.

Further, while market construction through 'making things the same' and its implications has received substantial attention, links to processes of valuation require more analysis. Dalsgaard (2013) argues that in making distinct qualities commensurate through the common metric of tCO_2e, carbon offers a potentially universal yardstick for value in which anything can be compared through its impact on the climate. However, he also discusses how such practices of 'carbon valuation' have encountered friction: the presupposed universal yardstick of carbon has not been unequivocally translated into practice, where the significance of actions is constructed in relation to multiple cultural and social concerns, of which carbon emissions are but one possible concern (Dalsgaard 2016; Karhunmaa et al. 2023).

Building on previous studies on both market construction and carbon valuation, I approach the question of valuation from another angle. Instead of looking at how carbon markets come to ascribe value to things and actions in terms of their emissions, I examine how the units exchanged in voluntary carbon markets are ascribed value by market actors.[3] In other words, I am not examining how thinking in terms of carbon produces comparisons regarding how to weigh one action against another (Knox 2020). Instead, I want to ask a seemingly more mundane question: how do market actors go about ascribing value to the things they are producing, trading, and selling in the markets? While this might seem to be a simple question, the analysis demonstrates that in markets concerned with both making things the same and keeping things different, ascribing value is not an easy task.

I take the concept of the 'good economy' as my starting point and as an investigative heuristic concerned with the practices that entangle the production of economic and other values (Asdal et al. 2023). The concept is suited to assessing voluntary carbon markets: first, because

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[2] Compliance carbon markets refer to markets where a regulator sets a limit on the number of emissions each year. The regulatory entity then allocates permits to polluters (e.g. through free allocation or auctioning), who can buy and sell permits among each other. The European Union's Emission Trading System is an example of a compliance carbon market.

[3] By 'market actors', I refer to those actors concerned with the functioning of carbon markets and involved in formulating the problems and solutions that carbon markets produce (Callon 2009). While this formulation also includes critics of the market, my focus is on those actors that criticize the market to reform it – not in order to abandon it fully. Thus, the extensive critique by actors calling to dispose of carbon markets fully (e.g. Lohmann 2006; Böhm and Dahbi 2008) is not dealt with at length in this article.

voluntary carbon markets are rife with declarations of good and bad as well as distinctions made through them (Dalsgaard 2022); second, the concept is appropriate because voluntary carbon markets draw on, but also complicate, the idea that price is always correct and by implication good (Asdal et al. 2023), with constant negotiation taking place on what prices can or cannot capture; finally, it is suitable because voluntary carbon markets constantly produce new methodologies and tools of valuation for enacting different versions of the good.

I contribute to this literature by demonstrating the development and evolution of three specific instantiations of a 'good economy of offsetting' over the course of the 2000s. I show how the move from one good economy to another is spurred by iterative cycles of critique and response, where market actors act on criticisms that have been raised. At times criticism pulls towards making things more the same, whereas at times the response has been to establish differences between carbon credits. These processes are marked by the development of complementary valuation practices and tools, with different tools focusing on the production of commensuration or differentiation.

I build on two sets of empirical materials that have been collected as part of separate research projects examining voluntary carbon markets. The first set of empirical materials includes my previous fieldwork on conceptualizations of co-benefits in voluntary carbon markets. This consisted of 18 interviews conducted in 2013 with experts familiar with voluntary carbon market projects focused on household energy technologies, such as improved cookstoves, biogas digestors, and water filters. Additional material consisted of project documents, publicity materials, and websites (as presented in Karhunmaa 2016). The second set includes documents, websites, online seminars, and videos produced by offset providers, regulators, researchers, and market analysts during 2021–2023.[4] This included attending and taking notes in 21 online seminars and detailed analysis of two Finnish offset-providing companies' websites, videos, and publicity materials. The article is based on an analysis of the materials, reflecting on them through the concepts of equivalence, difference, the good economy, and existing literature on voluntary carbon markets. In the rest of the article, I first present an overview of the literature on making things the same or keeping them different, before moving on to present the three instantiations of a 'good economy of offsetting' in three further sections. I end by discussing the implications concerning valuation.

[4] I present the title and date of the online seminars in the footnotes.

Literature review

A large share of both the critique and acclaim for carbon markets has revolved around the idea that carbon markets 'make things the same' (MacKenzie 2009) and hence also value these things as the same. The next three sections demonstrate how this is not always the case and how valuation and commensuration can be different processes. In this review of existing literature on carbon markets, I want to nonetheless first present the scientific, technical, and legal work that goes into commensuration in carbon markets and the implications this carries. I then proceed to present the critique that commensuration has faced and how it has been countered with calls to keep things different in order to value them in another way.

To be able to value and compare things in relation to one another, an active process of commensuration and a common metric is necessary (Espeland and Stevens 1998; Cooper 2015). In carbon markets, the shared metric is a unit called tonnes of carbon dioxide equivalent (tCO_2e). Paterson and Stripple (2012) give a brief overview on the history of tCO_2e, starting with scientists' desire to develop a single measure, called 'global warming potentials' or GWPs, to compare all GHGs to one another in the late 1980s (Rogers and Stephens 1988). However, GWPs were exchange rates used for conversion, not fungible units in and of themselves. The tradeable units of carbon markets emerged only later, together with the development of the Kyoto Protocol and its market mechanisms (Paterson and Stripple 2012). At the same time, tCO_2e was established as the metrological system used at the expense of other forms of measurement (Cooper 2015).

While tCO_2e functions as the explicit unit of exchange in carbon markets, it is possible to encounter and identify a multitude of things beyond tCO_2e that are rendered commensurate. In such a move, Bumpus (2011: 817) discusses four interrelated forms of carbon (existing emissions, counterfactual emissions, calculated reduced emissions, and commodified emissions) that come together in an offset project, showing how each form must be both calculated as well as legally and technically defined in order to produce a carbon credit. What this demonstrates is how commensuration is always a relative process of creating worth in relation to others (Espeland and Stevens 1998). At stake is not only one process of making things the same (MacKenzie 2009), but also connected processes required to hold that sameness in place.

A large part of the critique of carbon valuation is related to processes of commensuration and their problematic valuations. The first line of critique argues that carbon offsets attempt to commensurate things that morally, socially, politically, or ecologically should not be valued as the same but should be kept different. The

second line of critique argues that carbon offsets fail to produce the commensuration they promise.

One of the earliest critiques of commensuration precedes the current carbon markets. In the early 1990s, Indian scholars and activists Anil Agarwal and Sunita Narain (1991) argued that carbon pricing unjustly equates the subsistence emissions of the poor with the luxury emissions of the rich through creating common metrics. They proposed that carbon pricing and valuation schemes should consider the conditions in and purposes for which emissions are produced, as well as the historical distribution and development of GHG emissions. Their suggestion, which has not prevailed in the design of current carbon markets, can be seen as proposing alternatives to commensuration as a tool of valuation.

Further academic critique concerning commensuration in carbon markets has examined how offsetting produces equivalence across time and across distinct carbon cycles. For example, Knox-Hayes (2010, 2013) argues that carbon markets allow for compressing time by the commensuration of current emissions with future emission reductions. In a similar move, carbon markets have been criticized for placing on a par different biotic and abiotic carbon cycles, even though they operate in dissimilar timescales and their use and non-use have differing implications for climate change (Carton et al. 2021). These criticisms argue that commensuration produces undesirable valuation by eroding important differences. As such, Carton et al. (2021: 5) argue that the logic of equivalence 'serves the interest of simplicity, substitutability, and economic flexibility but introduces important social and environmental concerns that undermine climate justice'. This has been accompanied by calls from academics and civil society to keep things apart via introducing separate targets and policies for different types of emissions (e.g. Carton et al. 2021; Carbon Market Watch 2023).

At the same time, a large part of current media coverage on carbon offsets leverages a different line of critique towards commensuration in carbon markets. A recent piece of investigative journalism on carbon offsets argues that offsets are 'worthless' and produce 'phantom credits' (Greenfield 2023). It outlines how up to 90% of forest carbon offset programmes are failing to deliver the climatic impact they promised. This second line of critique questions whether a carbon credit adequately represents the socio-environmental impact it is supposed to produce (see Chiapello and Engels 2021 for an extensive discussion on this). Unlike the above calls to keep things different, this form of critique suggests that carbon markets *should* result in carbon credits being climatically equivalent no matter where and how they are produced, but currently fail to do so. What has often followed from this second line of critique is calling for better practices and greater transparency to ensure that the promise of equivalence and making

things the same does indeed take place (Integrity Council for the Voluntary Carbon Market 2023).

Uncovering the processes involved in producing a commensurate unit of exchange is a form of critique that gives visibility to the multiple historical, social, and material contexts that are rendered invisible through commensuration, thus aiming to make the practices of valuation discussable (Doganova et al. 2014; Dalsgaard 2014, 2016). Dalsgaard (2016) argues that commensuration is one form of valuation that allows for comparison to take place. This means that different alternative actions (e.g. driving a car, riding a bicycle) become potentially substitutable by one another (Dalsgaard 2016). At the same time, Dalsgaard shows how in the practices of voluntary carbon markets this idealized substitution does not take place: while on paper all credits are treated as the same, in practice they are valued differently and carry different prices (Dalsgaard 2016). To be able to proceed analytically, then, it is important to understand commensuration and valuation as processes that are not necessarily the same: something may be made commensurate and comparable to other things, yet it may still be valued differently.

Herein, a useful concept is what Asdal and Huse (2023) call tools of valuation, referring to the multiplicity of tools, such as maps, surveys, and documents, that can perform valuations. Tools of valuation may work quantitatively through calculations and prices, but they may also work qualitatively, through narrative accounts. Differing from commensuration, tools of valuation do not require making things the same in order to be valued. However, in valuing something, tools of valuation raise questions about the valuations and orderings of society, such as what is a good economy, for whom and why (Asdal and Huse 2023). In the following sections, I draw on extensive work that seeks to open up and make discussable the processes of commensuration and differentiation in voluntary carbon markets. However, I suggest that we address these as iterative processes of valuation that do not stand on their own but require support from complementary valuation practices and tools.

Internalizing externalities and correcting prices

As intentionally constructed markets, carbon markets are an experiment put into place to evaluate whether it is possible to change economies by putting a price on emissions and shifting to valuing and pricing those things previously thought of as external, undervalued, or invaluable (Callon 2009). The rise of carbon markets as a good tool for dealing with climate change has to be situated within the broader turn to markets in order to address public concerns, where previous regulatory approaches based on standards, taxation, and subsidies

were dubbed inefficient and costly by environmental economists (Asdal 2014; Voß and Simons 2018).

A first iteration of the good economy of offsetting argues that to have a decarbonized society, current practices of valuation need to be changed to account for and internalize the externalities, or the indirect costs to third parties, that arise in production processes. This view, drawing on the work of economists like Pigou (1920) and Coase (1960), was widely noted with the publication of the Stern Review on the economics of climate change in 2006, which argued that correct pricing and the benefits of early action on climate change outweigh the costs of inaction (Stern 2006).

However, correcting pricing to account for externalities does not automatically lead to interchangeable tradable units fit for markets. Being able to state that GHG emissions are equal no matter where they are produced requires drawing not only on environmental economics, but also on a particular understanding of how the atmosphere works. Research in STS has shown the elaborate scientific, technical, institutional, and political work going into perceiving of the atmosphere as global, shared, and indifferent to the origin of GHGs (Shackley and Wynne 1995; Jasanoff 2010).

In the context of voluntary carbon markets, understanding the atmosphere as global and shared has often been translated into ideas of a climate that 'does not care' where emission reductions happen, as in this report on voluntary carbon markets: 'It makes no difference to the climate where a certain amount of greenhouse gases are reduced or sequestered as sinks' (Niemistö et al. 2021: 13). Equivalence is described as enabling the targeting of emission reductions to the places in which they are the cheapest and quickest to undertake, thus producing flexibility and efficiency, and decreasing the overall costs of climate change mitigation (e.g. Stern 2006). Climatic indifference to the origin of GHGs is frequently depicted through highly simplified calculations of putting x tonnes of carbon into the atmosphere, as in this excerpt:

> I've been driving around and generating three tonnes of carbon dioxide, which of course I've released into the atmosphere to join all the rest of the greenhouse gases that are already up there. Now, imagine that miles away, maybe on the other side of the world, somebody else takes three tonnes of carbon dioxide out of the atmosphere.
> Now, what's happened?
> Three tonnes in, three tonnes out. Result, zero!
>
> Source: Video explaining carbon offsetting by Shell, aired in Last Week Tonight with John Oliver, 22.08.2022.[5]

[5] Available at https://www.youtube.com/watch?v=6p8zAbFKpW0

Visually, such indifference tends to take the form of scales that weigh polluting activities (such as flying or factories) on the one side with less-emitting or carbon sequestering activities (such as wind power or tree-planting) on the other (Figure 1). In this first instantiation of a good economy of offsetting, economists suggest carbon offsets can provide a solution to the imperfect valuation of goods since they allow for taking externalities into consideration. To be able to do this, they require support from various fields to hold in place the assumption that all carbon credits are of equal climatic worth and indifferent to their place of origin.

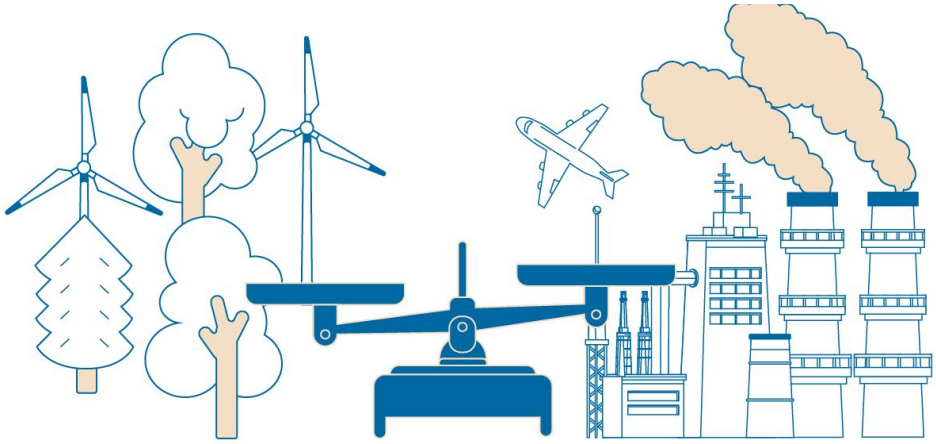

Figure 1: Illustration based on screenshot of BBC educational video: Can carbon offsetting help the planet?[6]
Source: BBC News 2021. Illustration: Kati Peltola.

Differentiation through co-benefits

The shift to a second good economy of offsetting can be described as a shift from economists' textbook visions of carbon markets to the practice of constructing such markets. Developing in the early 2000s, voluntary carbon markets were largely unregulated with no widely used standards to determine what projects should look like, how they should be monitored, how emissions should be calculated, or which technologies to accept (Lovell and Liverman 2010). The majority of offset projects were nonetheless implemented in the Global South as being easier, quicker and more cost-efficient to realize, reflecting economists' ideas that it makes no difference to the climate where emission reductions occur (e.g. Bayon et al. 2007).

At the same time, voluntary offset projects were rather diverse in terms of project type and location (Lovell and Liverman 2010). This

[6] Available at https://www.youtube.com/watch?v=b1xHUwszumw

contrasted with the development of compliance offsetting developed in the Kyoto Protocol's Clean Development Mechanism (CDM), where the aim was to ensure that a large number of uniform carbon credits entered the market for industrialized countries to meet their set emission reduction targets at a low cost. Producing voluntary offset credits that were 'charismatic', 'boutique', or 'niche', in contrast to the 'bulk' of the CDM was presented as a good attribute (Wang and Corson 2015; Lehmann 2019). Voluntary offset projects were promoted as more diverse since they accepted project types that were unwelcome in the CDM; they involved a wider range of acceptable methodologies and technologies, and were typically smaller, had lower transaction costs, and were located in less developed countries (Lovell and Liverman 2010). All of these points were employed by project developers and intermediaries to present carbon credits from voluntary offsetting as something unique and incomparable, which not only did good by offsetting the emissions of the buyer but also by enabling a connection between the buyer and the producer of the credit (Lovell et al. 2009).

The other facet that made voluntary offset projects good in the marketing materials of project developers was their focus on 'co-benefits'. Co-benefits refer to the local sustainable development impacts an offset project claims to produce in addition to emission reductions, such as community development, improved access to services, environmental conservation, improved health, and so on. Co-benefits capture the idea that offset projects have succeeded in the first iteration of the good economy or in accounting for the externality of carbon and creating an equivalence between emissions in one place with emission reductions in another place. The second iteration of a good economy of offsetting suggests that not only are the costs of carbon internalized, but offset projects can create additional, often qualitatively described, positive impacts where implemented. The co-benefits of voluntary offsets were fuzzy things, communicated by project developers to potential buyers via stories and images of underprivileged populations in the Global South doing better because of the offset project (Lehmann 2019).

How this relates to price as an indication of value is trickier, though. Development of prices in voluntary carbon markets has been tracked by the industry's State of the Voluntary Carbon Markets reports, published yearly since 2006. In general, these reports show high variance in offset prices. In 2011, for example, prices ranged from less than $1/ton to over $100/ton, with an average of $6.2/ton (Ecosystem Marketplace and Bloomberg New Energy Finance 2012). Projects that claim to produce more co-benefits have tended to receive a higher price in the markets (Ecosystem Marketplace and Bloomberg New Energy Finance 2012). The main variance in prices is due to different project types, locations, and standards, and thereby is compatible with the

idea that the market can value how, where, and by whom emissions reductions are made. However, there is also high variance in prices between projects of the same type, such as between cookstove projects (Forest Trends' Ecosystem Marketplace 2017). Further, while prices were seen as indicative of a better project, they were also acknowledged to be influenced by 'an infinite number of factors' (Forest Trends' Ecosystem Marketplace 2017: 8), leading to the conclusion that voluntary markets do not resemble compliance carbon markets or commodities markets where trading occurs by favouring the lowest price.

As voluntary carbon markets began to expand, they also faced a first round of critique. In media coverage, offset projects were criticized for being driven by unruly 'carbon cowboys' operating in a 'Wild West' where anything goes (Harvey 2007). Focusing on lacking – or insufficient – monitoring and regulation, criticism was concerned with the ability of offset projects to deliver on the promise of climatic equivalence as well as with the lack of evidence on the part of co-benefits (Ecosystem Marketplace and Bloomberg New Energy Finance 2012). Issues that had first been viewed as good attributes of voluntary carbon markets, such as the ability to be more diverse than the CDM, turned into sources of critique that necessitated a response and a degree of standardization. I interviewed a project developer working on 'charismatic' carbon offsetting in 2013 who, when asked whether the co-benefits of carbon projects should be measured and monitored, commented:

> Yes, it's quite obvious. Especially in the voluntary markets everyone claims to be social and you've got projects, which are very social, you've got projects which are average social … and you've got projects which are not social at all, making heaps of money, it's just business-oriented … but in the end nothing is there to monitor that. (Project developer, interview, 2013).

The voluntary offset project developers I interviewed in 2013 linked the formalization and measurement of co-benefits to a process of correcting what is valued in voluntary offset projects. Demonstrating a degree of reflexivity on how commensuration condenses information (Espeland and Stevens 1998), project developers viewed carbon offsetting as having the potential to narrow projects to focus solely on the emission reduction potential, failing to see, value, and account for the other socio-ecological aspects that projects alter (such as health, biodiversity, local economic impacts, etc.). Project developers also wanted to correct existing information asymmetries in the markets and enhance the comparability of projects (Karhunmaa et al. 2015). Price, and the ability to fetch higher prices for 'more sustainable' projects, was not seen as a sufficient indication of the added value produced by projects, because while some buyers valued 'charismatic' projects,

buyers were generally seen as unable to make clear distinction between what counts as a social or sustainable project. Therefore, what was needed were additional tools and means of valuation together with more standardized and comparable evidence that could aid in distinguishing offset projects from one another. The good economy of carbon offsetting thus evolved from the environmental economists' vision of internalizing externalities to demonstrating and proving the additional value of co-benefits in a more standardized way.

How to define what the additional value of co-benefits are and how they should be measured and monitored raised questions. To illustrate this, I draw on the example of improved cookstoves. Improved cookstoves are a household technology that can increase energy efficiency and decrease fuel usage. The technology has a long history in development cooperation and the first improved cookstove projects date from the 1970s (Urmee and Gyamfi 2014). Improved cookstoves have high technological variance, ranging from high-tech cookstoves to locally manufactured terracotta cookstoves (Urmee and Gyamfi 2014). In the 2010s, improved cookstoves became an increasingly popular project type for voluntary carbon markets due to their 'charismatic' features of addressing several concerns at once: reducing emissions, improving livelihoods, focusing on women and children, and so forth (Wang and Corson 2015).

During 2013–2015, I followed a debate that was unfolding over how to value the co-benefits produced by improved cookstoves: what types of technologies, supply chains, and local development impacts could and should be accounted for and how (Karhunmaa 2016). The debate is exemplary of a situation wherein concerned market actors enter into a dispute over how to relate the multiplicity of what is traded into a standard, what are the relevant judgment devices, what criteria should be used, and what weight to give to different qualitative assessments (Chiapello and Godefroy 2017). Some larger organizations advocated focusing on efficient, most often imported, technologies and their health benefits in terms of reduced indoor air pollution. In contrast, smaller organizations favoured focusing on long-term market construction with locally produced, less efficient technologies that have not been proven to reduce indoor air pollution as effectively. A project developer advocating building local supply chains contested focusing on indoor air pollution as a more readily quantifiable and abstracted health impact that provided quicker results, asking: 'But what is the health impact of a family that loses its income?' (interview, Project developer, 2013). By asking such questions, the project developer sought to show the troubles that arise when quantifying and comparing dissimilar things and opting to give value to those things that are more readily measured. The interviewed project developers saw the formalization of certain co-benefits as bringing about a market-altering potential, with the possibility of

influencing technology design, supply chains, project management practices, and so forth.

On a wider scale, criticism that voluntary carbon offsets had limited proof of their sustainable development impact was followed by a rapid proliferation of carbon offset standards as well as updates to existing standards' methodologies. The number of standards for voluntary carbon offsets expanded from 18 in 2009 to over 170 standards in use now[7] (Dalsgaard 2016). Catering to ever more specific desires resulted in the creation of specialized standards, such as Social Carbon, Women's Carbon, Fair Trade Carbon, and so on. Further, already existing standards, such as the Gold Standard, revised and updated their methodologies in the 2010s to better account for co-benefits. The ensuing competition between different standards has been described in positive terms by market actors as creating space for innovation and experimentation in markets (Chartier and Tsayem Demaze 2022), thus turning a criticism of the market into a driver of innovation. The situation is also indicative of no single standard managing to accumulate enough power to surpass others, resulting in market fragmentation and actors using a variety of ways to assess co-benefits (Chiapello and Godefroy 2017).

Reforms demonstrate how market actors juggle between the pressures to both standardize and differentiate carbon credits. On the one hand, the purpose of creating standards that take co-benefits into account was to respond to the criticisms raised about 'carbon cowboys', demonstrate concern, and set up corrective measures in the form of standardization, monitoring, and reporting (Valiergue and Ehrenstein 2022). On the other hand, the proliferation of different standards and methodologies shows the need to deliver a unique product that can be differentiated from other seemingly alike products on the market (Brill 2021). The reforms demonstrate how the good economy of carbon offsetting evolved dynamically in response to criticisms.

Novel ways of ensuring climatic equivalence in offset projects

This section outlines a move to a third iteration of a good economy, where the good economy of offsetting loops back from focusing on the co-benefits of carbon credits to questioning and seeking to demonstrate the ability of carbon credits to ensure the ideal of climatic equivalence. While in the previous section standardizing co-benefits arose as a response to critique of overly qualitative or unsubstantiated valuations of sustainability impacts, focusing on the realization of

[7] Notes, Nordic Environmental Finance Corporation seminar "Nordic Approach for Ambitious Carbon market cooperation under the Paris Agreement", 12 October 2022.

climate impacts in offsetting is also a response to critique. This critique needs to be situated in the context of the heightened attention in the 2020s to the urgency of climate change action. The market actors that I followed during 2021–2023 were always careful to state that emission reductions come first and are the 'most important tool in the toolbox'.[8] Nevertheless, this quickly proceeded to discussing how to enlarge the voluntary carbon market, without specifying a more prescriptive relation between emission reductions and offsetting. In general, voluntary offsetting was justified as a less-than-ideal, but necessary mid-term solution for addressing climate change.

As such, the 2020s saw the emergence of several proposals for reforming voluntary carbon markets. The proposals have the same starting point of characterizing current carbon credits as heterogeneous and the market as having 'low liquidity, scarce financing, inadequate risk-management services and limited data availability' (Blaufelder et al. 2021). Opinions differed about how or whether this should be dealt with.

A first set of proposals comes from the industry's own self-governance initiative, the Integrity Council for the Voluntary Carbon Market (ICVCM).[9] Released in March 2023, a key suggestion has been to divide the valuation and pricing of carbon credits into two separate parts: the 'core carbon principles' (CCP) or the verified ton of CO_2e produced by the project, and the 'additional attributes', including how the project aligns with the framework being built under the Paris Agreement as well as the quantified positive sustainable development goal (SDG) impacts. Providing this information allows buyers 'to purchase carbon credits that match their preferences' (Integrity Council for the Voluntary Carbon Market 2023: 45). Prior to the release of the CCP documents, additional attributes were characterized by the following diagram (Forest Trends' Ecosystem Marketplace 2020: 11) (see Figure 2).

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[8] Notes, Nasdaq and puro.earth seminar "The Role of Carbon Removal in Achieving Net Zero", 8 March 2023.

[9] The initiative commenced in 2021 and was then called the Taskforce on Scaling-up Voluntary Carbon Markets (TSVCM). It was first led by former Bank of England head, Mark Carney. The initiative soon changed its name to the ICVCM in response to criticisms that the Taskforce should focus on quality and integrity, not quantity and scaling-up.

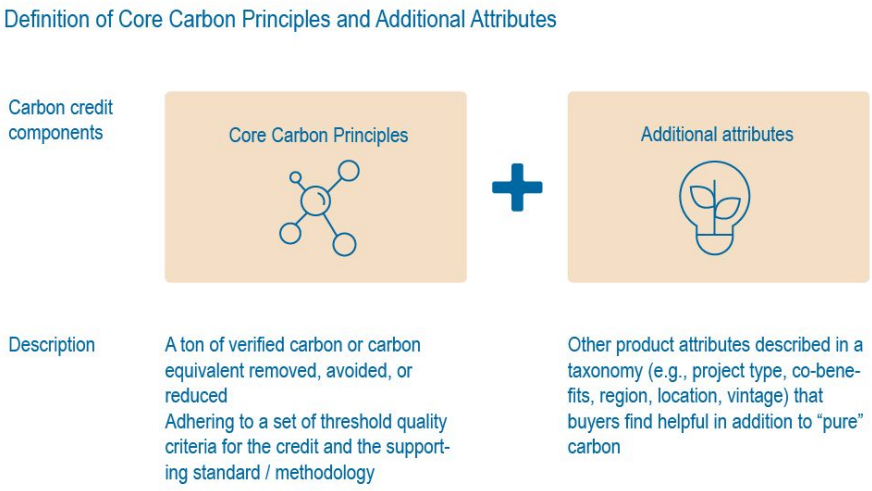

Figure 2: Core carbon principles and additional attributes as depicted in the Taskforce on Scaling Voluntary Carbon Markets.
Source: Forest Trends' Ecosystem Marketplace 2020, p. 11. Illustration: Kati Peltola.

The suggestion centres on maintaining the equivalence of carbon dioxide intact and producing standardized criteria for ensuring that all offsets deliver the 1 ton = 1 ton climatic equivalence on which they are premised. This was described as setting a 'threshold standard for all, so that we can separate the wheat from the chaff, know what the best of the best is'.[10] At the same time, the ICVCM suggested that valuing a unit of tCO_2e also entails valuing things that are not quite as easily thought of as equivalent, or for which constructing a common metric is more difficult. In allowing more variance in the 'additional attributes' that are compiled into a carbon credit, the ICVCM suggests making this part of offsets only somewhat standardized through a taxonomy that would allow for comparability between carbon credits generated from different types of projects. The ICVCM has maintained that carbon markets should be able to price the 'additional attributes' separately from the 'core carbon', thus continuing to allow for projects deemed better in terms of their sustainability impacts to be rewarded by higher revenues.

Other market actors contested whether this was possible. As a carbon trader commented in an online seminar: 'All projects are unique. There won't be a fully functional, liquid, commoditized market.'[11] The view was that offset projects are not created equal and

[10] Notes, Nordic Environmental Finance Corporation seminar "Nordic Approach for Ambitious Carbon Market Cooperation under the Paris Agreement", 12 October 2022.

[11] Notes, Ecosystems Marketplace seminar "State of the Voluntary Carbon Markets 2021: Carbon Offset Prices and Corporate Claims", 15 September 2021.

that the market price should reflect that. Further, information intermediaries described the trouble of disclosing specific information on offset projects in a 'commoditized and standardized way', noting that very specific and tailored information on offset projects is precisely what offset buyers want: 'buyers want to know what they are getting.'[12] This view suggests that the strength of voluntary carbon markets lies in their ability to create unique and differentiated products that rely on additional tools valuation.

While following proposals for market reform, I also encountered a small segment of actors who went beyond expressing doubts on the ability to create liquid markets to questioning even the basic assumption that the market is based on, namely the climatic equivalence between carbon credits and emission reductions. I focus on two Finnish-based offset providers to elaborate how market actors are dealing with this question. The Finnish carbon offset retailer Compensate has sought to carve out a position for itself as a novel market actor through ardent critique of the existing market. In 2021, Compensate published a white paper in which it claimed that 90% of credits in voluntary carbon markets were dubious and would not pass their stringent assessments (Compensate 2021). Existing valuation tools aimed at ensuring climatic equivalence, such as voluntary carbon standards, were described as insufficient, and the market was characterized as 'flooded with millions of essentially worthless credits. Still, these credits have the stamp of approval of the leading international standards, and offsetters keep buying them with no knowledge of the fact they're engaging in a lie' (Compensate 2023).

Compensate questions the valuation process behind standard carbon credits, claiming it is a 'poor metric' of climate impact due to a market design that promotes over-inflating impacts. Their solution to the problematic commensuration is to add another layer of evaluation to ensure that credits deliver the equivalence they are intended to produce. This is provided by a novel valuation tool, developed by Compensate, which produces tailored evaluations of CO_2 impacts (Compensate 2023):

> For instance, for a project with an impact score of 0.7, one credit is equivalent to 0.7 tonnes of CO_2. In order to provide a robust offsetting claim, Compensate overcompensates by purchasing enough credits to reach a real impact equivalent to one tonne of CO_2.

The process involves creating project-specific climate impact scores that allow one to determine the 'real' climate impact of projects. This leads to defining an overcompensation factor for each project, or the amount of carbon credits that must be bought from the project to

[12] Notes, Ecosystems Marketplace seminar "State of the Voluntary Carbon Markets 2021: Carbon Offset Prices and Corporate Claims", 15 September 2021.

ensure that the 1 ton = 1 ton equivalence is delivered. The final product is a new carbon credit established in 2022, called the Compensate Credit. The whole process of estimating impacts is done by Compensate and is guided by their scientific advisory panel, consisting of well-known Finnish academics. Compensate's business model[13] is based on distancing themselves from other actors in the market and assuring potential buyers that its products are better than others in producing the climatic equivalence of 1 ton = 1 ton on which the first instantiation of a good economy of offsetting is based.

The other example is from the emerging field of carbon removal and its use in voluntary offsetting. Carbon removal refers to practices that remove GHGs from the atmosphere and store them permanently[14] in specific materials, minerals, or sites. While carbon removal does not necessitate a relation to carbon markets, there are ongoing attempts to formalize carbon removals into carbon credits and thus enable their use for voluntary offsetting as well.

One of these attempts is by the Finnish-based carbon removal crediting platform, puro.earth. puro.earth focuses on creating crediting methodologies for engineered carbon removal and formalizing these into a standard unit, called a CO_2 Removal Certificate (or a CORC). Currently, it focuses on five methodologies: biochar, carbonated building materials, enhanced rock weathering, geologically removed carbon, and woody biomass burial. Of these, biochar is by far the most popular methodology. puro.earth describes itself as a standard and registry; it does not directly sell CORCs but leaves this interaction to take place between suppliers and buyers. Nor does it regulate how CORCs are used by buyers to make climate claims, limiting itself to reporting the purchase of all CORCs via a registry.

Combining the Latin word *purus*, meaning cleansed or purified, with the Finnish word *puro*, meaning a stream, puro.earth refers to itself through a 'metaphor of the flow of capital towards carbon net-negative companies' (Puro.earth 2023a). While the reference to cleansing is not further explicated, puro.earth refers elsewhere to turning 'a paradigm [i.e. voluntary carbon markets] that was not working on its head' (Puro.earth 2022). In this way, the company seeks to distance itself from most carbon credits on voluntary carbon markets based on avoided emissions. The main distinction that they seek to create is between avoiding emissions as compared to a baseline (i.e. the majority of current credits in voluntary carbon markets) versus

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[13] After research for this article had been conducted, Compensate announced in summer 2023 that it is filing for bankruptcy. The primary reason was that the company had not secured sufficient financing (through sales, investments, loans) to meet its expenses.

[14] Debates are ongoing as to how to classify the permanence of emission removals and what sort of timescales should be adopted (Meyer-Ohlendorf 2023).

a process of removing and permanently storing emissions (i.e. puro.earth's CORCs).

Visually and formulaically, puro.earth has sought to represent this distinction by contrasting the now familiar 1 ton = 1 ton to another formula: 1 ton emitted – 1 ton removed = zero tonnes emitted (Figure 3). The aim is to show how carbon removal contributes to building a net-negative society as emissions are removed from the atmosphere and permanently stored, not only avoided as with offsetting. As with Compensate, puro.earth seeks to differentiate from current market practices, but has to create novel tools of valuation and registries in order to standardize and formalize the ways in which it is producing a good solution to climate change that can be distinguished from others.

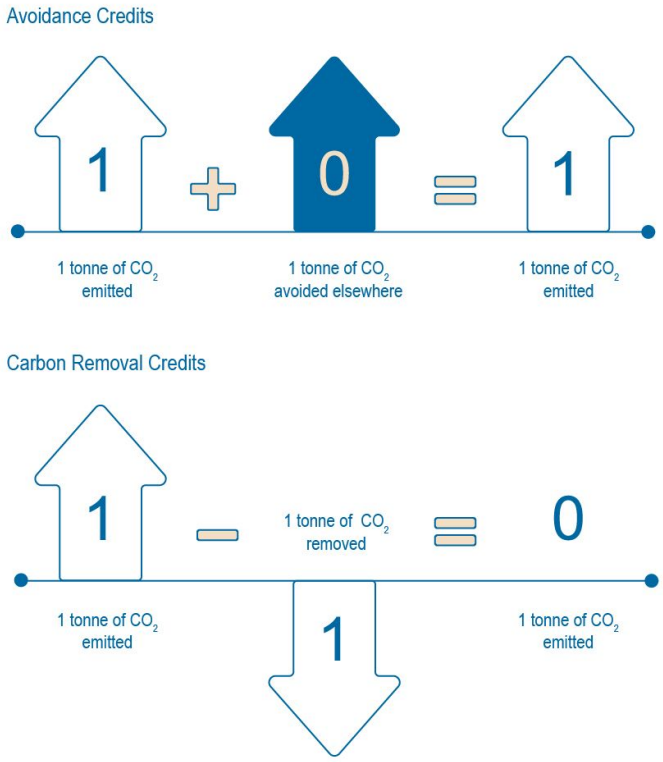

Figure 3: Difference between avoidance credits and carbon removal credits.
Source: Puro.earth 2023b. Illustration: Kati Peltola.

Both Compensate (€35/ton) and puro.earth (varying from €80–140/ton for biochar projects) have higher prices than average carbon credits in the voluntary carbon market (just above $3/ton in 2021 (Forest Trends' Ecosystem Marketplace 2021)). However, the two actors' views differed on prices, and how these shape markets. Both companies criticize existing market practices and are trying to create a tighter relationship between a carbon credit as an intangible asset and its intended environmental impact in the biophysical world (Dalsgaard

2016; Chiapello and Engels 2021). To ensure this, Compensate states that 'simply staring at prices is illogical: Increasing prices of terrible credits will not magically make them better' (Compensate 2023). They maintain that prices are currently a poor indicator of the quality of a unit of tCO_2e, and other valuation tools are necessary to measure and demonstrate the good of offset projects. In contrast, puro.earth sees their high prices as pushing companies away from purchasing credits towards focusing more on internal emission reductions: 'At the moment, our price index shows that durable biochar credits cost 125 euros per ton removed. If corporates see that price, I think they would be very highly incentivized to reduce their own emissions more radically than they have been doing until now' (Trendafilova 2023). puro.earth's approach is thus more akin to the first instantiation of a good economy of offsetting, where internalizing the externalities of carbon leads to the price being correct and by default good (Asdal et al. 2023). In contrast, Compensate argues that prices alone cannot capture the goodness of carbon offset projects and hence additional valuation tools are required to be able to make distinctions, which is more in line with the approach developed to value co-benefits in the second good economy of offsetting.

Discussion and conclusion

This article has examined how actors working within voluntary carbon markets come to value the things being bought, sold, and traded in those markets. As a contribution to studies on the good economy, I have explored how processes of valuation move through cycles of commensuration and differentiation and how new tools of valuation are created to support these. While commensuration and differentiation have previously been addressed more as market construction strategies (e.g. MacKenzie 2009; Doganova and Laurent 2016), I address commensuration and differentiation as valuation processes that seek to establish voluntary carbon markets as a good solution to climate change. The cyclical development of commensuration and differentiation shows how economization varies and changes over time (Asdal and Huse 2023); the good economy of carbon offsetting is constantly evolving in response to critique.

The valuation processes examined in this article rely on a back-and-forth movement between the technical and calculative aspects of carbon credits and the qualitative and social ones that produce value for the credits. This relates to Callon et al.'s (2002) argument that in an economy of qualities, market actors are engaged in reflexive activity and devote a significant share of their resources to position the products they create in relation to other goods. As shown by Brill (2021), this leads to a double movement of singularizing carbon credits while simultaneously making them comparable. In voluntary

carbon markets, this involves creating valuation tools that seek to establish that carbon credits can be both climatically of equivalent worth and different from other credits sold on those same markets. This positions voluntary carbon credits in the general frame of environmental intangibles, which according to Chiapello and Engels (2021) struggle to straddle the dual demand to be both detached from their place of origin to circulate in markets as well as attached to a specific location to guarantee the promised environmental impact.

Less explored has been the question of how this double movement relates to valuation in general and the development of price as one form of valuation. In voluntary carbon markets, the role of price as a tool for valuing the good is under constant negotiation. On the one hand, market actors are keen to hold on to the idea that markets are adept at valuing things through price and should be left to do so. On the other hand, market actors view it as a perpetual danger that the market might fail to see, account for, and price the correct things. This necessitates the development of an elaborate set of complementary valuation practices and tools (Chiapello and Godefroy 2017), such as methodologies and standards for evaluating co-benefits, impact scores, and overcompensation factors for securing climate impacts, or carbon removal crediting methodologies, just to name some of those discussed in this article. Market actors themselves seem to acknowledge the necessity of qualculation in valuing carbon offsets – or combining qualitative and quantitative assessment to determine what a good carbon credit is (Cochoy 2002; Callon and Law 2005). At the same time, this combination is not frictionless and settled; instead, in a concerned market shot through with values, disagreement constantly emerges over how to weigh and value such processes (Chiapello and Godefroy 2017). In voluntary carbon markets, this has led to iterative cycles through which the markets are positioned as good solutions to climate change.

As a contribution to understanding the development and evolution of good economies, I have outlined three instantiations of a good economy of offsetting from the 2000s onwards. In the first, voluntary carbon markets are proposed as a solution to the imperfect valuation of goods that enables taking into account externalities by maintaining that all emissions are of equal value. In the second good economy, a move from economic theory to market practices demonstrates that offset projects are actually more diverse and differently valued than imagined, with market actors calling for the acknowledgement of the additional benefits of offset projects. This in turn necessitates the development of new tools to value offset projects and their co-benefits. In the third good economy of offsetting, there is a return to focusing on the connection between carbon credits and their climate impacts, combined with the advancement of novel tools and practices to ensure the fulfilment of climate impacts. Analysing the evolution of voluntary

carbon markets through the lens of valuation shows how carbon credits were first proposed as a solution to problematic valuation (i.e. not accounting for externalities), but later developed into things that required valuation in and of themselves. In other words, what was first meant to enable valuation turned into something that had to be valued in and of itself, and which turned out to be rather problematic to value.

Taken episodically, each instantiation of a good economy of offsetting is a response to extant critiques of voluntary carbon markets and at the same time each response serves to further enable another good economy of offsetting to arise by showing how concerns are acted upon. The presentation of three phases of the markets thus shows how voluntary carbon markets appear entrenched in cycles of concern and contestation (Ehrenstein and Valiergue 2021). This produces an unresolved paradox of circularity, where new valuation schemes intended to value a good carbon credit need to be constantly tested and refined in practice (see also Voß and Simons 2018). This poses serious questions for the critique of voluntary carbon markets, as to exit from such cycles would require forming a critique in another manner.

Thereby, while voluntary carbon markets are on paper supposed to be highly simple, and good because of that simplicity, their transformation over recent decades has shown how they also require an excessive amount of scaffolding to hold that simplicity in place. Further, I have demonstrated that the valuation processes that occur in environmental economics and educational videos about offsetting, of a climate to which addition, subtraction and equalization can be applied, are constantly confronted by other forms of valuation. Taking the question of critique seriously could therefore involve rephrasing the question as one of who cares for a shared climate, how and with what consequences, instead of making all climate action equal in a climate that is indifferent to such matters.

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Theme issue contribution

Making Good Economies with Bad Economic Instruments: A brief history of wind power's changing economies

José Ossandón, Trine Pallesen, Peter Karnøe, and Susse Georg

Abstract
This article examines how notions of the good are entangled with instruments of valuation in the case of wind power in Denmark. Analytically, we develop what we tentatively call a comparative actantial approach to the study of policy instruments. Empirically, we inspect three support schemes introduced between 1979 and 1999 by the Danish state to foster the development of wind power. The comparative inspection shows wind power's notable shifts in what we call its actantial status: the same character appears as a very different kind of agent in the very different good economies for wind power portrayed by the instruments. The article contributes to two different but related literatures: it contributes to recent intersection between science and technology studies and economic geography inspecting the variable ontologies of energy resources, and it contributes to the discussion in this theme issue about instruments of valuation and the good economy.

Keywords: policy instruments; wind power; semiotics; resource; good economy; ANT

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Introduction

> Taxes and subsidies in the energy field are used for both *good* and *bad* reasons. In this analysis, whether a reason is good or bad must be based on whether the individual arguments are well-founded and may be used to bring about improvements in welfare from a socio-economic point of view. (Secretariat for Tax and Subsidy Analysis 2018: 9, emphasis in original).

The article's title paraphrases one of ethnomethodology's classics, Garfinkel and Bittner's 1967 '"Good" organizational reasons for "bad" clinical records'. There, Garfinkel and team reflect on the puzzle posed by the clinical records of an outpatient psychiatric ward that they were studying. If they were to approach the clinical records in terms of their statistical quality, the team realized, the ward's files were not good enough. Nevertheless, the records were important to – and a well-functioning part of – the everyday work of the organization. In practice the records were not read as statistics; they were seen as traces that could be used to reconstruct medical cases *ex post*. The ethnomethodologist's lesson is that, rather than confronting the situation as an expert whose task it is to assess the quality of the technical instrument they encounter, in this case patient records, they can study how such instruments become good or bad in an empirical situation.

Like ethnomethodologists, in this article, we approach technical instruments as a means of tracing the empirical notions of "what is good" in the studied situation. As in other contributions in this *Valuation Studies* theme issue, we are interested in how notions of the good or good economies entangle with instruments of valuation. What we do here, though, is not ethnomethodology in a strict sense. Rather than studying those who use technical instruments and the implicit ways in which instruments are used or assessed in practice, we focus on the notions of the good that instruments mobilize. To do so, we apply what we tentatively call "a comparative actantial" approach to the study of instruments. We find inspiration from some of the foundational studies in the actor–network tradition and we go back to Greimas's actantial categories.

Empirically, this article is about policy instruments in the energy field. Our focus, more specifically, is on the support schemes – the literal translation of *støtteordninger*, the term used in Danish – that have played, and still play, a critical role in fostering the development

of renewable energy in Denmark.[1] More precisely, we inspect three instruments: a support scheme from 1979 (Act on State Support for Renewable Energy); a support scheme from 1984 (Act Amending the Act on Taxation of Electricity); and a support scheme introduced in 1999 (Act on Electricity Supply).

What our comparative inspection of the policy instruments shows is wind's notable shift in what could be called its *actantial* status. The same character, so to say, wind, appears as a very different kind of agent in very different economies inscribed in the instruments. With the first instrument, the government introduced a subsidy to incentivize farmers and other rural residents to instal their own wind turbines and use less imported oil, thereby improving Denmark's balance of payments. Here, wind, or more precisely wind turbines and wind energy, is a resource tied to an oikos. The second instrument, a tax subsidy, was introduced to incentivize farmers and rural residents to instal even more turbines. Here wind turbines become a commodity whose commercialization will support a local industry. The third, and most recent, instrument is not a subsidy but a tendering mechanism. The instrument aimed at creating competition and incentivizing large energy firms to invest in large offshore wind farms, with the expectation that they will contribute to Denmark's future energy security and decarbonization. Here, wind becomes both a national energy resource and an asset. These different instruments, in turn, provide different ways of entangling wind power and "good economies". In the case of the first instrument, wind power is a *helper*, a character with a minor part in the task of reducing the use of imported oil. In the second, wind power plays a part in relation to the country's national growth, while in the third, it becomes the main hero in the country's quest for an economy that is both sustainable and guarantees energy security.

We expect that this article will be relevant to two different academic conversations. First, what we do extends the growing body of work on the economization of energy resources. Like part of this literature, we study the variable status of energy resources. To this discussion we add a comparative historical approach and a clearer emphasis on the instruments of re-sourcing. Second, we aim to contribute to the specific conversation developed in this theme issue on the good economy. We do that, particularly, by paying attention to the way in which the good

[1] The Danish wind industry has been studied extensively – often as a success story (e.g. Karnøe 1991). For instance, its success has been ascribed to effective communication and networking by engineers (Nielsen & Heymann 2014), the bricolage approach adopted by the industry (Garud and Karnøe 2003), sociopolitical devices allowing the positive valuation of wind power (Karnøe et al. 2022), etc. Our work is certainly informed by this literature, but rather than attempting to explain the success of the Danish wind industry per se, our attention is on the various policy instruments used to incentivize wind power development in Denmark.

economy is inscribed in policy instruments, and, importantly, by showing how this can be inspected in a historical fashion.

The argument unfolds in five sections: the first section introduces the analytical approach, the second explains our method, the third section presents the results of the analysis, fourth is the discussion, and the fifth is a short conclusion.

Analytical approach

Our approach could be labelled a *comparative actantial analysis of policy instruments*. In the following paragraphs, we explain what we mean by this, particularly, how our analytical position combines the concept of the actant, as originally used in semiotic analysis, with insights from actor–network theory (ANT) studies of technical instruments. Said briefly, what we do can be framed as *actantial*, but not in the usual sense of emphasizing how non-human actors have agency, but in the sense that we comparatively study the figures that populate the narratives inscribed in the analyzed instruments.

The actant

In his *Structural Semantics*, Algirdas Julien Greimas explains how investigations such as Propp's study of Russian popular stories permit us to separate two layers: on one level, each story with its delimited set of characters; on the other, when stories are read together, a delimited list of figures – "the villain", "the donor", "the helper", "the sought-for person", "the dispatcher", "the hero", "the false hero"– that appear in all narratives of a given genre. Greimas borrowed Tesnière's notion of the "actant" to name this second level. The following extracts, taken from Greimas and Courtés's dictionary of semiotics, further specifies the concept:

> An **actant** can be thought of as that which accomplishes or undergoes an act, independently of all other determinations [...] The term "actant" is linked with a particular conception of the syntax [...] In this aspect, actantial grammar, which is semiotic in nature, is seen as a more abstract formulation. At a deeper level, actantial grammar, not subject to phrase linguistic form, is able to account for the organization of narrative syntax [...] The concept of actant has the advantage of replacing, especially in literary semiotics, the term of character as well as that of "dramatis personae" (V. Propp), since it applies not only to human beings but also to animals, objects, or concepts [...] As the narrative discourse progresses, the actant may assume a certain number of actantial roles [...] This hero will be the hero only in certain parts of the narrative – s/he was not the hero before and s/he may well not be the hero afterwards. (Greimas and Courtés 1982: 5–6).

While "an articulation of actors constitutes a particular *story*; a structure of actants constitutes a *genre*" (Greimas 1976, our translation). Actants are classes of characters, the figures that populate genres, and actantial analysis is the inspection of narratives in terms of these categories.

As anyone who has opened a book on semiotics knows, semiotics can become very complicated. For instance, Greimas develops a sophisticated system to inspect relationships and transformations between actants in his famous semiotic square. At a more basic level – the level relevant here – however, actantial analysis can be relatively simple. Roland Barthes, in a recently translated interview (Fabbri et al. 2022, originally conducted in 1965), provides a simple explanation. In Barthes's words:

> Broadly speaking, these six classes are six archetypal characters, so to speak, divided in three pairs. The pair of desire and quest: that is, a certain character sets out in search of a certain object because they desire it. This character is the subject of the narrative, and what he's looking for is the object [...] A second pair is constituted by the character, who gives the sender-addresser of the good, which the subject is seeking. This is the arbiter, a sort of divinity of the situation, before whom the character who receives this good represents the receiver of the good. This is the pair, and the axis is that of communication. The third part is composed of the character (or characters of course) who helps the subject in his quest: they are the helpers, while the characters who oppose him are the opponents. (Barthes in Fabbri et al. 2022: 169–170).

Actantial analysis can be organized into a set of three pairs of categories. The pairs can be taken as the starting point for the inspection of all sorts of narratives, from Russian folk stories (Greimas 1976: 266), to fiction (Fabbri et al. 2022),[2] management literature (Greimas 1976: 279–281), or, as we propose here, the narratives inscribed in policy instruments.

ANT and the semiotic study of technical objects

Greimas's concept of the actant is, of course, well known, more widely because of its role in ANT. As Latour explains in his *Reassembling the Social*:

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[2] These are two of the examples given by Barthes (in Fabbri et al. 2022) "in the *Odyssey* we have a subject, Ulysses, who is the subject of desire, of the quest, and we have an object: Ithaca, the hearth, Penelope [...] Then you have a sender, the gods, who give Ulysses; and of course you have a helper, Athena, and an opponent, Poseidon" (p. 170). "Then for example the case of Marxism, where we can identify the actants, *lato sensus*: the subject is mankind, the good sought is a classless society, the opponent is the bourgeoisie, and the helper is the proletariat" (p. 172).

> To break away from the influence of what could be called "figurative sociology", ANT uses the technical word actant that comes from the study of literature [...] Because they deal with fiction, literary theorists have been much freer in their enquiries about figuration than any social scientists, especially when they have used semiotics of the various narrative sciences. This is because, for instance in a fable, the same actant can be made to act through the agency of a magic wand, a dwarf, a thought in the fairy's mind, or a knight killing two dozen dragons. (Latour 2007: 54–55).

Most commonly, when the term is invoked, it is in the formulation of that "that accomplishes and act" and it is used in ANT inspired studies to emphasize that answers to the question *who does the acting* should not be taken as known in advance: researchers should rather pay attention to those often surprising sources of agencies in each study. The importance of this insight notwithstanding, more relevant for our purpose is a second way in which ANT can be seen as an extension of the actantial narratology programme (Mattozzi 2019). The clearest and, perhaps the most relevant source, is Akrich's (1992) piece on how to study technical objects. In her words:

> Like a film script, technical objects define a framework of action together with the actors and the space in which they are supposed to act [...] Designers thus define actors with specific tastes, competences, motives, aspirations, political prejudices, and the rest, and they assume that morality, technology, science, and economy will evolve in particular ways. A large part of the work of innovators is that of "inscribing" this vision of (or prediction about) the world in the technical content of the new object. I will call the end product of this work a "script" or a "scenario". (Akrich 1992: 208).

Technical objects inscribe *scripts* – "actors with specific tastes, competences, motives, aspirations, political prejudices, and the rest, and they assume that morality, technology, science, and economy will evolve in particular ways" – and one key task for analysis is to reconstruct these narratives.

Another important antecedent is Latour's inspection of what he calls "programs of actions" (in itself a reformulation of another of Greimas's terms, "narrative programs" (Mattozzi 2019)). Technical objects – including, famously relatively simple ones, such as doors, or keyholders – are loaded with programmes ("a set of written instructions that can be substituted by the analyst to any artifact" [Latour 1992: 255]). The evolution of instruments, from this perspective, can be studied as a series where programmes of actions become more complex as designers attempt to reintroduce the anti-programmes (scenarios pre-empting ways in which original programmes of actions could in practice be counteracted) in the object's design. An even earlier example is the emphasis Callon (1980)

gave to the notion of problematization. It is not that technical objects are responses to given problems; from this perspective, technical objects *problematize*: they inscribe a particular reconstruction of the situation they are supposed to respond to, with a simplified set of characters and their expected agencies, and a particular narrative of how they might combine in order to produce a desired future.

The ANT approach to technical objects has more recently applied in many areas, including – importantly in the context of this theme issue – various studies of instruments of valuation, including financial formulae (MacKenzie and Millo 2003), tables (Pollock and D'Adderio 2012), and business models (Doganova and Eyquem-Renault 2009), in what is often known as "market devices" (Callon et al. 2007). Some of the work in this area, in particular the various studies conducted by Muniesa and colleagues, have not only paid attention to how devices act (i.e. how they performatively change the situations in which they are implemented), but also how instruments themselves constitute semiotic entities. For instance, Ehrenstein and Muniesa (2013) inspected the characters and constrained realities present in documents of carbon offsetting projects, while Lezaun and Muniesa (2017) analyzed the specific actant, a decisionalist hero, contained in business school case-based training. More generally, Muniesa et al. (2017) proposed an approach to compare what could be seen as two key economic semiotic genres: the *market* (as understood by Callon 1998) characterized by homo economicus and pacified commodities, and *capitalization*, a situation where instruments portray economic agents as investors, investees, and assets. Finally, articles in a recent *Valuation Studies* theme issue (see Muniesa and Ossandón (2023) for an introduction) push this agenda further, by, for instance, exploring the semiotic – and dramaturgical – properties present in documents by global consultancy firms (Aguiar 2023).

A comparative actantial study of policy instruments

To sum up, not only does ANT borrow the notion of the actant from narrative semiotic analysis, we can see ANT inspired studies of technical objects as a continuation of the *actantial* programme of semiotics. Technical objects *inscribe* narratives and the analyst's role is to develop conceptual categories to describe and compare these narratives. What we attempt in this article can be placed within this tradition.

As early ANT did with engineering instruments and studies of valuation have done with market devices, we inspect policy instruments semiotically, that is, we comparatively inspect policy instruments as narrative constructions and use analytical categories to compare the figures that populate these narratives. We have however decided not to limit the categories of analysis to the concepts

developed in the ANT tradition, but to go back to the original categories used in semiotics. The main reason is that ANT studies of technical instruments tend to focus on one main actant, the technical object's expected users and the scripts and programmes of actions assigned to them, i.e. the instructions of how to make those actors act in particular ways. Greimas's categories – and semiotic analysis more generally – permit us to expand the scope of actants to consider which, as will become clear in the analysis, is relevant to comparatively inspecting the instruments in our study.

Of course, we are aware, this is not all ANT offers. Akrich, for instance, identifies a second task, besides that of identifying the scripts inscribed in technical objects, that consists of analysis of the empirical adjustments between the scripted scenarios inscribed in the object and the specific milieu in which the object is introduced. It is, certainly, this double movement, between script and de-scripting, that characterizes the ANT approach to technical objects more widely. Or, as Latour put it, ANT = Greimas + Garfinkel. As mentioned in the Introduction, what we do here focuses only on the first half of this "equation": we comparatively study the narratives instruments inscribe, but we do not study – in this article – how these narratives are enacted or creatively modified in the instruments' implementation. This is not for lack of interest. It is work for other articles.[3]

Methods

What follows details how we proceed in the investigation whose results are presented here, and how, in the iterative process of research, our initial problem and analytical approach become more delimited.

Our original intention was to inspect the various economic realities that have been attached to wind as an economic resource. To do that we decided to focus on the instruments used to support wind power: the economies these instruments inscribe to use the conceptual language presented in the previous section. Of course, this in no way assumes that the economies we find in the instrument are the economies finally implemented. As mentioned, that would require a very different type of study. Our aim is more simply to comparatively inspect the various economies that have been attached to wind as an energy resource. The research process we followed can be organized in three steps.

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[3] This article is part of a broader research where we inspect what we call the dynamics of problematizations that shape the various policy instruments used to support energy resources. We work with different methods. We inspect current forms of expertise and practices used in creating instruments to support future energy resources ethnographically. We also work historically, we inspect past instruments that have come to shape the successful development of wind power in Denmark. This article is part of the latter.

Step 1: Identifying the relevant instruments. Using the Danish media database, Infomedia, we began with a review of newspaper articles over a span of four decades, 1975–2021. We followed the news coverage in four (daily) media outlets – two major newspapers, a smaller more critical newspaper, and the leading business newspaper (Politiken, Jyllands Posten, Information and Børsen, respectively). We selected all articles covering or debating the remuneration of wind power as well as debates concerning the societal costs of wind power in Denmark (N=750). Through our initial reading of these articles, we established a timeline for initiatives and events referred to in the articles as important for the development of wind power. More importantly for our analysis here, we identified three key policy instruments subject to much debate. These became the focus of our analysis. The instruments, often referred to as either support schemes and/or subsidies, share that they were introduced over the past 40 years to promote wind power. There are many other policies, which also have significant implications for the economy of wind power (e.g. technical details of grid connections, environmental impact assessment requirements, etc.). We have, however, limited our study to the instruments stipulating terms of exchange and forms of remuneration, i.e. directly affecting economization processes.

Step 2: Constructing an archive. Once the focus of study was restricted to the three policy instruments mentioned, we gathered information to reconstruct the narratives inscribed in each instrument. The news coverage, as mentioned, helped us to identify them, but, naturally, newspapers do not necessarily cover policy instruments in detail. Unlike more recent policy instruments (for instance those developed in the context of the EU electricity market), the support schemes we studied were not necessarily connected to technical reports elaborating on specific reasons and expected outcomes. To reconstruct the semiotic narratives in each instrument, we had to construct our own archive. In other words, the policy instruments inspected here cannot be reduced to one document, but to a network of documents. In some instances, this network of documents also includes later modifications of an instrument. In these situations, we refer to them as the same instrument, if the main script and terms of exchange remain stable. The three instruments studied are adopted by law and thus can be traced to specific bills and acts in Folketingstidende.dk, a database collecting all authoritative parliamentary documents since 1953, including bills, acts, inquiries, debates, statements, etc. The three instruments, as presented by law, outline the terms of exchange between the defined parties. To better understand each instrument, we also collected minutes from parliamentary hearings and meetings as well as technical reports and evaluations of the energy sector, Energy

Plans, consultancy reports, and reports from for instance energy agencies as well as tax authorities.

Step 3: Comparative actantial analysis. Once all relevant documents had been collected, we proceeded to analyze them by identifying key actants in each instrument and the script and programmes associated with them. To do this, we worked in two steps (as summarized below in Table 1). We used the traditional ANT categories (we identified *users*, *programmes of action*, and *scripts* in each policy instrument), to then use the six categories or three pairs (subject – object of desire, sender – receiver, helper – opponent) to pinpoint the relevant actants in the three instruments.

Findings: Tracing the economies of wind power

Exposition of the results follows three levels. First, we provide a descriptive overview of the three instruments, with an emphasis on their internal narrative logic. Second, we systematize each of these instruments in terms of the relevant actantial categories. Third, we focus on the insights the comparative exercise provides.

Three policy instruments

Investment scheme (1979)

The very first policy instrument offering support to producers of wind power was enacted in 1979 (Act on State Support for Renewable Energy).[4] The law was part of a series of measures introduced in Denmark with the aim of countering the effects of the oil crises of the 1970s.

At the time, Denmark imported up to 98% of its energy, predominantly oil (Rüdiger 2011), and with oil prices dramatically increasing, energy supply became, for the first time since World War II, a major economic and political concern. The oil price increases triggered an economic crisis, including a negative balance of payment and rising unemployment. Denmark's first national Energy Plan (Ministry of Trade 1976) identified three main priority areas of action to alleviate the effects of the crises and to better prepare the energy system for the future: first, to reduce dependency on imported oil (mainly by shifting to coal and multiple suppliers); second, to reduce import of oil by increasing energy efficiency through insulation of buildings and co-production of heat and power; and third, to develop a multi-stringed energy supply, while increasing the use of domestic energy sources (Ministry of Trade 1976).

[4] From hereon Act 1979.

The law introducing the investment scheme was formulated by the Ministry of Housing and approved by *Folketinget*, the Danish parliament. The law grew out of an employment plan from 1977, the purpose of which was "to promote the use of renewable energy sources, and thereby limit the import of energy" (Act 1979). More specifically, the support scheme stipulated that 30% of an investment in the "installation of facilities/equipment that use solar energy, wind power, geothermal energy, biogas, straw, and other similar energy sources" would be reimbursed when "installed in connection with buildings" (Act 1979). The expected beneficiaries were rural homeowners. The instrument provided an incentive for rural residents to instal a wind turbine (or other renewable energy technologies mentioned in the bill) to replace their consumption of imported oil.[5] The owner of a new wind turbine could ask the municipality for reimbursement of nearly a third of the investment costs when installing a new turbine; the maximum amount allotted per application was €15,000 (€130,000 in 1981). The equipment had to be formally approved through a technical review in order to be eligible for support.

Even though turbines could, technically, be grid-connected, the prime intention with the support scheme was not to incentivize electricity generation per se, but rather to promote the use of other sources of energy (than oil) for immediate – or almost immediate – consumption. Given that a very high share of imported oil was used for heating, the policy instrument appears to be aimed more towards promoting the installation of heating technologies, such as solar heating, biogas, straw and wood. These were considered better means for import reduction, compared to what small wind turbines would be able to deliver.

By stimulating homeowners to invest in renewable energy equipment, the scheme was supposed to have a series of effects. First, as mentioned, it was part of a policy made to improve employment, particularly in the construction industry. Second, the law focused not only on the homeowner, but also on (private) companies producing or installing the renewable energy equipment. Homeowners were supposed to use the investment subsidy to buy, not build or assemble

[5] Domestic residents and farmers were assumed not to have the necessary competences to make investments in the new wind power technology. In 1978, the Danish Windmill Owners Association (DWO) was founded in order to secure the members' investments in the new and unknown technology (Karnøe and Garud 2012). The organization built new capacities with consultants who assisted in the assessment of local wind resources, exchanges with the electrical utilities association to establish conditions for grid-connection, insurance companies to cover component failures, etc.

equipment themselves.[6] Thus, indirectly, the support scheme was also aimed at producers of such standardized equipment.

The scheme was terminated in 1989, at which point in time support had been reduced to 10% of the investment costs.

Production scheme (1984)

The second instrument was enacted in 1984, when an act (Act Amending the Act on Taxation of Electricity)[7] authorized Denmark's Minister of Taxes and Duties to grant economic support to producers of wind power injected into the grid.

To understand the specific shape this instrument took, it is important to refer to a tax on the consumption of electricity, introduced in 1977. In the context of the series of reforms seeking to reduce the use of imported oil, the consumption of electricity was taxed. By the time the tax was introduced, producers of electricity, such as wind power, were exempted from the electricity tax. For instance, a wind turbine owner who consumed their own wind power would not be taxed on electricity consumed. What the production scheme of 1984 did was somewhat more complicated. It created an equivalence between the amount of electricity injected into the grid by private owners of wind turbines and their electricity consumption, and offered to "reimburse" them for the tax paid for electricity consumption as a form of remuneration for wind power delivered to the grid. As expressed in the Act:

> The Minister for Taxes and Duties is authorized to provide support corresponding to the tax per kWh to electricity producers for the amount of electricity produced by wind power, hydropower, biogas or other renewable energy and which is delivered to the electricity grid. (Act 1984).

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[6] This was critiqued by the Organization for Renewable Energy, who stated that this would lead to "the exclusion of people who will buy and assemble the equipment themselves (in particular wind turbines and biogas plants that mainly will be installed by the user)" (written critique Appendix 3, Law 212 1978). Arguing that self-building was a normal practice among farmers and rural residents, the Organization of Renewable Energy made it clear that the law would fall short of its aim, if the exclusion of self-builders was maintained, as self-builders would also replace imported oil. This critique indirectly indicates that the aim of the support scheme was to improve employment and build new industrial capacity, while leaving self-builders on their own. The support scheme aimed to incentivize rural residents and farmers, who were not self-builders, to buy approved renewable energy equipment from (Danish) producers that could produce electricity or heat for their own consumption from sources other than oil.

[7] From hereon Act 1984.

As the following quotation shows, wind power should be exempted because its use replaces the use of oil, which was the problematic energy source, targeted with the original tax:

> … no energy resources are consumed and no expensive fuels are imported, it seems only reasonable to exempt this electricity [wind power] from the electricity tax. (Parliamentary hearing of Act 1983).

As with the previous instrument, the direct expected beneficiaries were farmers and rural residents. As the following quotation from a parliamentary hearing of the bill shows, this second instrument targeted another more indirect beneficiary:

> Additionally, tax exemption will further the development and production of wind turbines, which is of significant importance to the new industry that has evolved. A considerable domestic market is essential for the export opportunities that are currently exploited, to be sustained and further developed. (Parliamentary hearing 1983).

During the early 1980s, the Danish wind turbine industry had been growing significantly, mainly as an effect of export to California (Karnøe 1991). At the same time, the economy was experiencing a recession and economic policy turned to new sources for growth. Against this backdrop, the growing wind turbine industry presented itself as a prominent source for export and possible growth, all the while providing energy from domestic energy sources. To strengthen exports, it was argued, a domestic market had to be made possible by providing private turbine owners with "economic benefits" (Parliamentary hearing of Act 1983). In other words, the expectation was that by supporting wind power producers, the demand for turbines would increase and thus benefit the wind turbine industry, and the economy of Denmark more generally.

The other key aspect regarding this second instrument is that the grid was considered a means of wind power producers to "store" their electricity rather than selling it as such. In other words, remunerating wind power producers a payment corresponding to the tax per kWh for wind power delivered to the grid meant that they could later

consume the same amount of kWh as if it were their own tax-exempted wind power.[8]

Eight years after its introduction, in 1992, the production scheme underwent an important transformation. As documented in the national energy plan of 1990 (Ministry of Energy 1990), and following the Brundtland report from 1987, CO_2 had become a new concern in Denmark's energy policy. The energy plan laid out the environmental effects of energy production. This time, wind power was to be tax reimbursed, not because it was local or because it benefited a local industry, but because: "Increased use of renewable energy sources reduces the use of fossil fuels and thus reduces the environmental effects of the energy industry". (Ministry of Energy 1990: 60)

The economic support provided to wind power delivered to the grid, on top of the electricity tax, now added a CO_2 tax. From 1992, wind power delivered to the grid became remunerated an amount corresponding to both the electricity tax *and* a CO_2 tax.

Tendering (1999)

The third instrument was introduced by the Act on electricity supply[9] (1999) as part of the electricity reform in 1999 (Ministry of Environment and Energy 1999). The reform was Denmark's local adaptation of the EU electricity liberalization directive, which entailed the unbundling of distribution and transmission from generation and a gradual market opening (the following year, in 2000, when Denmark entered the Nordic spot market, Nord Pool).

Since 1984, and the introduction of the production scheme, turbine technology had been developing rapidly: not only had turbines grown significantly in size, but it had also become possible to build offshore wind farms. In 1991, Vindeby, the world's first offshore wind park was established in southern Denmark. The park had eleven 450 kW turbines. Eleven years later, an even larger offshore park, Horns Rev 1, was opened. With 80 turbines, it could produce electricity at a different scale of magnitude, 160 MW. With the development of offshore wind farms, wind power became concentrated in large production units, quite unlike the historic small-scale and scattered

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[8] This strong framing as a local production unit was reinforced by regulation, the so-called "residence criterion" from December 1985. The production scheme had stimulated investment in wind farms in rural parts of the country, but many investors lived far from the turbines. This was against the intention of the law, stipulating that owners construct turbines on their own land. The residence criterion required beneficiaries to own the land on which the turbine was installed – or in the case of collective ownership, to live in the proximity of the turbine – no more than 10 km away (Administrative order on state subsidies for the utilization of renewable energy sources 1986).

[9] From hereon Act 1999.

development. Thus, wind power started to take on a new role in Denmark's energy supply.

The reform's emphasis on wind parks shifted the past association between wind power and rural homeowners producing energy for their own use. Instead, the expected beneficiaries of this third instrument were large energy companies with considerable capital to invest in costly offshore wind farms. As a debate following the tendering of Horns Rev II illustrates: "[t]he tender material is written so that it can only be carried out by a large electricity company, with a significant equity capital, or a state-owned company that may provide the necessary security." (Horns Rev II Konsortium 2004: 2).

Not only was the beneficiary different, the type of instrument importantly changed. As stated in the reform text,

> [A]n increasing share of our electricity consumption will be covered by renewable energy sources. Therefore, it is essential that a future electricity market can make use of more competition-based schemes, which may guarantee a cost-effective development of RE generation. (Ministry of Environment and Energy 1999).

Furthermore, the instrument was based on project-based tendering mechanisms designed to incentivize the development of wind farms. As stated in the electricity reform, "Offshore wind farms will be developed based on a centralized bidding procedure. Permits will be granted to the producer who offers the state the most favourable conditions." (Ministry of Environment and Energy 1999).

The expectation was that a tendering scheme would create competition between wind power developers, while at the same time guaranteeing the developer a stable strike price: the winning bid price and a variable premium, often with a predefined cap.[10] Considered a means of "balancing" the economic risks between state and developer, competitive tendering was expected to drive down prices all the while allowing the state to continue to control the installed capacity of electrical power and its location. What has often been argued to be the advantage of tendering over production support is the control that the state maintains over location as well as size of wind park, and thus the development of installed capacity (Hvelplund 2001).

Although introduced as early as 1999, it was not until 2004 that the tendering scheme was employed for the first time: Horns Rev 2, a 209 MW wind farm of more than 90 2 MW turbines covering an area of 35 km2, became the first to be commissioned from a tendering process. Almost 20 years later, the 2018 energy agreement challenged the specific design of the tendering scheme, encouraging the development

[10] To illustrate, the price would be composed of the bid price and in moments where the bid price was below the spot market price, the producer would get a supplement defined as the difference between bid price and spot market price.

of new models where "revenues may be created for the state as a result of the wind resource being exploited" (Ministry for Climate, Energy and Supply 2018). This led to the adoption of a so-called two-sided CfD,[11] in which the investor pays back the state when the market price is higher than the strike price. This was considered a more acceptable distribution of risk between the state and the developer (Energy Agency 2020), even allowing for the state to profit directly from continued growth in offshore wind power.

The three instruments' narrative semiotics

The three support schemes, we have proposed, can be read as semiotic narratives. We do this reading in two steps.

The first step uses the categories used in ANT analysis of instruments, the user's script and programme of action. The second step uses the basic categories of actantial narrative analysis. The table below provides a summary. As in previous ANT analyses of instruments, we identify expected users and their expected scenarios. This basic script is supplemented by the actantial categories that show a more complex storyline. Nevertheless, the three instruments show a similar basic form. The sender is the government that initiates the support instrument, the instrument is the subject, who is given the task to make others, the helpers, act differently and with that defeat certain opponents, which, in turn, will make the final addressee benefit more generally from the object of value. What varies in the different instruments are the specific characters.

[11] Contracts-for-Difference, or CfDs, are well-established financial instruments, a derivative, used in a variety of financial markets. First developed to leverage gold, CfDs have become a widespread tool in energy markets, most commonly used to support renewable energy projects, but also used at for instance the Hinkley Point C nuclear plant in the UK. Where CfDs are heralded for their distribution of risk between developers and state, they were preferred over other tools such as concessions, which would likely have ensured a more significant income for the state (through e.g. rent of the seabed). While a concession model was considered (quite like the historical arrangements for exploring natural gas and oil in the North Sea), it was argued to have negative effects on the further development of wind power (Copenhagen Economics 2020).

Investment support scheme (1979)	**Production scheme (1984)**	**Tendering scheme (1999)**
ANT categories		
Expected users are farmers and residents in rural areas. The *programme of action* takes the shape of an economic incentive. Farmers and residents in rural areas that instal wind turbines or other forms of renewable energy equipment for domestic use can claim compensation for 30% of the installation costs. The *script* is that the incentive is expected to increase the chance expected users will instal renewable energy equipment for domestic use, therefore reducing use of imported oil, enabling a future where Denmark is less dependent on foreign oil and has improved employment and balance of payments.	*Expected users* are farmers and residents in rural areas. The *programme of action* takes the shape of a tax return (reimbursement). Domestic producers of wind powered electricity will be reimbursed the electricity tax, equivalent to the amount of Kwh they have injected into the electricity grid. The *script* is that the tax return scheme will incentivize rural users of energy to become energy producers, while also leading to a growing industry.	*Expected users* are large energy companies. The *programme of action* takes the shape of a tendering scheme. Large energy companies that receive the right to exploit wind farms in a delimited area will be benefited by secured long-term investment. The *script* is a competition, where the winner is guaranteed secured investment, while participants are supposed to compete for the most cost-efficient bid.
Actantial categories		
Government (*sender*) introduces investment support scheme (*subject*) with the goal of making the country, Denmark (*receiver*), less dependent on foreign sources of energy (*opponent*). The instrument's (*subject*) goal is to incentivize rural inhabitants and farmers (*helpers*) to instal wind turbines (*helpers*) which will be used as sources of domestic electricity and heat, and with that to rely less on oil (*opponent*).	Government (*sender*) introduces a production scheme (*subject*) with the goal of increasing Denmark's (*receiver*) economy. The instrument's (*subject*) goal is to incentivize rural inhabitants and farmers (*helpers*) to instal wind turbines (*helpers*), which will help the local wind turbine industry further develop. Excess demand (beneficiaries, *helpers*) will lead to an increase in investment in facilities to make wind power technology available.	Government (*sender*) introduces competitive tenders (*subject*) with the goal of ensuring Denmark's (*receiver*) cost effective wind power production. The instrument's (*subject*) goal is to incentivize large wind power developers (*helpers*) to build and instal offshore wind farms (*helpers*), which will provide the country (*receiver*) with cheap wind power generated electricity.

The incentive (*subject*) will also expand demand and this will lead to an increase in investment in facilities to make renewable energy technologies available at lower prices. The instrument's beneficiaries – farmers and residents in rural areas – as well as wind turbines are only minor helpers in the larger quest (*object of value*) for Denmark's energy independence.	The instrument, farmers and residents in rural areas, are minor helpers in the larger quest (*object of value*) for Denmark's economic growth. With the modification of 1992, farmers and residents in rural areas, wind turbines and wind turbine industry, became helpers in the larger quest (*object of value*) for Denmark's economic sustainability.	The tendering mechanism, large wind power developers, wind farms, are helpers in the larger quest (*object of value*) for Denmark's energy security and sustainable economic development.

Table 1: Summary of the analysis.
Source: Authors' own work.

Comparing the three instruments

Although we do not engage in specialist semiotic or narrative analysis per se, borrowing basic aspects of this language helps to compare the different economies of wind power inscribed in the support schemes. Three aspects are, in our view, particularly salient in this context.

A first way of comparing the instruments is by paying attention to what in the semiotic language would be the "sender" and the "addressee", or in simpler terms, the final beneficiary. The first two support schemes assume a mechanical logic. The government sends – or implements – a support scheme that will make it more likely that a specific type of actor will act in a desired way, and this, in turn, will make the final beneficiary get closer to the final object of value. In the first instrument this is simpler: a domestic energy infrastructure investment subsidy is expected to increase farmers and rural homeowners' use of wind turbines, which, in turn, should reduce Denmark's reliance on imported oil. In the second instrument the logic is similar but with a slightly more complicated chain of connections. Tax reimbursement will increase farmers' and rural homeowners' wind power use, which will benefit a *helper*, the developing wind power industry, which, in turn, will help the Danish economy to grow. The instrument is not only oriented to reduce use of a particular type of energy source, but also, more explicitly than with the first instrument, which was also an employment support, is an industrial policy, a scheme to support the development of a local industry. The third instrument, finally, has a quite different internal logic. The government creates a tendering mechanism where companies that fulfil the entry

requirements are expected to bid on the right to develop a particular wind farm site, and it will be the task of the tendering or auction mechanism to identify the most efficient proposal. Here, unlike the previous instruments, the government does not create an incentive that will make a type of actor more likely to act in a particular way; the government introduces a competition that will make bidders compete to offer the lowest bid. If the sender of the second instrument becomes a developer of industrial policy, in the third it is a designer of competition, a market designer of sorts. The market designed in turn is expected to be able to sort between alternative scenarios, producing the most cost-efficient intervention.

A second relevant comparative issue appears when the instruments are considered in terms of what in the semiotic language is the "object of value" – the goal of the quest – its relationship with the "addressee" and key "helpers", the wind turbines themselves. In the first instrument, the main goal is to reduce Denmark's dependency on imported oil, which, in turn, is part of a broader quest to improve the Danish economy's balance of payments. In the second instrument there is an important transition. In its first version, the main goal was the country's economic growth, and, more indirectly, employment. However, since its 1992 modification, it has also been an instrument expected to reduce CO_2 emissions. It is here where CO_2 enters the economies envisioned in the studied support instruments. Wind power is now both a minor helper in reducing dependency on oil and economic growth, and a helper in the new national quest for making the economy less CO_2 dependent. Finally, in the third instrument, there is a combination of energy security and a growing sustainable economy. A key difference here is what is expected of the wind turbines themselves. In the first two instruments, wind turbines are deemed part of the infrastructure of farms and rural homes: wind turbines are domestic sources of heat or electricity. In the third instrument, on the other hand, turbines and wind farms are seen as national sources of energy: key components of the national power infrastructure.[12]

A third aspect refers to the ways in which each instrument portrays its key user and how it expects to change their way of acting; in ANT language, the instrument's scripts and programmes of action. In the first and second schemes, beneficiaries are private homeowners. The schemes should make them act differently: farmers and rural owners are incentivized to invest in non-oil energy infrastructure. This is a type

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[12] Even though in the second instrument, wind turbines are thought to be connected to the electricity grid, wind power was, however, still considered as providing a marginal contribution in terms of overall energy supply (the expected potential was less than 10 times the installed onshore capacity in 1990 (Ministry of Energy 1990: 41). In fact, it seems as if the wind turbine industry was of more interest than wind power as such.

of economic intervention targeting a unit that could be thought of in terms of an *oikos*.[13] This, of course, does not mean these are instruments that work with pre-modern economic logic. These are instruments scripted with the specific narrative constraints of neoclassical economics governance. In the first instrument, the expectation is that by reducing the final cost of investing in non-oil-based energy infrastructure, beneficiaries will be more likely to replace oil dependent infrastructure. It is a similar logic that is present in the second instrument, but here instead of subsidizing domestic investment, economic action is incentivized via tax exemption.[14] The expected beneficiaries of the third instrument is, however, very different. These are definitely not located at the *oikos*, they are large energy companies. The type of incentive is also very different. While the first two instruments incentivize beneficiaries with different forms of savings, in the third, the final beneficiary, the winner of the tendering so to speak, is benefited with compensation that will provide security for the investment. While the user of the first and second instrument was assumed as domestic – and incentivized accordingly in terms of their budgeting (tax exemptions and return on machine investment), the user of the third instrument is assumed to be a large energy company that is incentivized in terms of future cash flow.

Discussion

The analysis presented in this article connects, we propose, with two different, but related streams of academic literature: work on energy resources and work on valuation and good economies.

Economic objects and energy resources

In their influential proposal for a research programme on economization, Çalişkan and Callon (2010) identified five foci of study; one was the study of economic objects. Research on economic objects, in turn, connects literature coming from economic

[13] Ossandón and colleagues (Ossandón et al. 2022) propose a programme of research that examines the practices and instruments through which household finances are managed and governed. They call this approach financial oikonomization. In these terms, it could be argued that the two first schemes are instruments of energy oikonomization: interventions that aim to shift how the energy economy of the rural house is managed.

[14] Even though in the second instrument, wind turbines are thought to be connected to the electricity grid, wind power was, however, still considered as providing a marginal contribution in terms of overall energy supply (the expected potential was less than 10 times the installed onshore capacity in 1990 (Ministry of Energy 1990: 41). In fact, it seems as if the wind turbine industry was of more interest than wind power as such.

anthropology (notably the tradition associated with Appadurai's edited volume (1986) that emphasizes the temporal character of the commodity status of things; and work at the intersection of economics and sociology originating in France on how economic goods acquire certain qualities (see Musselin and Paradeise 2005 for a review). The key issue here is to follow the trajectories of economic objects, the life of the product in Callon and colleagues' terms (Callon et al. 2002), and how the qualities of economic objects shift with the different relational configurations in which they become situated.

The emphasis on the life of economic objects and their variable ontologies has become relevant in recent social studies of energy. Most work here comes from science and technology studies (STS) inspired economic geography, where long-lasting disciplinary interest in "resources" has given space for work on *resource-making*. From this perspective (see Bridge 2009, 2014), *being a resource* is not a given, but rather an effect, and what studies here do is to pay attention to the process in which things are turned into energy resources (Kuchler and Bridge 2018), with a more recent emphasis on assetization in current efforts of decarbonization (Langley et al. 2021). A different but related stream comes more directly from STS where attention has focused on the devices involved in energy resource making (see the chapters in Labussière and Nadaï 2018). Here too, it has been stressed that more attention should be paid to how energy resources are qualified as renewable and the specific assemblages participating in such processes (Labussière and Nadaï 2018).

In the light of this tradition, what we do in this article could also be seen as a study of wind power as a resource. As in the work just mentioned, we follow wind power not as a fixed entity, but as it is constituted in specific relational configurations. Analysis of the three policy instruments illustrates that the question in this case is not so much when – or when not – wind power becomes an energy resource, but rather the significant differences in the ways in which it becomes a resource. Comparatively inspecting the instruments supporting wind power development helps us to learn more about the relational properties of energy resources, and the way in which resources become commodities and assets.

In the first instrument, wind power is conceived as a domestic source of energy. At this stage, wind power is not framed as an exchangeable commodity, but as a resource consumed immediately in the adjacent home. With the second instrument, wind power is thought of as circulating in the grid and can, accordingly, be metered. It becomes a recognized source of energy, but it is not conceived of as a commodity that is sold. On the other hand, in instrument one partially but more clearly in instrument two, wind turbines are recognized as commodities on their own that are at the centre of a growing industry that requires support. All this changes with the third instrument. Here,

wind power is an essential part of the marketized electricity system. Wind power becomes a commodity – to be priced in the Nordic integrated market – and this commodity is taken as an essential component for the financial economy of energy investment. Future sales of wind power become a future cash flow that can be treated as an asset.

Good economy

A second literature is more directly connected to this *Valuation Studies* theme issue. A key problematic, in this context, is the study of what Asdal and colleagues have called "good economies" (Asdal et al. 2023). The following extract from a recent commentary by Asdal on Weber is helpful:

> A hypothesis with regard to our contemporary society is that the economy is now instead emerging as a new and differently ordered normative sphere. If this is so, this can be linked to a new financialized and moralized version of economy where the issue is no longer the correct allocation of scarce resources based on precise calculations of alternative costs and ends, but rather the idea of manufacturing markets for collective concerns (Frankel et al. 2019) and that of doing good with money […] Rather than ensuring no penny is spent in vain, the aim becomes the provision and directing of capital; an economy where the division between fact and value is displaced from being the overriding good, to capital as both the instrument for moving capital towards good ends and capital as a good in and of itself. In other words, a version of economization as a "good economy" (Asdal et al. 2023) where that of distinguishing between fact and value is no longer the issue, but rather an idea of value creation that encapsulates the good, and the sustainable too. (Asdal 2022: 851).

The quotation has two implications that are relevant here. On the one hand, it is a diagnosis: contemporary government is not about separating the economy and the good. On the contrary, it can be characterized in terms of the various ways in which the good is pursued through economic instruments: markets that are supposed to work as policy devices (Frankel et al. 2019), green finance and accounting (Chiapello and Engels 2021), etc. On the other hand, what Asdal makes is also a methodological call to pay more attention to the various "good economies" that these economic instruments produce. In Asdal and colleagues' work (Asdal and Reinertsen 2021, Asdal and Huse 2023, Asdal et al. 2023) this is done by paying attention to the documents of policymaking.

What we do in our analysis can clearly be read with these lenses. On the basis of document archival methods, we compare policy instruments, and the comparative study shows the various good

economies of wind power. What we do is see that our comparative inspection is not of the different documents associated with one policy, but that rather we compare different instruments, and, accordingly, the different *good economies* of wind power. As mentioned earlier, we cannot claim to know how the instruments we study implement the narrative inscribed in them.

What we can see are the economies that wind power support schemes seek to underpin. The three instruments share that they are framed as responses to one key concern, namely, the energy dependency of Denmark. Wind appears as a local alternative to imported oil. Aside from that, the instruments differ significantly. In the first and second instruments, the economy of wind power is conceived as an intersection of an *oikos* and the overall national economy (if rural households and farms instal wind turbines, they will be less dependent on oil, which will, indirectly, increase employment in the construction sector, and improve Denmark's balance of payments; if rural households and farms are incentivized to inject wind power into the grid, they will demand more wind turbines, which will help to develop the wind turbine industry, and positively impact economic growth). There was, however, an important shift with the second instrument's modification in 1992, when wind power was supported in terms of its impact on CO_2 emissions. It could be argued that it is precisely with this modification that the support instruments we study become less driven by more or less traditional (macro-)economic goals (balance of payments, growth, employment) and become instruments that are expected to support a *good sustainable* future. This, in turn, is consolidated with the third instrument, which is closer to what Asdal and colleagues seem to have in mind when they think of a good economy. It is an instrument with "an idea of value creation that encapsulates the good, and the sustainable".[15]

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[15] As one of our reviewers pointed out, a third line of discussion – that we cannot expand on here for reasons of space – concerns the literature on policy instruments as developed for instance by Lascoumes and Le Galès (2007). One way of doing this could be by exploring further how what we do here, and what others have done before (e.g. Asdal and Huse (2023), Ossandón and Ureta (2019), Pallesen (2016)), that is, using ANT tools originally developed for the analysis of technical devices to study policy instruments, modify our understanding of instruments of policy more generally. Another and perhaps more difficult possibility could be to explore what here remains only an analytical hypothesis: namely, that policy instruments more generally can be inspected semiotically. A way of doing this could be to further test whether the method we rehearse here – when we look at an instrument in terms of a narrative with the instrument as the subject, with senders, receivers, helpers, beneficiaries, objects of value, opponents – works for other cases. We thank our colleague Troels Krarup for pointing us in this direction.

Conclusion

The quotation that opens this article comes from a six-volumes analysis of the tax and subsidy system in the energy sector published by the Danish tax authorities in 2018. The quote illustrates what has come to be the dominant expert position within energy policy. It is from this position that *good* and *bad* reasons for using policy instruments such as "taxes and subsidies in the energy field" can be expertly distinguished as a matter of "improvements in welfare from a socio-economic point of view". This article has also been about policy instruments in the energy field. We have inspected a series of economic support mechanisms in relation to wind power introduced in Denmark in previous decades. The analytical position, however, is not that of the expert implied in the quotation. We do not define what is good but study what becomes good: we compare the different good economies that are implicit in the different instruments we study. There is, however, a different way in which we could connect what we do in this article and the quotation. From the perspective of contemporary policymaking implied in the quotation the first two support schemes studied here are bad instruments. While they appear to have been perfectly reasonable in the context in which they were introduced, these are support schemes that do not pass the test of socioeconomic cost–benefit assessment used today, and more generally, what is today accepted as good instruments. They are relics of past forms of supporting the economies of wind power. From this perspective, the method rehearsed here could be read as a call for future work where what is traced is not only a transformation in the good economies of wind power, but in the nature of economic support instruments and the policymakers implied with them. We see, perhaps, a movement from a type of instrument where the policymaker's position is conceived of as someone tinkering with supply and demand (an expert that creates employment support and industrial policies that are supposed to impact the macroeconomic balance), to one in which the position of the policymaker is that of a market-designer, and from where it is possible to compare alternative policy instruments as if they were possible avenues of investment.

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Theme issue contribution

Bio-Efficiency: On the valorisation of innovation in the bioeconomy

Oscar Krüger and Alexander Paulsson

Abstract
This article discusses a concept that institutions from the OECD to the EU increasingly employ in their response to the ecological crisis: The bioeconomy, wherein materials for economic activity would be bio-based and renewable. As a present-day project, the bioeconomy translates the critique of (fossil) carbon into patterns of (material) resource use and (economic) resource allocation, not least through a new valorisation of *innovation* in the form of public–private partnerships. Yet where literature on the bioeconomy scrutinizes innovation, the concrete link between funders and funded has seldom been subject to focused analytical inquiry. This link is essential to the structure of the bioeconomy project. To broach the arrangements by which efforts to conjure a (bio-)economy underwrite specific patterns of value distribution, this article asks: Which discursive and conceptual resources are deployed to define the worth by which projects are construed as worthy of funding? Drawing on online ethnographic observation at funding events as well as on document analysis, we show how these arrangements are structured by a valorisation of *efficiency*. We propose to call this bio-efficiency, and relate it to a construal of the world as scarce.

Keywords: efficiency; bio economy; innovation; valuation

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Introduction

An ethnographic scene to evoke the concerns of this article appears, as the familiar PowerPoint layout fills the screen that we are observing. A collection of words already on display: Mission, aim, pillar, cluster. Some 90 persons in attendance. Remotely, just as we are, and none with a camera switched on. Then, next to the presentation, a face comes into view. Long, light hair hovers in front of a white curtain and a woman, with an air of professionalism about her, begins to explain: What we have in front of us is '… the green growth strategy called the European Green Deal'. Today, we are here to learn about the new programme for Research and Innovation, which – the audience hears – 'is extremely important and timely … for the sake of new innovations, for a sustainable future'. That way, we are going to 'manage in a sustainable way'. A brief pause, then: '… and profitable! This should not be forgotten. So, there needs to be a balance!'

In that spirit, the floor soon cedes to the next step in the event: Presenters, telling stories of success from projects that the persons in attendance are meant to emulate: One woman – white shirt against a painted wall, appearing on one side of the screen as her PowerPoint presentation covers the other – speaks about thermal depolymerization processes; one man speaks about fungi and how these illustrate 'how smartly integrated products can solve parts of the challenges facing mankind and the Earth'; a man with short hair and round glasses tells of how the plastic deployed for artificial sports turf can be replaced by non-plastic alternatives capable of providing the qualities of conventional turf; another presenter speaks of the 'fully bio-based materials that can replace metal'; yet another celebrates the 'bio-based diesel', which would 'help us reduce emissions from transport'. And so the afternoon continues, at this event on innovation for the sake of a coming bioeconomy.

* * *

Carbon is no longer the future, and if there is to be a future for our species it will be carbon-free. The most striking thing about this statement is the extent to which it is no longer striking at all: The critique of carbon is now ubiquitous across the mainstream political spectrum, and underpins a wide array of discourse, positions, innovation, and struggles. The old way of doing things – constructing houses, providing energy, transporting goods and people, playing sports – will no longer do, and a new way of life must emerge. In the introductory vignette, we encounter one social product of this consensus: The project, as pursued by actors from the OECD to the EU, to bring a bioeconomy into being.

In Europe, this bioeconomy project – the specific focus for this article – is not a straightforward object of inquiry. Institutions and

actors are manifold, making attempts at coordination difficult in networks now branched out in various states (Vogelpohl et al. 2022; see also Lühmann 2020). The very concept of a bioeconomy is descendent from a considerably more radical pedigree than found in its present-day deployment, remains far from unitary, and is used by conflicting categories of stakeholders (Levidow et al. 2013; Paterman and Aguilar 2018; Vogelpohl and Töller 2021) to frame efforts where the 'bio' carries connotations of bio-tech, bio-mass, or agroecology (Hausknost et al. 2017). However, while European bioeconomy strategies thus suffer 'conceptual ambiguity', which can 'lead to a certain vagueness and arbitrariness' (Vogelpohl and Töller 2021: 143), it remains the case that the rise of the bioeconomy is coupled with the promulgation of certain overarching conceptions of our present predicament and the appropriate ways in which to face it.

At stake in these overarching conceptions is a new reckoning with the material underpinnings for the economic generation of value (Birch 2017). Underpinning the bioeconomy project is a framework for which the contemporary economy is 'bad' by virtue of its reliance on fossils at each stage from production to consumption. Thus innovation is required for the sake of provisioning the means for shifting the entire economy – including the chemical industry, fuel industry, and traditional construction materials – to (non-fossil) biological materials. In short, the bioeconomy project is about supporting a shift where value (in the narrow sense) would henceforth be linked to material processes of a more worthy kind – a 'bad' economy finally made 'good' by virtue of a new alignment with a 'bio' (Asdal et al. 2023). There is ample literature on how such bio-economic innovation would break down existing natural impediments to the economic utilization of nature, particularly the barrier of the cell wall (Waldby 2002; Rose 2007a; Schmidt et al. 2012). Our concern in this article, however, lies much closer with what we actually put on display in the opening vignette above: not cell-walls being broken down, but an occasion where prospective applicants for R&D funding are presented with one framework for resource allocation, as well as examples of successful projects for them to emulate.

Innovation processes are costly (O'Sullivan 2005). Yet where '[i]nnovation has become a leitmotif of policy making and institutional design' (Pfotenhauer et al. 2019: 895), substantial sums are now expended through public investment into private initiatives for green innovation (see Goldstein and Eldield 2018). Thus, in Europe, funding for bioeconomic projects has been channelled through frameworks such as Horizon 2020 and Horizon Europe. While it is difficult to get precise numbers on the funding allocated, funding for 'Circular economy and bioeconomy sectors' amounts to €326 million only in 2023 and 2024 (European Liaison Office of the German Research Organisations 2023). In Sweden, several authorities finance R&D and

research in the 'bioeconomy', including Vinnova (Innovation Agency), Formas (Research Council for Sustainable Development), and the Swedish Energy Agency, along with foundations such as Wallenberg and Mistra. Vinnova also manage the governmental innovation programme 'BioInnovation', which has received SEK50–60 million per year since 2015. When asking one of the managers at Vinnova how many competitive R&D projects this has made possible over the years, he guessed somewhere between '250 and 300' (pers. comm.).

With a focus on its expression in the Swedish context, our aim is to depict and interpret valuation processes operating in this specific domain of the bioeconomy. Thus our concern is not with value where nature has been taken into the economy in the form of novel commodities or procedures of production (e.g. Asdal and Huse 2023). Nor is it value as the patents through which such novelty is turned into propertied assets valorised irrespective of deployment (Kang 2020). Instead, we address the allocation of economic resources within arrangements for funding innovation. These are three distinct moments, where the dynamics of value – as Birch (2017: 483) argues – must be analysed in the modulation specific to each step. In particular, there is a marked disconnect between potential devices that innovators promise and the deployment of actual innovations, and yet this 'failure to deliver on the promise of bountiful new products and services' coexists with 'high and rising financial valuations' (Birch 2017: 461).[1] The bioeconomy project thus operates as a 'new machinery of anticipation' (Hilgartner 2007: 382; see also Petersen and Krisjansen 2015), in which value allocation hinges more on future promise than present deployment. But what promises do innovators actually make in order to attract bioeconomic funding for their projects?

Crucial to this dynamic is the fact that funding, no matter how ample at any given time, will always be scarce in relation to the myriad of possible innovation projects. Funders must thus decide which projects are worthy recipients, and prospective innovators must frame their contribution as significant, viable, and worthy. But this raises a fundamental question: in what does 'the worth of the worthy [consist]' (Boltanski and Thévenot 2006: 14)? Fortunately for our inquiries, this same question is asked – albeit perhaps not in these words – by actors within the bioeconomic machinery itself. Worth, as Boltanski and Thévenot (2006: 132) suggest 'is the way in which one expresses,

[1] When approaching the bioeconomy, the 'bio' poses a magnetizing force and is often theorized in relation to Foucault and his concept of biopolitics. Birch and Tyfield (2013), however, believe that this amounts to a fetishization of the 'bio', which could obscure relationships that are contained in the emerging bio-based economies. Instead, the dynamics and the struggles shaping these relationships could be explored, they argue. Interestingly, however, formal politics is surprisingly absent from many discussions about the bioeconomy, although much resource allocation and many funding schemes are decided and administrated by formal political institutions (e.g. Asdal and Hobæk 2020).

embodies, understands, or represents other people'; this is precisely what the event depicted in the vignette above pivots around, where representatives of a funding institution face an audience of prospective 'innovators' in order to explain what they themselves can offer and what they would expect for doing so. The privileged means for representing worth at this event, as it was systematically during the course of our inquiries, was the example. Indeed, whether presenting fungi or sports turf, the examples on display served to express and represent success of a kind the audience might emulate. In the first instance, success is about the fact of being funded and bringing a project towards a conclusion. Yet beyond recounting the mere facts of projects, the point of doing so is to display what made the project worthy of funding to begin with. Thus, in this article, we understand such examples – examples first selected by interlocutors in the field rather than ourselves as researchers – as means by which bioeconomic actors themselves put the logic of their social field on display for themselves (see Graeber 2001). Events at which examples are presented, thus take on the character of 'grammatical enterprises intended to clarify and fix rules for reaching agreement' (Boltanski and Thévenot 2006: 66). In this manner, they serve our entry point for analysing a social order they both represent and construe (Boltanski and Thévenot 2006: 17; see also Patriotta et al. 2011; Gond et al. 2016).

We build our exploration on Asdal et al.'s (2023) demonstration that bioeconomic discourse promises an economy made 'good' by virtue of a new alignment with a 'bio'. But while we show similar discourse of alignment, we argue that the virtue of the 'bio' is, in turn, construed through promises to render industrial and economic activity more efficient. The economic dynamics by which the capitalist economy subjects actors to imperatives of efficiency has been a topic for the social sciences avant la lettre (see Marx 1990: chs 12–14). In the bioeconomy machinery, by contrast, efficiency interacts with value only as also construed as a normative criterion for defining a good economy (Asdal et al. 2023). We argue that it is imperative to distinguish between these ways in which value and efficiency interlock. Thus, we develop an analytical lens for scrutinizing and criticizing what we term bio-efficiency. This is our contribution and our take on what a proxy of 'the good' is in this particular context.

Our article is organized as follows. After an outline of the methods by which we inquired into bioeconomic innovation funding, we provide a minute depiction of one event. Written in a mode which 'remains a matter of evocation rather than of analysis' (Herzfeld 1987: 23), our intention is to display the lived context in which social actors express and reproduce the notions of worth for which we seek. We supplement the ethnographic depiction by attending to project reports from concluded bioeconomic innovation projects, which brings us to

an ensuing analytic discussion on how to construe the significance of efficiency to bioeconomic innovation processes. Noting that efficiency is already the organizing value of the industrial world whose problems the bioeconomy project seeks to redress (Boltanski and Thévenot 2006), we conclude by suggesting that the primacy of efficiency reflects a construal of the world as scarce rather than abundant, which can contribute to reducing innovation into the activity of finding new efficient means for pursuing old ends (see Goldstein 2018).

Zoom-ethnography, observing the field through a digital prism

During 2020, we began exploring the European bioeconomy by following the networks that make up this economy and how these networks are branched-out into various member states. Many of these networks are the result of innovation and research-funding from the EU Horizon 2020 programme, which has targeted calls for applications on bioeconomy projects. In individual member states, national research funding schemes have also propelled research on the bioeconomy. In 2017, an 'Expert Group' assessed the European bioeconomic strategy and stated that they had observed 'significant reinforcement of policy interaction and stakeholder engagement, for example the stakeholder panel and the stakeholder conferences' (Expert Group Report 2017) The significance of the conferences should not be underestimated (see Brosius and Campbell 2010; Nyqvist et al. 2017). These are events where networks are built, and conflicts contained in the bioeconomy are addressed (e.g. Lühmann 2020). And they are also occasions where expectations and norms are explicated and reproduced, not least by means of the 'exemplary' projects that the organizers elect to present.

From the outset, our research design placed these events at the centre. While not quite the public investment pitches studied in much of the literature (e.g. Lounsbury and Glynn 2001; Chapple et al. 2021), they provide a stage for highly performative presentations where especially presenters of successful innovation projects 'must concisely yet charismatically convey the value of their innovation' (Fairbairn et al. 2022). The COVID-19 pandemic jeopardized our strategy of focusing on such events, as they were cancelled. However, many soon turned into virtual conferences, which provided ample opportunities for our ethnographic work, only now in digital form. Whereas much digital research is concerned with researching 'the digital', as in digital social media, the digitized self, or digital politics (see e.g. Lupton 2015; Ash et al. 2018), we were not primarily interested in the digital practices of online networking. The digital ethnography we adhered to merely meant, following Pink et al. (2016: 21), that we were 'in mediated contact with participants rather than in direct presence'.

Indeed, the virtual conferences we attended amounted to a field of exploration. So, rather than meeting people face-to-face, we listened to and observed what happened in scripted presentations, Q&As and break-out rooms on Zoom.[2]

That the bioeconomy conferences and much of the networking within this industry-science community occurred online meant that we were able to participate in more events, hear more people talking, and learn about the many research projects that were tapping into the bioeconomy policy discourse. Because of the easy access, digital ethnography often leads to, as it did in our case, an overwhelming amount of empirical material, gathered while taking notes, collecting PowerPoints, downloading screenshots, and saving and storing hyperlinks. While our fieldwork spanned a period of 10–12 months, our participant observations were confined to shorter events. We observed around ten events, the shortest being around two hours and the longest two full days. This echoes Góralska's (2020: 50) reflection that digital ethnography tends 'to be shorter than the non-digital ones, as there is more data that can be collected in less time'. We also conducted an analysis of documents relating to the bioeconomy (Asdal and Reinertsen 2022) both upstream (e.g. overarching EU policy documents) and downstream (e.g. reports from concluded innovation projects) in order to attend to how notions of worth may carry through such instantiations. Finally, we interviewed civil servants who, while working with the European bioeconomy in Sweden, were mostly developing research and innovation funding schemes.

"The good economy" at the Bioeconomy Parliament

As discussed above, a critical component of the bioeconomy machinery are events that aim to cultivate the role of 'the innovator'. But what actually takes place at these events? In order to situate our analysis, we begin with a protractive description from one event. We then turn to reports from concluded innovation projects, thus creating a resonance that forefronts the theme for our ensuing analytic discussion.

'The Bioeconomy Parliament': this is the name of an annual event that attracts the big corporations in forestry and chemical industries in Sweden. This time, on a cold winter day, a diverse group of researchers, corporate representatives, and government officials would gather in a virtual room to watch and listen to presentations by start-ups, R&D projects, and researchers. The facilitating presenters are gathered together in what appears to be a small studio. Then, it begins. First, the usual presentation round by the organizers (a city in Sweden together with the Regional Authority) and the agenda and purpose of

[2] All personal names used in this article are pseudonyms.

the parliament is conveyed. Subsequently, to properly open the event, the first keynote speaker: the star-architect Will Gertsson, articulates his thoughts about the housing of the future. Gesturing, leaning forwards, and speaking in the animated manner which has made him a household name in the country, Gertsson enthusiastically voices his thoughts on moving away from using building materials excavated from below ground. As he is very much involved in creating the future of housing, with many prestigious building projects throughout Sweden and Scandinavia, his idea of a 'sustainable' future could be realized – Gertsson explains to his audience – if he only managed to convince his clients. Confessing that he does not care much for today's waste and high-tech solutions in housing construction, Gertsson expounds, instead, on his vision for a dense future city shaped by multifunctional housing, where cement as well as other carbon-intensive materials would be replaced by timber.

Gertsson's presentation is unmistakably both sweeping and visionary in its views for the future, which sets a tone that endures as the floor is ceded to actors of the kind Gertsson would need to convince to realize his envisioned future: Representatives from industrial trade associations. The next speaker, who represents the Swedish chemical industry, pursues his arguments through a series of PowerPoint slides composed, not predominantly by words, but as a series of graphs and images. Concerned with conveying how his industry could switch to circular and bio-based production, and under which conditions this could be done, one slide appears particularly central to the argument. This time, a slide with a figure displays a scenario of embedded carbon in different types of materials up to 2050. While fossil-derived materials constitute 84% of all chemical products as of today, this is supposed to be zero in 30 years. Recycling, he explains over the slide, is forecasted to move from constituting only 5% to 55% over the same time period. And the use of bio-based materials will double.

Against this background, the presentations move on to representatives from the industry which more than most others, at least in the local context, will be tasked with providing those bio-based materials: the large-scale forestry and logging industry.[3] Discussions are once more wide-ranging, but one presenter would take particular care to emphasize a crucial point: that the production of pulp, paper, and timber generates many different by-products, such as bark and chips. Historically, we learn, these by-products have not added any value to production and therefore been treated as waste to dispose of. Now, with efforts to launch the European bioeconomy, the ambition is to integrate the earlier by-products as valorised biomass to be included

[3] In Sweden, the bioeconomy has been characterized as shaped by a 'closed network structure' between research and regional councils and forestry industries in particular (Holmgren et al. 2022: 44).

as inputs in other production processes. Subsequent presentations deliberate the same issue, making this ambition – to turn waste into value – more concrete. Biofuels are a particularly prominent topic of concern, and we listen to technical presentations about how biomass from forestry and logging could be processed in biorefineries and then used as biofuel. Seemingly to round off this part of the discussion about the bioeconomy, the final slot is awarded to Börje Pålsson (professor of Energy Systems at Northern University) to give a broad picture of the availability of biomass globally and nationally, and he points out that in the long term, demand will exceed supply, which could lead to a critical point in the transition to a bio-based economy.

After over 1.5 hours of presentations, we are told that there will be a short break before a new round of presentations will follow. Soon, however, we assume that the invisible audience of listeners returns to their screens, much as we do ourselves, as it is now time for politicians and policy-advocacy representatives from large industries.

One after the other, for just over an hour, four persons speak under the telling heading: 'What political decisions and instruments of governance are needed to transform to a circular and bio-based economy?' Again, the event turns into a series of PowerPoint-presentations. First comes Lars Ekman, Chair of the board of the forestry and logging company Northern; then Sandy Norup, head of economic policy at Sweden's agribusiness association; then Nora Ylvasson from a public agency tasked with developing policy and evaluating regional economic performance; finally, Göte Jylland, member of the European Parliament and the committee for the environment, public health, and food safety. Each in turn gives their view on how transition could come about, based on their respective areas of expertise in forestry, agriculture, the circular economy, and the nitty-gritty of advocacy work in the EU Parliament. As we listen, what strikes us is the overall consensus: where each presenter emphasized the importance of harmonizing political decisions and policy instruments at different scales – the regional, the national, and the European level. Unless there is such a politics of alignment across scales, there is an overhanging risk, those of us in the audience are informed, that policy instruments that promote a transition to a bio-based economy will be hampered. The hosts then end the event by summarizing their main reflections and by thanking all participants, wishing everyone a nice evening. We finished our notes and then shut down our laptops.

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The depiction above, which we have subsequently written on those same laptops, may appear bewildering in an article ostensibly about efficiency – a word which is yet to appear. At this point, however, our

intention has been to portray the bioeconomic field as depicted by certain actors themselves within it. Having already presented innovation projects in the introduction, we here show problem formulations and precepts operating within the institutional framework whence this prospective funding is channelled. Our contention, then, is that this activity is also shaped by a certain valorisation of efficiency. This becomes even more clear if we briefly turn to excerpts from bioeconomic self-description at yet another stage in the innovation process: that where innovators present the results from a concluded project. First, the case of a consortium of government research institutes and energy and fuel companies who, as part of the Bio-innovation research program, received around SEK6 million to explore hydrothermal liquefaction. In their project summary, they write:

> To increase the profitability of lignocellulosic processing, it is necessary to maximize the value of the co-products from the process. In various processes based on wood, side streams are produced, such as sawdust, lignin and bark. As a rule, these are combusted to generate heat and power. There are also forestry residues, most often left in the forest or collected for heat and power generation (BioInnovation 2022a).

Second, the case of a bio-innovation R&D project intended to 'develop technologies for integrating mushroom and biofuel production' to be scalable and potentially profitable (BioInnovation 2022b). After describing the chemical processes, this project reports that more can be produced with less energy. Indeed, they explain that '[t]he studies succeeded in determining key parameters for hot-air pasteurisation of mushroom substrates that can reduce 60 percentage energy use and 65 percentage CO_2 emission than conventional steam autoclavation' and how they have now developed 'new devices and processes […] which may save >30% labour costs and 25% cultivation time' (BioInnovation 2022b).

In sum, our inquiries show how the Swedish bioeconomic innovation field operates much as it does elsewhere. Already Gertsson adopts its anticipatory framing turning his listeners towards a future where the 'bad' present construction has been made 'good' partly by virtue of a shift in the materiality of its composition. His keynote was followed by industry representatives, showing both the kind of private market-oriented economic actors involved in this field, as well as how their involvement remains underwritten by the belief that a bioeconomic transition will let us 'manage in a sustainable way' – to recall words from the introductory vignette – in a manner that is nonetheless aligned with the 'profitable'. Other actors concerned themselves with obstacles to this envisioned future. Yet when it comes to the desirability of that future itself, there is unanimity. Thus, we

contend, the social field we depict here is defined not by brute force but rather by competition shaped by invocations of a notion of common good (Boltanski and Thévenot 2006). So what does that notion amount to?

On the one hand, there is the turn to innovation – not at all a foregone conclusion even as such.[4] The prospective point of innovation, moreover, is on display with all the proposed novelties above. From football turfs to biodiesel, each would turn the old 'bad' economy 'good' by aligning it with 'the bio'. Such alignment is itself a measure of success (Asdal et al. 2023). Yet neither the prospective profitability nor the significance of these innovations for sustainability is about such alignment alone. There is another dimension, particularly explicit where our last example relates the relative savings of labour costs and time expenditure their contraptions enable. These innovators have succeeded in connecting an economic process with 'the bio' – but doing so is a success also because it allows that process to become more efficient in several respects. Similar notions everywhere permeate the vignettes above and our empirical materials as a whole: Energy use is to be reduced so as to render production more efficient; new ways of harnessing living matter will enable more efficient use of biological materials already available; procedures for turning industrial waste into new material input will make production evermore resource efficient. The significance of precisely such claims has – perhaps because they are so omnipresent so as to almost fall out of view – scarcely been touched upon in literature on the bioeconomy. For the remainder of this article, we show why analysing this efficiency of the 'bio' is significant for understanding the 'good' it postulates.

Critiquing carbon by making "bio" efficient?

In the preceding sections, we discussed innovation processes, and specifically such processes where those involved – from funders to researchers – frame their activity as oriented towards a bioeconomy. Once it has paid its due attention, concerns with efficiency appear ubiquitous in this context. For instance, the EU's ambition is to create 'a modern, *resource-efficient* and competitive economy […] where economic growth is decoupled from resource use' (European Commission 2019, emphasis added). This partly builds on the 2012 Bioeconomy Strategy and Action Plan, where the very point of constructing a bioeconomy is underwritten by the alleged need to build 'a more innovative, *resource efficient* and competitive society' (European

[4] The predisposition towards innovation as a panacea for social and ecological ills is itself historically specific. As 'formerly principally an analytic category used to explain technological change and economic growth', innovation is only recently 'a framing device […] through which we tend to frame policy problems as problems of innovation' (Pfotenhauer et al. 2019: 896).

Commission, Directorate-General for Research and Innovation 2013, emphasis added).

One reason that the worth of efficiency is often overlooked in the literature on green innovation, despite its prominence, may lie with how uncontroversial its worth is, among actors in the field as among those tasked to analyse it likewise. In a succinct definition, efficiency amounts to '[g]etting the most output for a given input' (Stone 2012: 67). Whether pertaining to resources or energy or labour, it is a 'technological orthodoxy [that] all things *ought* to act efficiently' (Dunlop 2019: 101216), and efficiency amounts to a 'positively ambiguous euphemism for "good" [whose] seemingly uncontroversial nature makes it difficult to criticize' (Dunlop 2022: 726). In the context of ecological issues specifically, furthermore, contemporary society is shaped by 'a widespread sensibility that efficiency is tantamount to environmental benevolence [and] that using less and producing more is a recipe for sustainability' (Guthman 2022: 77).[5] Precisely by being so uncontroversial, however, it is not clear that an analysis of efficiency contributes towards an understanding of the particular nature of bioeconomic innovation processes. Social worlds coalesce around notions of the substantive worth of the worthy. Efficiency, instead, brackets the worthiness of any worth, and simply compares input-output ratios between means for attaining an end, irrespective of how worthy that end may be. The bioeconomic concern with efficiency, thus, may simply explicate a value that transcends the values of *any* social world. We do not believe that this is the case. Yet, appreciating how the bioeconomic project connects value and efficiency requires distinguishing between two ways in which value and efficiency are connected, as well as two analogous strategies for critically scrutinizing this connection.

The first manner in which to broach the connection between value and efficiency is to approach it as a property of productive processes that generate valued output. Such efficiency is intrinsic to the dynamics of capital itself: Firms are involved in intense competition, meaning that producers are pressured to cut production costs – maximize output for given input – in order to gain competitive advantage on markets structured by price-based comparisons made by consumers (Shaikh 2016). While such augmentation of efficiency can be pursued by different means, it is also the case that '[r]aw-materials-saving processes' – thus akin to the concerns prominent in the bioeconomy – 'are older than the Industrial Revolution [and] have been dynamic

[5] Resource efficiency underpins not only much of the discourse on sustainability, but also the original conservationist discourse built on an imperative of efficiency (Hays 1959). Rather than endorsing a morality of protection or preservation, conservationist efforts are aimed at safeguarding the efficient use of resources for a growing nation.

through the history of capital' (Bunker 1996: 421; see also Martinez-Alier 2011).[6]

Efficiency of this first kind has long been subject to environmentalist scrutiny voiced in what is also the first mode of critique. Some invoke the 'paperless office paradox' in order to question the extent to which we should expect one resource substituting for another to lead to decreased pressure on the resource displaced (York 2006). Others invoke Jevons's paradox to point out that augmentation of the relative efficiency of resource use tends to increase rather than decrease use of the resource in question (Alcott 2005; Herring 2006).[7] The imperative of efficiency would then be paradoxical in the sense of generating some of the very problems that it portrays to solve. Similarly, European efforts to dematerialize the economy by means of technological effectivization may be but a concealed form of environmental load displacement (Hornborg 2009).

These critiques hold significant implications for how we ought to regard efforts to supervene the ecological crisis by means of stimulating innovation. Such implications, however, are wholly internal to a contestation that plays out within an already established regime of worth. The very effort to demonstrate that *apparent* efficiency is *actually* concealed inefficiency draws the force of its claim on one assumption that remains unquestioned: That it is better to be efficient than to be inefficient, and that efficiency amounts to a privileged variable for comparing different options. Thus, this manner of engaging efficiency is wholly different from what is required to answer the questions we pose in this article.

The *second* mode of critical scrutiny hinges on a shift in focus, which moves attention from efficiency as a property that facilitates the generation of value within a productive process, to ways in which social actors construe efficiency *as* the valued property. In the ethnographic scenes portrayed above, a worth is postulated, assessed, and connected with resource allocation – but it is not the case that innovators gain competitive advantage by being efficient themselves. Novel devices, procedures and materials developed within such innovation processes might certainly augment the production of

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[6] See also Boyd et al. (2001) for how bio-based production often struggles with efficiency. Biological growth cycles in both plants and animals are understood by agri-businesses as limits that must be overcome in order to produce the highest level of outputs with as few inputs as possible.

[7] The bioeconomic project of substitution can be read as an effort to reverse a yet earlier substitution: That where biomass was replaced by fossil fuel as the dominant source of human energy. Yet whereas this was a dramatic shift away from biomass in relative terms, absolute energy consumption increased sufficiently to also increase the absolute consumption of biomass (Smil 1994). There is as yet little evidence that a relative shift back to biomass will not have the same (absence of) effect on the absolute consumption of fossil fuel.

valuable output once deployed; in the context of the innovation process itself, however, worth is assessed (and value allocated) on basis of *promises* of efficiency. Efficiency is not a property of their own process of (intellectual) production, but rather the commodity that they produce. There is nothing efficient in these promises in and of themselves, and critical analysis thus requires a different strategy for engaging their concealment and consequences.

In the bioeconomy project, the adjustment of beings to this 'principle of equivalence' (Boltanski and Thévenot 2006) means that efficiency becomes an object, around which everything else is orbiting and is tested against. Then, instead of addressing how apparent gains in efficiency are unavailing (or consist in dissembled exploitation), an analysis of efficiency valued-as-such would challenge naturalizations of efficiency, which construe its beneficence as a universally revered value. This is a task primarily for historical genealogy of the kind that aims at unsettling our own taken-for-granted assumptions.[8] To then understand the consequences of the historically contingent valorisation of efficiency requires addressing specific qualities of the concept, chief among which are its apparent *lack* of qualities. Efficiency simply compares the input-output ratios associated with the processual means for attaining *any* specific good; as a value pursued as such, then, efficiency primarily underwrites efforts to attain 'mastery of the process itself' (Alexander 2009: 1011).

To see how, note above how the overbearing way to represent the inefficient vice of the old relative to the benevolently efficient (bio-)new is numerical quantification – a mode of representation long favoured precisely for its purported detachment from specific perceptions of values (Porter 1995). Accordingly, all the 'exemplary' bioeconomic achievements above amount to augmentation of productive processes, detached from considerations of the worth of specific productive output, let it be either turf on football fields or biofuels. This is particularly clear in the emphasis on substitution, where the good is equated with producing and consuming the same products as before, only aligning production with 'the bio' by replacing the material substance with biological and more efficient alternatives. Likewise with the worth of projects that focus on waste, which aim to more fully master productive processes by reducing or valorising unintended pollution that eludes control (see Klitkou et al. 2019; Böcher et al. 2020).

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[8] Dunlop (2019) concludes that 'investigations into the historical and cultural underpinnings of energy efficiency remain scarce', and the same holds for efficiency more broadly. Yet see Alexander (2008) and Cobley (2009) for how efficiency migrated from a concern for theologians (engaged in efforts to make sense of the properties of God) to its place as a defining 'good' (Asdal et al. 2023) of a cultural ethos in wake of the Industrial Revolution (see also Boltanski and Thévenot 2006).

Directed towards the bioeconomy project we have explored here, this second mode of critical analysis furnishes verdicts that do not rely on challenging (or espousing) claims to efficiency. Instead, two issues come to the fore: First, the ostensible disfiguration produced through 'adjustments' to the criterion of efficiency, readily seen in the 'molecularizing' (Rose 2007b) comportment to living entities, which decontextualize life from its embedded contexts and turn it into matter malleable for a 'real subsumption of nature' (Boyd et al. 2001). Second, in respect of how the bioeconomy project challenges the ecological crisis in a manner that reproduces its underlying drivers. Even the European Union now invokes the once-radical precepts that we live in 'a world of limited resources' where there are 'ecological boundaries of our planet' (European Commission, Directorate-General for Research and Innovation 2018: n.p.). Yet as policymakers fulfil the obligations that follow this conundrum by funding innovation oriented towards efficiency, they also direct public concern down a path where the substantive *ends* of life – against whose horizon the socio-material world of humans takes form – remain in brackets.

Conclusion

Decades ago, radical environmentalists used a variety of concepts – planetary boundaries, limits to growth – to challenge the logic of an economy premised on endless growth. Once deeply controversial, such concepts now find their place in the policies of established institutions, ranging from the Bioeconomy Parliament to the European Union. To insist on the scarcity of both resources and time for action has come to mark the conventional political standpoint, and the rejection thereof amounts to the standpoint that is beyond the pale for many. In this context, conventional economic activity – ways of producing, transporting, consuming – is perceived as fundamentally problematic. Such problematization, in turn, generates a novel moral field, where efforts are marked 'good' by virtue of their trajectory away from the conventional way of life (Asdal et al. 2023).

The prospect of natural scarcity and limits to growth now underwrites abundant resource streams and growth for some. Not least among the beneficiaries of this structure are certain innovators. In the European context, such innovators are presently at work to bring a host of new entities into being, from bioplastics to biofuel and bioenergy. In order to expand the present understanding of bioeconomic innovation, this article has addressed the innovation context found in Sweden. From the observation that *potential* innovation projects tend to become *actual* projects at the point of receiving funding, there is an indispensable link between funders and funded. In what terms is the worthiness of projects construed at this juncture? The answer to this question, we have proposed, reveals

dimensions of the bioeconomy overlooked even as they are hidden in plain sight.

Our ethnographic observations and analysis confirm many observations already made about the bioeconomy project: First, how its public private partnerships operate within a specific future-oriented 'machinery of anticipation' (Hilgartner 2007: 382); second, that the overall 'ethos' of the bioeconomy identifies 'alignment with the bio' as a good in itself (Asdal et al. 2023); third, how many efforts focus on turning what is now regarded as waste into a source of value (Klitkou et al. 2019). Our analysis, however, shows how these characteristics are bound together by a concept often left aside from critical scrutiny: *efficiency.*

In the context of 'green' innovation, efficiency is one of the words most prominently deployed to articulate the worth of an innovation. More fundamentally, however, efficiency underpins the bioeconomic logic of innovation also where the word is not in overt use. Take the three points immediately above: Policymakers' novel apprehension of natural limits underpins their turn to public-private partnerships for innovation. This follows a pattern hearkening back to those responding to Malthus, who alleged that the latter's prospect of a scarce world of inevitable famine was mistaken insofar as it overlooked how *technological innovation* can perpetually push the boundaries of natural scarcity. By means of technology, such detractors assert, the finite nature available for human use can be made to deliver (infinitely) more. And that – to grow not by expanding the resource base, but by making an available resource yield more – is the task of efficiency. Innovators respond to the request for efficiency when, for instance, developing procedures to turn the waste-part of a productive process into a new source of value. What furthermore reveals the logic of efficiency at work is the aim of substitution (of 'aligning with the bio') itself. Where such substitution *is* the criterion of success, there worth is an issue entirely of means – the relative value of *what* a process can produce is bracketed, in favour of a focus on measurable and quantitatively comparable properties of the process itself (from energy to time to money).

We propose to call this the logic of *bio-efficiency.* In addition to encapsulating the observations made above, this term aims to add something further: An emphasis that what bioeconomic innovation aims to make effective is human use of 'the bio', and that it is such *promises* that attract funding, primarily the promise of resource efficiency (rather than from any efficiency in the proposed novelty itself). Beyond situating the bioeconomic innovation field squarely within the industrial world where efficiency serves the cardinal principle invoked in tests of worth (as delineated in Boltanski and Thévenot 2006), the latter is a crucial distinction to enable an analysis of contemporary modes of concrete resource allocation. Where there is

a vast literature on how and why producers who adopt an innovation can increase profits by cutting resource use and so the costs of production, the function of efficiency in the context of bioeconomic innovation is significantly different. Instead of being a characteristic of a process that produces commodities valued by consumers, efficiency (in this latter context) is the property that *is valued.* The promise of efficiency is, in a sense, the 'commodity' that innovators actually sell.

By proposing the concept of bio-efficiency, our article calls for further critical scrutiny of an overlooked dimension of the bioeconomy. Such critical scrutiny does not amount to a denigration of the innovation presented above, nor of the bioeconomic project as a whole. Our point, instead, is to emphasize that a burgeoning socio-economic field – bio-economic innovation – must be analysed with due consideration of efficiency as a core structuring value. If there is a political critique that follows from this, it would focus on the effects of a proliferating cultural preoccupation with efficiency. And that brings us back to the radical environmentalists and their politics of limits. There *is* a limit, these pioneers claimed, to what resources the planetary system can make available for human purposes. Hence, limits must also be put on production and consumption. Those who trust effectivization take the opposing position. Yet the difference between these political camps is, in one way, structured by disagreement simply as to whether effectivization is sufficient for aligning growth and sustainability. Insofar as the widespread sense that we now need to turn our 'bad' industrial economy 'good' is channelled into innovation, and innovations are tested in respect of the criterion of efficiency, such deliberations reproduce the normative values of the very industrial world whose legitimacy is now in question. Neither side asks whether (or how) efficiency is desirable to begin with, nor if the postulate of scarcity is the appropriate point of reference for environmental politics (D'alisa et al. 2014; Krüger 2019).[9] To scrutinize bio-efficiency means to adopt a standpoint cognizant of how contingent the valorisation of efficiency really is, which – we hope – might facilitate a shift to where innovation would innovate more on new *ends* of human life, rather than on ways to pursue old ends by new (more efficient) means.

[9] Guthman (2022: 72) writes that 'there are many reasons to disrupt and probably eradicate industrialized livestock production [but] lack of efficiency is arguably not one of them. Indeed […] industrialized livestock (and crop) production has long been underpinned by a logic of efficiency'. Our article contends that the same holds for the world of industry generally.

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Theme issue contribution

Making Mining Good: Tracing the semiotics of justification in mineral exploration and mining

Tobias Olofsson

Abstract
What does it mean for a business or industry to be and do good? And who can count themselves within the good economy? This article investigates the justification of goodness in mineral exploration and mining and uses the entwinement between value creation and destruction characteristic of mining to trouble notions of goodness in impactful industries. Based on analyses of in-depth interviews, ethnographic fieldnotes, and archival materials, the article follows the ways in which mining industry actors seek to negotiate contradictions between creation and destruction; and does so while using an innovative conceptual framework based in Peircean semiotics to open up justification for analysis of the underlying semiotic machinery that actors rely on to signify goodness. Mobilizing this conceptual toolkit, the article investigates how miners and explorers emphasize certain values, or signs, over others and how values are used to assert that some mines and miners do more good than others.

Keywords: justification; semiotics; mineral exploration and mining; valuation; extractivism; green technology

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Can mines be good?

> Everybody has a kettle at home, everybody drives a car, everybody has a mobile phone. Even the worst of the objectors show up with something that came from a mine, y'know. (Interview 9).

When it comes to doing good, mining holds a uniquely contradictory position rivalled only perhaps by the oil industry (see Lautrup Sørensen 2022). While its products are of fundamental importance to modern society, mining has costs that, at times, can be severe and irreparable (Jacka 2018; Miranda et al. 2003). The rapidly growing demand for metals and minerals in contemporary societies and industries has ushered in an era of extractivism unparalleled in human history (Arsel et al. 2016); the booming demand has made metals and minerals such a concern that the European Union has begun replacing natural protection and tourism with extractivism as its main framework for rural development (del Mármol and Vaccaro 2020). Meanwhile, the socio-environmental effects following in the wake of a booming minerals industry linger in the complex long-term social and environmental impact that arises both in the communities living around a mine and from the vast amounts of waste materials produced at mines (see e.g., Ureta and Flores 2022). It is therefore not surprising that while mineral extraction plays an important part in contemporary economies and industry, it is also often subject to significant contestation from local communities, stakeholders, and NGOs (Martinez-Alier et al. 2010; Acuña 2015; Conde 2017).

Because of these tensions, mining is rife with paradoxical valuations at the same time as it is subject to multiple lines of critique. The mineral exploration company CEO quoted above was eager to stress the good that mines bring to the world and pointed to the ubiquity of metals and minerals in contemporary society as an example of this. Having said this, he also expressed frustration with mining critics. Complaining that critics' accounts of mining and its impact are one-sided, he reversed the criticism and said, "don't benefit from something and then complain about it. That's really bad y'know." Mining critics, it follows, should not expect to have the cake and eat it.

This article investigates the ways in which mining industry actors, including miners and mineral explorers, justify the goodness of their work and industry. Asking who may claim to belong to the "good economy," the article draws on recent scholarship on emergent post-petroleum- and bio-economies that has outlined how industry actors point to extra-economical values to claim a form of goodness for their businesses or industry (Chiapello and Godefroy 2017; Asdal et al. 2023). Grounded in the observation that impactful industries, like mining and oil extraction, also claim to produce beneficial spillovers and extra-economic goods, including jobs, economic growth, and the kettles, cars, and other products mentioned above (Weszkalnys 2008;

Olofsson 2020; Lautrup Sørensen 2022; Ureta and Flores 2022), the article troubles notions of what it means for economic actors to be, or to do, good. In doing this, the article explores the ways in which mining and mineral exploration negotiate the kind of dual position that the exploration company CEO quoted above refused mining critics.

Previous research has described how the mining industry has launched initiatives that seek to balance out the negative aspects of metal and mineral commodities. Examples of such initiatives include attempts to differentiate good mineral products from bad by creating a certification system for ethically produced minerals, including for conflict-free gold (Reinecke 2015). Other examples include the introduction of corporate social responsibility programs that target mineral extraction and its relation to the surrounding human and non-human world (Jenkins and Yakovleva 2006; Kirsch 2014) and discursive inventions such as the oxymorons "clean coal" and "sustainable mining" (Kirsch 2010). But is certification or discursive innovation enough to make an industry good? And how do individual companies and projects navigate the many contradictory and conflicting values inherent in mining?

Focusing on how explorers and miners[1] negotiate the destructive potentiality of mineral exploration and extraction, this article follows the invitation to trouble "the good" (Asdal et al. 2023) by opening up the justificatory claims they make for an investigation of the values used to signify goodness and the ways these values are used to negate the costs of mining. In doing so, the article maps the semiotic content of claims of goodness and examines how the values actualized therein help miners and explorers negotiate contradictions and criticisms in order to represent mining as something that is and does good. To facilitate this investigation, this article employs a conceptual framework based in Peircean semiotics (Peirce 1992; see also Tavory and Timmermans 2014) and uses it to explore the practical and creative work mining industry actors engage in when justifying the goodness of their industry.

The continuation of this article is divided into four sections. The first outlines the conceptual toolkit used to open up justification for analysis. The second presents the methodology and outlines its three-pronged dataset consisting of ethnographic field notes, in-depth interviews, and archival materials, including applications for mining

[1] This difference between explorers and miners is an emic distinction made in the mining and exploration industry. While some companies bridge the distinction and do both, many mining and exploration companies belong to either one of three categories: companies that carry out exploration in previously unexplored areas, so called green-field exploration; companies who carry out exploration in regions known to hold mineral deposits, so called brownfield exploration; and companies solely focused on purchasing and exploiting already discovered deposits (Olofsson 2020).

leases. The third section accounts for research findings and demonstrates how miners and explorers justify mines and exploration projects by relating them to values claimed to signify goodness. The section also discusses moments of critique and critical disagreements between the mining industry and other actors. These moments illustrate how assertions of goodness depend on contextual factors and a receptive public for their legitimacy. The article's concluding section discusses the different strategies miners and explorers deploy in their justification and reflects on the benefits of using a semiotic bottom-up approach for studying justification in contested fields and industries.

Justification of goodness: A semiotic approach to claims of goodness

Valuation, or the processes of appraisal through which values are ascribed to objects and persons through different means of comparison such as ratings and rankings (Dewey 1939: 5), lies at the heart of justification. Based on the assignment and comparison of values, someone or something can be said to be of a particular character or possess more of a quality than someone or something else. In much research on justification, the source of these values has been located in certain regimes of worth (Blokker 2011; Silber 2016) or in discourse (see, e.g., Vaara and Tienari 2002; Erjavec and Erjavec 2015); and the work of Boltanski and Thévenot has played a foundational role in the emergence and growth of this branch of research. In their original work, Boltanski and Thévenot (1999, 2006) outlined six institutionalized economies of value in relation to which justification is claimed. These "worlds of worth," as they called them, include the worlds of the civic, domestic, fame, industry, inspired, and market,[2] and subsequent studies have drawn on this distinction between different worlds of worth to investigate the ways in which actors justify the merits of acts, decisions, goods, and services. Nevertheless, while this approach to the study of justification has been extremely successful, it is not without challenges.

The first challenge is that the worlds of worth framework struggles to accommodate paradoxes, especially paradoxes that do not confine themselves to tensions between two or more worlds of worth (Lee and Helgesson 2020). The second challenge is that there is a tendency in the literature to overdetermine empirical trends in a way that reduces justification to examples of particular worlds of worth, and this makes it hard to understand and untangle contradictory and competing

[2] Note that the worlds of worth framework was not intended as an exhaustive list limiting the number of possible worlds of worth to the six listed here (Lamont and Thévenot 2000) and has later been expanded upon by Boltanski together with Chiapello through a discussion on how new worlds of worth may emerge (Boltanski and Chiapello 2007).

values in justification. Addressing these challenges, scholars have proposed different ways to amend the orders of worth framework to make it better suited for analyzing conflicting valuations. One suggestion made by Gond and colleagues (2016; see also Krauss and Barrientos 2021) is that power should be added as a further analytic besides the worlds of worth to support inquiries into how the use of power is justified in conflict situations. A second solution has been proposed by Centemeri (2015), who writes that researchers need to look beyond the worlds of worth toward the ways in which the actors making justificatory claims engage with that which is being justified. In this amended version of Boltanski and Thévenot's framework, justification is tied in with other kinds of regimes of valuing, including values such as utility or personal attachment, and these regimes add further dimensions to the worth attributed to something; dimensions that lie beyond the economies of worth described by Boltanski and Thévenot (Centemeri 2015: 11; see also Langa 2020).

However, while approaches such as these help broaden the scope of investigation in studies of justification, they leave the tendency to reify the worlds of worth described by Boltanski and Thévenot unresolved. Moreover, by emphasizing power and engagement they move the focus away from conflicting values toward conflicts between actors in ways that, in turn, shift the focus away from the justification itself on to the actors claiming justification. Because of this, these amended approaches also end up leaving the key challenges associated with the worlds of worth framework partially unresolved.

While the solutions proposed by Gond and colleagues (2016) and Centemeri (2015) have been to complement the worlds of worth framework with other concepts or theories, this article suggests an alternative strategy. Leaning into and staying with the messiness of the paradoxes and controversies discussed above, this article reimagines the problem from the bottom up and focuses on justification itself. In doing so, it develops an approach that homes in on the contents of justification and on the creative work involved in crafting justificatory claims. To accomplish this, the article adopts a broadened approach to justification that draws on the semiotic theory developed by American pragmatist philosopher Charles Sanders Peirce.

By focusing on the semiotic components of justification the focus of the inquiry is shifted away from the worlds of worth toward opening up and interrogating the ways in which actors use actual or perceived relations between an object and one or several values claimed to mark its worth. In the context of this article, this means mapping the representations actors make of the relation between the object, e.g., their industry, a mine, or an exploration project, the values mobilized in the justification, and the results they seek when choosing to represent the relations between objects and values in a particular way. In Peirce's terminology this line of investigation constitutes an

exploration of how relations between objects and *signs* are represented in efforts to produce a particular *interpretant* (Peirce 1992; Tavory and Timmermans 2014). The sign is the value(s) used in justification to signify worth and the interpretant, e.g., goodness, becomes the result sought when representing the relationship between a sign and the industry, mine, or exploration project in a particular way. That is, it is through the representation of mining as being related to one or more signifiers of goodness that mining becomes good.

Using a semiotic framework to study justification allows inquiries to bypass the worlds of worth and to focus, instead, on how values are used to ascribe worth to things and persons from a bottom-up perspective. This approach prioritizes the representations actors make of the relations between objects and signs and the ways in which actors use these representations to negotiate contradictions and paradoxes in their claims. Consequently, this Peircean approach to the study of justification finds its analytical torque in unpacking the semiotic structure of justificatory claims rather than in mapping which worlds of worth actors draw upon when claiming justification (for a similar approach to valuation – rather than justification see Muniesa and Ossandón 2023, and Duterme 2023). Mobilizing this conceptual toolkit, the article investigates how miners and explorers emphasize certain values, or signs, over others and how values are used to claim that some mines do more good than others; and it does so without assuming that the actors and objects involved belong to or are restricted to a particular normative polity and that justification can creatively be adopted to fit different contexts, audiences, and lines of critique.

Research site and methods

Sweden as a mineral exploration and mining destination

In a global context, Sweden is a small player among the world's top mining destinations in terms of the volume of metals and minerals mined annually. Nevertheless, the country is one of the largest producers of metals and minerals in the EU – contributing 91.5% of the EU's annual iron ore production – and in terms of exploration expenditure relative to country size, Sweden sees more investment than exploration and mining giant Canada (Geological Survey of Sweden 2019). Additionally, Sweden has a reputation of being a low-risk jurisdiction – albeit with cumbersome natural resource and environmental regulation[3] – and Swedish mining and exploration

[3] For examples of such ratings see, e.g., the Mining Journal's Annual World Risk Report in which mining jurisdictions are rated according to their performance on legal, governance, social, fiscal, and infrastructure variables, e.g., https://www.mining-journal.com/category/research/world-risk-report-2023

policies describe mining as an important industry for the country (Ministry of Enterprise and Innovation 2013).

Nevertheless, while the country has a reputation of low-risk and political goodwill, mineral exploration and extraction in Sweden is a contested industry and subject to several salient conflicts. Examples of such conflicts include civil society contestation of exploration and mining projects (see, e.g., Anshelm et al. 2018) and conflict between competing interests, including competing uses of land and water areas on and around mining sites. One important example of the latter is how exploration and mining in the northern half of the country are carried out in conflict with the interests of indigenous Sámi communities. At the heart of this conflict is the mining industry's part in the expansion of industrial and government interests on traditional Sámi lands that threaten indigenous traditions such as reindeer herding, which is practiced by members of the Sámi community (Sörlin and Wormbs 2010). Mines disturb reindeer in their migration and force reindeer-herding Sámi to develop strategies to adapt their customs to fit within a mining impacted landscape (Gallardo et al. 2017). At the same time, explorers and miners often fail to recognize, or outright reject the Sámi's indigenous status and their right to the land (Persson et al. 2017; Lawrence and Moritz 2019).

These conflicts between contradictory values and interests are managed through legal processes overseen by governmental agencies and the regional land and environmental courts. For example, before a mine can be opened, a mining company will first have to demonstrate, in a court hearing, that a mine is the most suitable use of the area "in respect of the nature and situation, and the present needs" and that the mine "entails, from a general point of view, good resource administration" (Swedish Riksdag 1998: ch. 2, §1). Consequently, it is up to the parties in these conflicts to demonstrate why one set of values or interests should be granted precedence over others.

Taken together, Sweden's exploration- and mining-friendly policies, the long-term conflict between mining and other interests, and the environmental legislation's emphasis on resource husbandry and best use, means that Sweden as a mining destination offers a window through which to investigate how mining is made "good" through justification.

Dataset

The dataset consists of three complementary bodies of empirical materials: (i) 18 in-depth interviews with miners, explorers, Sámi representatives, and government officers; (ii) field notes from ethnographic fieldwork at exploration and mining sites, industry events, conferences, and courses; and (iii) a corpus of mining lease applications filed with the Mining Inspectorate of Sweden (MIS)

between 2010 and 2016.[4] Out of the 18 interviews, 16 were carried out face-to-face while two interviews were carried out using Skype. Sixteen interviews were audio recorded with the permission of the informants. Two informants declined audio recording. For these two interviews, extensive notetaking was carried out during the interviews. Ethnographic observation amounting to approximately 90 hours was documented in fieldnotes, either during the events, during breaks, or immediately after leaving the field for the day. In addition to the interviews and observations, documentation from 43 applications for mining leases filed with the MIS were collected through freedom of information requests made directly to the inspectorate. The corpus of applications includes supplementary materials such as financial and geological studies as well as the preliminary environmental impact assessments (PEIAs) produced for each application. Because of their role in mining lease and environmental permit processes, PEIAs complement informants' statements and field notes in that they offer a window into the practical work of justifying new mines. Taken together, the three types of data offer opportunities to explore in detail and from different perspectives how mining industry actors use signs when justifying their industry and what signs they use to signify worth in a mine.

Analysis: Unpacking justification

Interviews and field notes were coded using a constant comparative approach based on descriptive line-by-line coding and subsequent thematization by means of axial coding (Strauss and Corbin 1998). Care was taken to identify statements and events involving the justification of mines, mining, or mineral exploration for further analysis of which signs were used, how they were represented and what interpretants were suggested by the actor making the justification (see Peirce 1992; Tavory and Timmermans 2014). Because of the heft of the corpus of mining lease applications (the corpus consists of 577 documents and a total of 7,855 pages), line-by-line coding was determined unfeasible. Therefore, a less fine-grained thematic approach was used in which each document was read through and summarized

[4] Interviews, transcriptions, and data storage have been carried out in accordance with the guidelines provided by the Swedish Research Council (2017). All informants were apprised about the purpose of the study, the measures taken to anonymize their contributions, and gave their informed consent to participate. Observations were made with the full disclosure of the researcher's name and place of work and the author made sure to inform anyone with whom they interacted of the purpose of their presence at the event in question. To ensure confidentiality and to protect the identities of informants, all transcripts as well as the index of mining lease applications were anonymized by removing identifying information such as names of individuals, places, companies, and corporations as well as identifying information such as places of employment and geographic location.

in an index cataloguing the type of document and its origin as well as a summary of its contents.

Reproduction of the empirical materials in this article has been made with the aim of providing a detailed account in the form of a "collection of composed set-pieces" (Fine 2003) organized around the types of justificatory claims put forth in the materials. Examples from the interviews, observations, and documents presented here were selected based on their ability to illustrate the thematically organized findings.[5]

Becoming good: The justification of mining and exploration in Sweden

Because miners and explorers frequently must justify mining and exploration projects to government agencies, the land and environmental courts, investors, and stakeholders, the question of how mines are made good in justification is more than a mere philosophical curiosity. Instead, it is a question with far-reaching implications. Moreover, it is a question that is actualized every time a mine or exploration project's costs and benefits are outlined and weighed, including in the permit applications and court hearings discussed above. For explorers and miners working in Sweden, the process of opening a new mine or expanding the operations of an existing mine involves several steps in which justification takes center stage. For example, to receive the right to exploit a mineral deposit, they must first apply for a mining lease, a process which requires applicants to demonstrate: (i) that it is likely that the mineral deposit in question can be mined at a profit within a 25 year period; and (ii) that the location or quality of the deposit does not mean that mining it will cause such an impact on public or private interests that its exploitation is rendered unsustainable (Swedish Riksdag 1991). Applications for mining leases therefore include several types of documents that describe the geological qualities of the deposit, the economic viability of the new or expanded mine, and the consequences the operation will have for other interests and for the environment.

One of these documents is the PEIA, and this is one place in which the reconciliation of a mine's socio-environmental impact and economic benefits comes to the fore. In the PEIA, applicants are to account for and weigh a mine's impact on environmental, social, and cultural values in and around the projected mining area. This multidimensional assessment includes reviews of the expected impact on landscape; land and aquatic life; surface waters; and ground waters.

[5] Quotes from interviews conducted in any language other than English have been translated to make them more accessible to readers. All quotes have been edited for readability meaning that stutters, repetitions, and similar features have been removed.

PEIAs also include estimates of the mine's contribution to noise pollution and vibration levels in and around an area, as well as an account of the values that may be impacted by the mine, including impact on to environmentally valuable species, biotopes, or artefacts and historical or archeological remains.

The environment, economic benefits, and rural livelihoods: Job creation as a sign of goodness

While the balancing of socio-environmental costs and economic benefits runs like a thread throughout the PEIAs analyzed for this article, the tension between different values takes center stage in the sections of PEIAs that discuss the so-called "zero alternative." A zero alternative is a statement on what the applicant proposes would happen if the planned mine were to go unrealized. In discussions of zero alternatives, miners and explorers contrast the costs and benefits of a projected mining operation and justify the benefits of mining a deposit. In the quote below, the applicant is outlining what would happen if a mining project in northern Sweden were not to open:

> The zero alternative means that the deposits at [the location] are left unexploited. This in turn would mean that there will be no conflict between other interests and mining in the area and that the planned investment will not materialize. This in turn means that the near 100 jobs that [the mine] is estimated to generate directly during its operation, as well as the equal number of jobs created at the construction stage, will not be realized. (PEIA 21a).

In the applicant's discussion, the number of jobs expected to be created at the mine is brought forth as a central, characterizing value of the mine. Later in the same section, the applicant goes on to state that in addition to the 200 jobs expected to be created in constructing and operating the mine, an additional 100 jobs are expected to be created indirectly in the surrounding community supplying the mine with materials and servicing its workers and their families. In other words, refusing the applicant a mining lease would mean pulling 300 jobs off the table – a decision that would amount to a significant loss to many of the sparsely populated rural communities in the mineral rich parts of Sweden.

The justification made in the PEIA cited above is characteristic of all PEIAs in the corpus and it offers an example of how mining industry actors justify what they do by stressing the benefits they bring while also pointing out the costs involved in refusing them a mining lease or environmental permit. By centering a particular sign, in this case job creation, miners and explorers emphasize the relation between the mine and the sign in a way that downplays the relevance of other

signs related to the mine such as the environmental impact it would cause, including permanently altered landscapes, increased pollution, reduced groundwater levels, or other forms of socio-environmental disruption.

While mining industry actors successfully highlight the relation between mines and jobs, this does not mean that jobs are in and of themselves an inherent mark of goodness. Instead, to understand how mining's contribution to regional economies becomes a viable sign of goodness, one must look to the context, discourse, and debates that give weight to the signs used. One important contextual factor is that many mines and exploration projects in Sweden are located in sparsely populated rural areas where the establishment of a large industrial operation, such as a mine, would mean a significant boost not only to the local economy but to all municipal operations, as new jobs and new residents would be reflected in the municipality's tax base. An exploration geologist based in a small northern town discussed how dependent communities like hers feel about mines operating in the region. In the discussion, she contrasted the situation of her community to that of communities in other parts of Sweden:

> Up here, in northern Sweden, any village or town located near a mine is very dependent on it. And here in [Town] we have [Mining company's] mine. And many here are employed, yeah if not directly, then as consultants or in associated businesses like at the vulcanizing shop that does a lot of business with [the mines in the region] and if just one of those mines were to close it would really affect a lot of people out here. The thought is actually quite frightening! So having these mines is important for us who live up here, that we have mines and mining, definitely! Southern Sweden is different, absolutely; they have many other industries and job opportunities. That's a fact! (Interview 17).

The differences in economic opportunities between the northern periphery and the central south described by the geologist is a prominent feature in contemporary Swedish debate (see Olofsson 2019). It is this tension between urban economic centers and rural communities that mining industry actors rely on when using a mine's ability to create jobs and economic growth as a justification for their goodness. That is, in statements such as those quoted above, where goodness becomes an interpretant because of the ways in which the signs used are embedded in a larger universe of tension and debate around the varying economic opportunities in Sweden's centers and peripheries, mines become a vehicle of critique against real or perceived injustices in Swedish domestic politics. An example of this line of critique is how a senior mining officer complained that the policies that regulate mining and mineral exploration in Sweden

reduce rural landscapes to something to be visited and looked at, rather than places that people can live in:

> The regulation was written by those who, if you allow for some simplifications, visit nature and look at it, not by those who live and work in it. You know, the Swedish Environmental Protection Agency, which is a powerful actor in these matters, have their main office on Valhallavägen [in central Stockholm]. I believe it would be better if they'd move out closer to nature. Then perhaps they'd gain a better understanding of the need to build opportunity structures so that people who want to live and work in the countryside can do so. (Interview 13).

Nevertheless, while the miners and explorers quoted above use signs such as job creation and economic growth as near universal marks of good, the justificatory claims they put forward neglect the fact that there are others living and working in rural regions who disagree with the contents of these claims or see their businesses and ways of life threatened by the mining industry. In their responses to arguments that stress the importance of mining to rural economies and livelihoods, critics often use the interpretant suggested in this justification as a sign in their own second-order justification. One example of this is how a senior member of a Sámi district, on whose traditional lands an exploration company was looking to establish a new mine, criticized the shortsightedness of the justification made for the project. While he admitted that the mine would bring some economic benefits, he did not agree that the benefits would outweigh the costs:

> [The mine] was only planned for seven years, and they said that "it could grow to become much bigger and last longer." But to cause so much destruction for just seven years! (Interview 14).

That is, while the economic benefits may offer some degree of good, the short lifespan of the mine meant that its benefits, in the eyes of the Sámi district member, did not outweigh its long-term costs. And the Sámi are not alone in arguing this. The Swedish Tourism Association, for example, has voiced a similar critique and argued that Swedish policymakers erroneously place the benefits of mining before the long-term costs the industry causes other rural industries, including tourism and reindeer herding (Svenska Turistföreningen 2022).

Critiques of the shortsightedness of using economic benefits to justify long-term environmental impact demonstrates how the capacity of a sign to outweigh others, and thereby negate paradoxes and contradictions, depends on the willingness of others to recognize the validity of the claims made. Conflicts between the mining industry and other actors in rural areas are illustrative examples of this as both sides are critical of the ways that the other represents and justifies what is

good and right; the Sámi and tourism sector by criticizing the shortsightedness of mineral extraction and emphasizing their long-term engagement with the affected landscapes, and the mining industry by rejecting the validity of the criticism, because it comes from people who merely look at nature, or by refusing the Sámi their indigenous status and associated rights.

Green means good: Environmental benefit as a sign of goodness

A second context that gives weight to the justification made by mining industry actors are the debates on climate change and the role of electrification in combating global warming. Pointing to how wind turbines, solar panels, electric cars, and other hallmarks of contemporary imaginaries of a fossil free energy system all depend on metals and minerals, miners and explorers argue that mining is an acceptable and necessary price to pay for a greener future. And this justification has a receptive audience. For example, when the state-owned Swedish mining company LKAB in January 2023 announced that they had discovered a deposit of rare earth minerals – a group of minerals for which applications include batteries and wind turbines – the Minister for Energy, Business, and Industry, Ebba Busch, participated in the press briefing, where she told journalists that the discovered deposit, although it had yet to receive a mining lease or environmental permit, would be of critical importance for green energy transition and for the Swedish government's ability to meet its climate targets (see Lutto 2023).

As with job creation and economic growth, justification relying on the relation between mining, green technologies, and electrification as signs of goodness depends on the discursive context surrounding green technologies and climate change for their justificatory torque. Moreover, as current levels of metal and mineral recycling are far too low to meet even present demand (Ciacci et al. 2017), miners and explorers have plenty of opportunities to argue that mineral extraction, however impactful it might be, is good because of how important it is for a green future. For example, one mineral exploration company's CEO emphasized how important present and future mines will be if contemporary ambitions on electrification are to be realized:

> If we want to have enough copper for all these views about electrification, y'know, electrification of cars, getting away from fossil fuels and what have you. Shit, there is a lot of work to be done! So every person that is out there right now with an idea about trying to find something somewhere needs to be taken seriously. (Interview 9).

The way that mining industry actors draw on the need for metals and minerals in electric vehicles and renewable energy infrastructure exemplifies the way in which the paradoxical tensions between value creation and destruction in impactful industries can be rebalanced by references to external tensions. Just as the Norwegian oil sector was made good by regulators' efforts to use its revenues for expanding the welfare sector (Asdal et al. 2023; see also Lautrup Sørensen 2022), the mining industry is made good through its potential to contribute the raw materials needed for a green technology and energy future. Then again, compared to the Norwegian oil industry, the mechanism through which mining is to make this contribution is reversed as the modern mining industry is not expected to share its surplus, but expand its operations so that it can put more metals and minerals in the hands of car manufacturers and wind turbine producers.

By their relations to signs associated with greenness, mines, despite their environmental impact, are made good through the part they play in current plans to mitigate the climate crisis – a semiotic relation that paradoxically recasts an environmentally impactful industry as a green enterprise. However, the use of the mining industry's relations to green technology and infrastructure in justifications is not uncontroversial. In a statement published by Amnesty Sápmi (a branch of Amnesty International Sweden), activists seeking to stop a nickel mining project on traditional Sámi lands (a project that boosters claim will make an important contribution to the emerging Scandinavian battery industry) decry the use of environmental values in justification of mineral exploration and mining, labeling it a "green colonialism" and a violation of the Sámi's indigenous rights (Amnesty Sápmi 2023). As with justification using economic benefits to signify goodness, greenness is not an absolute sign of good, but a contextual one that depends on the recognition of others to hold merit. Gaining acceptance for one's claims of good is therefore a matter of who is able to make their version of what is good the dominant one – and when a government minister praises a mine's importance for the country and its transition to a green future, the voices of local stakeholders, indigenous groups and other objectors may find it hard to be heard.

Relativized costs and benefits

In the above examples, justification works by singling out certain signs as more important or more relevant than others. However, justification can also be based on comparisons between two or more objects' relation to a sign. One example of this form of justification is how mining industry actors discuss the failures of past mines to prevent long-term social and environmental damage. In a keynote address at an international mining and mineral exploration conference, the CEO of an international mining corporation spoke about the

boom-and-bust rhythm characteristic of mining and of how the industry, as mines waxed and waned, used to leave ghost towns in its wake. He then turned to the present and stressed that modern mines must do better than their predecessors and ensure that local communities do not dwindle and die when a mineral deposit has been depleted and the mining company has moved on to other projects.

Like the keynote speaker, mining industry actors in Sweden also draw on narratives about history to justify why the mines of today are better and do more good than the mines of the past. For example, an officer with the Geological Survey of Sweden, a state agency responsible for producing, archiving, and making available national geological data, said that he could understand that mines of the past were built and operated in ways that caused irreparable environmental damage. After all, he continued, "the word 'environment' hardly existed back then," implying that miners of today possess a type of environmental awareness that miners of the past did not (Interview 16).

By comparing present-day mining to mines of the past, miners and explorers effectively sever relations between past and present in a way that frees contemporary mines from potential associations to signs attributable to historical mines. And they do so by suggesting that mines today will not cause the same social or environmental costs that historical mines did. This distinction between past and present environmental consideration (or lack thereof) is one example of how comparisons are used in justification of contemporary mineral exploration and mining. Another example is the distinctions made using geography and real or perceived differences in environmental policies and practices between the global north and the global south as signs of goodness. This distinction represents the relations between mining and signs such as a willingness to take social or environmental responsibility, as significantly different in different regions. This distinction is perhaps best exemplified – or at least, most nakedly visible – in the following quote from an exploration consultant working in Sweden: "Swedish gold is relatively good. It is better than Latin American gold where they destroy the rainforests and shoot Indians." (Interview 7).

Here the line of comparison is not between past and future, but between different locations and the real or imagined differences in what mineral exploration and mining entails in different contexts. This is a common form of justification among mining industry actors in Sweden and the global north, who point to their adherence to environmental regulation and oversight as something that sets them apart from other mines. Using signs such as rainforest destruction or the murder of indigenous people, miners and explorers working in the north lean into common stories about villain companies and evil states in the global south (see Appel 2012) in ways that allow them to cast

their mines and exploration projects as comparatively less impactful and therefore more good. Some informants even went as far as describing the proposed relation between mining in the global south and the risk for social and environmental harm as a moral dilemma facing the industry. Talking about the ability or willingness of different national governments to limit or restrict mining out of environmental concerns, the CEO of an exploration company working in Sweden compared the way that governments in the global north might be prepared to restrict mining in environmentally sensitive areas to how governments in less privileged parts of the world might act:

> [Y]ou can imagine other poorer countries on the planet that don't have any choice. So then here comes the, sort of like, the moral dilemma. So it's easier to go to a country like Mali, okay, that has historically been mined for gold, or Ghana, another one, and set up a new mine. And y'know, there is a lot more potential for corruption in the system. And that's not just today, that's developed. So now it's an industry, if you like, which is largely benefitting the people that work on these mines and also the officials in power of these countries. But they probably wouldn't want to stop such a project because it might affect some environmental thing, some bush or some frog or some tree or something like that. (Interview 9).

As noted above, this use of real or imagined differences in the willingness or capability of governments and state actors to enforce policies that safeguard social or environmental values as a sign of relative goodness is common among actors in the Swedish mining industry. By using narratives about the relative strictness of Swedish environmental legislation as signs of goodness, miners and explorers working in the country claim that because Swedish legislation is stricter than that of many other jurisdictions, mines and exploration projects in the country do more good – or less bad – than mines elsewhere. According to this line of reasoning, allowing more exploration and mining in Sweden becomes a way of ensuring that the mining industry on the whole does more good. Or as the exploration company CEO concluded in his discussion of this proposed, moral dilemma:

> So, the thing to do is to actually explore in countries that have got good regulation, like the United States, or Canada, Sweden, Scandinavia. Whatever you find must be the real thing and it must actually meet the requirements of becoming a human activity that is in favor of all of us that live here. Not just this party or that party. (Interview 9).

This justificatory strategy works in the opposite way from the strategies observed among oil companies operating in southern jurisdictions, who have been shown to seek to disassociate themselves

from negative signs such as corruption by walling themselves off from their surroundings (Appel 2012). In contrast, justification offered in accounts like the ones made by the exploration company CEO above depend on representations that highlight the mining industry's embeddedness in the social, political, and regulatory environment of countries such as the United States, Canada, or Sweden. And in doing so, miners and explorers make a mine's relative relation to signs such as regulatory strength and a perceived willingness to enforce environmental legislation a mark of goodness.

The structure of this justification differs from the forms of justification discussed in previous sections. While justification that stresses a mine's relation to positive signs, such as job creation or the contribution of raw materials to green energy and technology, or claim goodness by placing certain signs before others in ways that favorably balance a mine's costs and benefits so it becomes good, comparison-based justification follows a different structure. By relying on comparisons between mines operating in more or less strict regulatory environments, this justification expands the notion of goodness from being a question of whether a mine is capable of producing sufficient benefit to outweigh its costs into a question of whether a mine's costs or benefits can be expected to be comparatively more or less good than those of another mine. A second example of this mode of justification can be found in how several informants criticized Swedish policies that allow municipalities to veto uranium mining projects. Several informants said that they believe that Sweden should open its bedrock for uranium mining, and a mining engineer argued passionately for why this should be done:

> We have nuclear power in Sweden and we import our uranium from Russia and Namibia, and Canada. And we probably have the strictest environmental regulation in the world here in Sweden. Is it then morally correct that we purchase our uranium from Namibia, which has poorer environmental regulation than we do, and use it, unless we are also prepared to mine our own uranium, under stricter environmental regulation? That's something to think about, whether that's hypocritical or not. I believe it is. (Interview 3).

As in previous examples, the perceived strength of Swedish environmental regulation is used here as a sign of goodness, which is used to claim that a Swedish uranium mine – had there been any – would be more 'good' than the Namibian mines from which Swedish reactors source their fuel. Here the justification relies on positioning a potential uranium mine in Sweden as possessing more of a sign (such as environmentally friendliness) than a Namibian uranium mine. And it does so in a way that not only claims that Swedish mines do more good, but which also casts a Namibian mine as an immoral and

hypocritical alternative. Because it relies on comparison, justification such as this necessitates a normative valuation that favors the object of justification. It does not matter whether Swedish environmental legislation is as strict as those using it to justify Swedish mining make it out to be, or whether Namibian uranium mining really is an immoral alternative. Instead, what matters is what the idea that Sweden has strong environmental legislation and that Swedish authorities, unlike those in other jurisdiction, do not hesitate to use it, allows mining industry actors to claim in justification. Narratives such as these afford comparisons that in turn allow miners and explorers to cast questions about where to mine as moral dilemmas that are best resolved by opening "good" jurisdictions for more mining.

Implicit in the comparison-based justification discussed here is a refusal of the premises of some critiques. By drawing boundaries between past and present mines or between Swedish and Namibian mines, industry members claim goodness by arguing that while other mines were or are bad, their mines are not. A manager at a local mine, for example, had the following response when a participant in a workshop on sustainability in mining challenged his assertion that mines are not inherently harmful: "Just because Hitler was German does not mean that all Germans are bad!" That is, although some mines may be bad, a few bad mines do not undo the goodness of other mines.

Conclusion

The paradoxical tension inherent in mineral exploration and mining makes the mining industry a uniquely well-positioned case for exploring the semiotics of justification and to trouble notions of good in the economy. Being simultaneously necessary for contemporary socio-technological arrangements, including for green technologies, and inherently non-renewable and impactful, mining upends distinctions between value creation, preservation, and destruction as the goods and benefits it produces come at significant cost. This paradoxical position is visible in the ways mineral exploration and extraction, while environmentally damaging, are prerequisites for many of the environmental initiatives that typically fall under the banner of the good post-petroleum economy, including renewable energy and electric vehicles. As influential actors, such as the European Commission (EC), embrace electrification as a means of cleaning up their energy system (see EC 2020), the importance of metals and minerals for energy production and storage as well as for transportation has seen the mining and exploration industry grow increasingly entangled with positive environmental values. But is this enough to make mining part of the good economy? The short answer is probably no. But the long answer is that it is complicated. After all,

when miners and explorers claim to do good their appeals to goodness are different from those made by actors in the burgeoning alternative economies, such as impact investment or the proto-renewable bioeconomy, who rely on a distinction between past and future economic entanglements to justify their goodness (see Karhunmaa (this issue) and Stilling (forthcoming)). While the miners and explorers quoted above stress their contributions to rural communities and environmental technologies, they are only able to do so by downplaying the drawbacks of their industry, or by pinning problems on a temporally distant or underprivileged Other. As with the oil industry (Appel 2012; Lautrup Sørensen 2022), the mining industry's claims of goodness depend on their context and its willingness to give some values more weight than others.

Using mining's paradoxical relation to value creation and destruction as an analytical lens, this article has investigated how mining industry actors justify the goodness of mineral exploration and mining. Focusing on the semiotic content of justification made by industry members as well as by their critics, this article presents two strategies, or modes, of justification through which claims of goodness in mines and mining are made. In the first mode, a sign is treated as more relevant or important than other signs attributable to the same object. A mine's ability to create jobs or its contribution of necessary materials to the green energy and technology sectors, for example, may be used to argue that, based on the merits of the first sign, other aspects of the mine, such as its environmental or social impact, can be forgiven or ignored. In the second mode, justification works by representing two or more objects as being either more or less related to a sign. In this strategy, a mine is made good by being more beneficial or less impactful than another mine. Miners and explorers in Sweden, for example, claim that because they operate in a jurisdiction characterized by strict environmental legislation and oversight, they are forced to do more good than mines operating in more lax regulatory spaces. Being forced to limit their negative impact, the argument goes, Swedish mines are by necessity better than mines in other jurisdictions.

Like other industries and phenomena, mining holds multiple relations to many different signs. Because of this, the way in which justification weighs signs against each other or stresses the relative strength of the connection different mines have to a sign is the root of the paradox of good mining. In practical terms, this paradox emerges from the plurality of signs attributable to a mine and the way that different justificatory claims, often made to different audiences in different arenas, emphasize some signs while neglecting or downplaying others – after all, when your access to water is unstable and uncertain, even the runoff from a mine's tailings dam can be a lifeline (Ureta and Flores 2022). Nevertheless, while the specificities of

the examples of justification discussed above differ, they are alike in how they connect a mine or exploration project to institutions such as environmental legislation and discursive notions of economic fairness, greenness, or legislative strictness. This inquiry has highlighted the ways in which justification combines objects and signs to achieve a particular result, an interpretant, and how justification becomes meaningful through the broader universe of meaning that the signs inhabit, including debates and narratives on issues such as rural impoverishment or green technology and electrification. It is this broader universe of meaning that allows miners and explorers to bracket out costs and emphasize the good in a present or future mine.

While the signs discussed here could potentially be sorted into the worlds of worth outlined by Boltanski and Thévenot (2006), the bottom-up approach developed in this article pushes the analysis beyond the limits of their framework. By centering the way justification relates signs and objects to produce interpretants such as goodness, the framework opens up justificatory claims to a detailed investigation of the ways in which actors relate what they do to signs that in different ways allow them to claim goodness and negotiate paradoxes and contradictions. Moreover, while this article has primarily troubled notions of goodness in mining and mineral exploration, it has also outlined several instances of critique in which miners and objectors seek to refute each other's claims by questioning the relevance of the signs used or by pointing to alternative signs. These moments of critique contain disagreements over the weight given to different signs, for example, whether short-term economic benefits can be said to outweigh long-term environmental costs, as well as attempts to disqualify the premises of critique. Examples of the latter include miners' refusal to be lumped together with other, bad, mines as well as their strategic use of comparison, through which they claim that what they do is different, and therefore better, because their relation to a certain sign, such as corruption or a regulative environment, is unlike that of the Other.

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Theme issue contribution

Temporal Layering: How past, future and present intersect in the valuation of pharmaceutical innovation

Anna Brueckner Johansen, Susi Geiger, and Sarah Wadmann

Abstract
We investigate how temporality matters in processes of valuation. Taking our empirical point of departure in the case of a novel gene therapy that has been the centre of a heated pricing debate, we explore how the 'goodness' of such a pharmaceutical good was negotiated by researchers, patients, pharmaceutical companies and regulators, and how these negotiations were shaped by the mobilisation of past experiences and future expectations. Seeking to advance the beginning of an analytical sensitivity to temporality in valuation studies, we develop the notion of 'temporal layering'. We argue that moments of valuation consist of multiple 'temporal layers' where select past experiences and future expectations are rendered visible – or left obscure – depending on how these layers are drawn upon in valuation struggles and by whom. Thus, what is at stake in determining the 'good' in particular moments of valuation is not just a contest over certain qualities or ways to evaluate an object, but also over which (particular layers of) pasts and futures come to count. We suggest that such fine-grained temporal analysis can provide new openings to questions of valuation for a wide-ranging array of economic objects, particularly for those situated in contemporary bioeconomies.

Keywords: temporal layers; gene therapy; pharmaceutical innovation; pricing; temporality; valuation

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Introduction

> The documentation of the effect and impact of Luxturna is very uncertain. (…) [Still,] Novartis (…) charges an exorbitant price that is neither connected to value nor development and production costs. A price that made me think of ransom in a hostage drama, though this is not the case in a strictly legal sense. Even with half the price, Novartis will still make a huge profit. What drives the greed behind such prices that bring children and their parents into desperation?
>
> - Prof. Jes Søgaard, December 2019.

The foregoing quote by health economist Jes Søgaard is from a column written during the height of an emotionally heated controversy about patient access to novel gene therapies in Denmark (Søgaard 2019). Søgaard drew on an extreme crisis metaphor, 'a hostage drama' and a morally laden attribute, 'greed', to describe the pricing decisions made by the pharmaceutical company in question. At the centre of the dispute was the gene therapy Luxturna (voretigene neparvovec), licensed by the pharmaceutical company Novartis. Luxturna is the first gene therapy that targets an inherited eye disease causing children and young people to develop blindness. The treatment had been approved for marketing by the European Medicines Agency (EMA) in 2019. Yet, it was rejected as a standard treatment in Denmark due to 'unreasonably high pricing', causing uproar from families affected by the disease. In contrast to the critique raised by the Danish health economist, a co-founder of the American start-up who developed and initially marketed Luxturna expressed concern that 'the promise of gene therapy will never be realised' if pricing becomes 'too much of an issue' because it will divert the attention of researchers and companies away from truly innovative research (Prof. High, pers. comm. 2022).

In line with other authors in this theme issue, we study valuation controversies over one of the manifold objects that are populating 'the good economy' – but we do so with an explicitly temporal tack. Bringing together insights from valuation studies with work on temporality in organisation studies and anthropology, we seek to explore how negotiations about the 'goodness' of Luxturna are shaped through acts of temporal layering, which serve to foreground certain temporalities and obscure others. Marketed as one-time, one-cost treatments, the pricing of gene therapies, like Luxturna, is typically justified with reference to life-long treatment effects and future cost savings to society. Yet, the high upfront costs pose challenges to public healthcare systems facing resource constraints (Wadmann and Hauge 2021). In Denmark, Luxturna was eventually offered to patients in 2020 as part of an outcome-based payment agreement. While the pricing controversy was settled in this case, it raises a more general question about how temporality might shape negotiations over such therapies' 'goodness' when actors draw together the past development

costs with the uncertainties of long-term therapeutic effects, or, conversely, when they emphasise future-oriented hopes and past patient pains. While we argue that temporality always plays into moments of valuation, gene therapies represent a new paradigm in life science that brings distinct valuation dilemmas with it, some of which are intrinsically related to issues of temporality. With Luxturna, temporality was central to everyone's understanding of what a 'good' price ought to entail – but they could not agree 'which' temporal layers mattered.

We suggest that settlements on what is considered 'good' are only temporary stabilisations in ongoing contestations over which past experiences and future expectations come to count. More specifically, we argue for a multilayered conception of time that attends to how past experiences and future expectations are brought into the present and mobilised at particular moments to establish or critique certain ideas of the 'good'. We do so by introducing the notion of temporal layering as the act of selectively choosing, framing and amalgamating specific pasts, presents and futures. Pausing at three particular moments in the 'career' (Çalışkan and Callon 2010: 24) of Luxturna, we explore which understandings of 'the good' are negotiated through such temporal layering in the becoming of the gene therapy. Moments of valuation, from this perspective, are always temporally layered; consequently, valuation studies researchers may benefit from an analytical sensibility towards questions of how temporal layers are brought together and drawn upon in valuation controversies. This analytical move serves to trouble and question taken-for-granted claims about the 'goodness' of current developments in the life science industry as well as other 'biopolitical economies' (or bioeconomies, for short), where different temporalities of life and economy come into tension (Adams et al. 2009).

We start by discussing how the pharmaceutical sector can be understood as one instantiation of the 'good economy'. Next, we outline how valuation studies have started to engage with temporality and discuss how these insights can be further developed through work on temporality in the fields of organisation studies and anthropology. Then, we pause at three moments in the story of Luxturna to illustrate how a temporal layering perspective can help us understand the contingency of any stabilisation of what is considered 'good'. We end with a discussion of how an analytical sensibility to temporality matters for contemporary critique of the good (bio)economy.

Pharma as an instantiation of the 'good economy'

In valuation studies, recent analytical frames have started to consider valuation as a *problem* rather than a *practice* (Board of Editors 2020). In other words, when studying how valuation works,

consideration should centre on the problems, conflicts and political struggles of which practices of valuation are part. In line with this call, analytical attention has been given to shifting normative assumptions undergirding claims about what is 'good' in a given economy, resulting in what Asdal and colleagues (2023) refer to as 'the good economy'. Challenging any unequivocal notion of 'the good' in economic exchange, this concept invites attention to shifts in normative positions over time and the concerns that may be located out of sight when particular versions of the 'good' are promoted by different actors. Accordingly, the scholarly task is to tease out which conceptions of the 'good' are brought forward and by whom, who it can be considered good for, and how dominant conceptions of the 'good' might be challenged.

Because of its position in a contested space where ambitions of doing good for patients and combating disease sometimes clash with concern for market value (Geiger 2021), the pharmaceutical industry can be seen as a peculiar instantiation of 'the good economy'. The pharmaceutical industry moves across different dimensions related to economy, politics and health in what Petryna and Kleinman (2006) have referred to as 'the pharmaceutical nexus'. Scholars have critically examined the normative assumptions underpinning claims towards 'goodness' in this nexus. Mirroring concerns expressed in the opening quote of this article, these prominently include pharmaceutical pricing strategies and patient access to new therapies (Mazzucato and Roy 2019; Bourgeron and Geiger 2022; Kjellberg et al. 2023; Roy 2023; Doganova and Rabeharisoa 2024). Authors have interrogated the economic rationales informing the idea and practice of 'value-based pricing' that increasingly displaces claims about pricing based on research and development (R&D) costs (Mazzucato and Roy 2019; Doganova and Rabeharisoa 2024). Illustrating contestations around 'biofinancialization', Bourgeron and Geiger (2022) show how the economic 'career' of a high-priced medicine for Hepatitis C was laced through with moments of scientific and social contestations of its 'asset condition' obtained through extensive patent protection. Scholars have finally taken the question of what is 'good' in pharmaceutical markets to a global level, noting the inequalities that can arise as some populations bear the risk and costs of pharmaceutical innovation but often cannot partake in its benefits (Petryna 2005; Sunder Rajan 2017).

Building on these studies, we start from the vantage point that there is nothing self-evident in the valuation of pharmaceutical goods and that settlements on which forms of 'good' they represent are to be understood as temporary stabilisations, which express themselves, for instance, in the price of a pharmaceutical product or in certain market access agreements. Hence, we use the notion of the 'good' as an overarching term that refers to the multiple types of concerns and

critiques that guide actors in their pursuit to develop, market and access pharmaceutical goods. In line with Dussauge and colleagues (2015: 10), we are interested in 'the production – in practice – of what comes to count as valuable, desirable, or otherwise worth caring for'. Demonstrating the contested nature of these concerns, we seek to tease out how various actors represent and enact the 'goodness' in pharmaceutical markets and how their various conceptions of the good might intersect, collide and be temporarily settled. We take a particular interest in moments of collision and settlements, but rather than seeing these as isolated moments, we argue that paying particular attention to temporality can help our understanding of how actors seek to establish what is 'good'. Contestations over the 'good' in economic exchanges are shaped not only by distinctive past experiences sedimented in certain qualities of the good or in specific tools of valuation; actors may also mobilise different future expectations to establish what is 'good' in the present. Thus, we propose that what is at stake in determining the 'good' in particular moments of valuation is not just a contest over certain qualities or ways to evaluate an object, but also over which particular temporal layers come to count. Attention to these temporalities makes it possible to distinguish how layers of past experiences and future expectations are drawn upon by various actors, unearthing an essential dimension of the normative assumptions that establish the 'good economy'.

Developing an analytical sensibility to temporality in valuation

Combining insights from economics, economic sociology and economic anthropology, Çalışkan and Callon (2009, 2010) outline an ambitious programme for analysing how things acquire economic value through what they call processes of economisation, that is 'the assembly and qualification of actions, devices and analytical/practical descriptions as "economic" by social scientists and market actors' (Çalışkan and Callon 2009: 369). They briefly allude to the importance of temporality for these processes. Drawing on Appadurai (1986), they note that products are goods with a 'career' and argue that 'markets have a history; they also have a future that cannot be reduced simply to an extrapolation of the past' (Çalışkan and Callon 2010: 24). Although this work has been hugely influential, their points about temporality seem to have had limited impact within valuation studies. As Mennicken and Sjögren (2015) highlight, many studies have tended to magnify the 'market moment' without exploring how this moment was shaped by past experiences and future expectations. Only recently has the interplay between valuation and temporality surfaced as an explicit analytical theme in studies such as Hammarfeldt et al.'s (2020) work on narrative trajectories in academic

CVs, in Muniesa and Doganova's (2020) work on future-oriented financial reasoning, or in Doganova and Rabeharisoa's (2024) study on the temporality of pharmaceutical prices.

Engagements with temporality in valuation studies have tended to focus on how future visions are folded into present valuations. Extending an analytical apparatus attuned to exploring how the value of something is configured by the use of particular valuation tools or discursive practices, these studies point to how particular ways of conceiving future value can have important implications in the present (e.g. Beckert 2016; Muniesa and Doganova 2020; Ortiz 2021; Doganova 2024). Some of this work has addressed temporality in a healthcare context. Building on the case of drug development, Doganova (2018, 2024) argues that 'uncertainty' about the future can be enacted in very different ways depending on the specific formulas and practices of discounting that are used. Geiger (2020) suggests that future-rhetorics are powerful devices that shape contemporary capital valuations in health technologies, where the productive power of uncertainty creates visions about open and desirable futures. Costa and Milne (2023) consider the valuation of diagnostic technologies for Alzheimer's through narratives of the inherent 'goodness' of knowing the future. Most recently, Doganova and Rabeharisoa (2024) study the value-based pricing of the gene therapy Zolgensma as a future-oriented technology with political and epistemological consequences. More broadly, a longer-standing tradition in the sociology of health has critically analysed the effects on the present of future imaginaries, expectations and narratives (Brown 2005; Adams et al. 2009).

Where the bulk of this literature has been concerned with future imaginaries and visions, comprehensive literatures on temporality have developed in other areas that can help extend valuation studies' beginning engagement with temporality. In particular, selected works in organisation studies and anthropology can stimulate an analytical sensitivity towards how past, present and future temporalities may be brought together in moments of valuation. It is from this literature that we conceptualise our notion of 'temporal layers' and how 'temporal layering' may be employed to enact these layers.

In organisation studies, seminal work on time highlights the 'immanent' interweaving of pasts, presents and futures in organisational processes (Hernes 2022). Hernes observes that '[organising] implies bringing together strands of a tangled whole within some selected and temporally evolving structures of meaning' (2014: 14). In Hernes's work, this bringing together is expressed through the term 'present-past-future', which signals the potential actualisation of past experiences and future expectations in the present. The ordering of the three words and the hyphens in the term 'present-past-future' emphasise a confluence of the three temporalities, which are all actualised and enacted in the present, no

matter how distant or near these pasts and futures may be (Flaherty and Fine 2001; Hernes and Schultz 2020). Actualising is an organisational process, in the sense that it is aimed at 'creating a meaningful and predictable order out of a tangled world' (Hernes 2014: 14). As with any act of organising, this ordering is not only socially embedded (see Pulk 2022); it is also purposeful.[1] Extrapolating these insights from organisational settings to broader valuation controversies – those happening in various 'good' economies – we take from this literature that what we call temporal layering is a purposeful, organisational act that gives meaning to and simultaneously mobilises certain amalgams of present-past-futures.

A similar move towards understanding the present as a confluence of past, present and future has been made in the newer anthropological literature on temporality. This literature yields additional concepts that point to how actors may go about constructing and deploying a 'multi-layered' present, that is, a present both shaped by past experiences and future 'horizons of expectation' (Bryant and Knight 2019; Elbek 2022).[2] For example, drawing on ethnographic observations from photography, Pinney invites attention to the choices that lead to multiple temporal layers comprising a photograph – which not only 'freezes' a present that is suggestive of a certain past but can also frame future aspirations (2023: 40). Building on Guyer (2007) to explore experimental science as an inherently anticipatory enterprise, Sharp (2014) writes about the normative assumptions embedded in particular 'temporal framings', that is certain ways of conceiving of and representing time, which can serve to legitimise certain actions in the present. We find the photographic metaphors deployed in these studies useful to highlight the selective nature of this temporal ordering: what is chosen to be 'in the frame' is not only a matter of perspective but also one of leaving out that which ought not to be seen.

Taken together, these perspectives invite us to understand temporality as drawn together in multiple layers of past-futures actualised in the present. Further, they bring attention to the compositional and organisational work undertaken by actors as they represent and enact time in certain ways that are themselves imbued

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[1] Pulk (2022) employs the notion of 'temporal layers' but for her, these are social layers, with some more micro and some more macro ones being brought to bear in the same moments.

[2] These ideas originate from historian Reinhardt Koselleck's work on 'multilayered' history (Koselleck 2018). Although we are inspired by this idea, we do not use his concept of 'Zeitschichten'. Where Koselleck uses the notion of layers to describe three different sediments of time that encapsulate how time progresses with different speeds of change and transformation (2018: 9), we look at temporal layering as a metaphor for how particular present-past-futures are brought into view in valuation processes.

with normativities. While insights from organisation studies allow us to root our notion of temporal layering firmly in discussions on temporality's immanence, the anthropological literature enables us to envisage how past experiences and future expectations may be used to render certain actions in the present 'present'. The way that particular temporal layers are actualised depends on what we refer to as acts of temporal layering that actors employ at any given moment to make certain temporal layers stand out and, consequently (but perhaps not always consciously) to obscure others. We thus highlight the compositional work undertaken by actors to bring certain horizons of expectations and experience to the fore. Temporal layering can be enacted through discursive moves. For example, a 'prophetic' (Sharp 2014) layering may be mobilised by actors in moments of valuation to argue that experimental research's value will materialise in a distant future where young people with inherited eye diseases will no longer go blind. Temporal layering can also be undertaken through the mobilisation of non-human elements. For example, the application of evaluative schemes such as cost-effective analysis relies on a layering of incremental benefit that mobilises a particularly distant horizon of expectation but that by extrapolating costs into this distant future also draws in a layer of the past.

We deploy this analytical framework in the following section as we pause at three moments when Luxturna's 'goodness' opened up to negotiation. While we zoom in on particular moments, we do not see these as isolated events. Rather, we seek to illustrate the specific layers that emerge and linger over time and to trace what this implies for Luxturna's becoming. This framework illuminates that each temporal layer is the outcome of momentarily stabilised struggles. It also opens up possibilities for critique. Instead of naturalising the 'career' of an object, attention to the various temporal layers employed in its valuation makes us aware of the choices made in tracing a particular social biography and of the normativities that render some ideas of the 'good' more visible than others. Combining the literatures above thus chimes with a long-standing tradition in science and technology studies (STS): to explore how things 'could have been otherwise'.

Case presentation and methods

The case of Luxturna is illustrative of current transformations in the pharmaceutical sector and the valuation dilemmas they entail. In 2017, Luxturna was the first gene therapy tackling an inherited disease to be approved for marketing by the US Food and Drug Administration (FDA). Among a small subgroup of young people living with the rare inherited disease called Leber's congenital amaurosis (henceforth LCA), Luxturna represented new therapeutic hope. Orphan drugs, like Luxturna, often fill a gap in existing treatment options for rare disease

patient groups. Yet, they tend to come with unprecedentedly high pricing, and their valuation is often marked by great uncertainty because clinical effectiveness can be difficult to determine due to the small study populations. Randomised controlled trials with as few as nine to 29 patients in each trial, as was the case with Luxturna, are not unusual (Pierce and Bennett 2015). While prices tend to be justified based on the expectation of life-long treatment effects, debates ensue about what constitutes adequate time horizons for estimating the 'added value' of these therapies (Ronco et al. 2021). As horizon scans predict a substantial rise in the number of gene and cell therapies to be marketed from 2020–2030, such challenges of valuation are likely to become more pronounced (Quinn et al. 2019).

We base our study of Luxturna on publicly available documents regarding Luxturna's pricing, access and discussions it raised. These documents include regulatory documents, meeting transcripts, patent applications and news sources. Moreover, we consulted scientific and popular scientific publications about Luxturna's development from 2001–2022 (see Appendix 1 for a complete list of sources used). We conducted a close documentary analysis of all relevant materials, analysing some texts as sites and some as tools written for specific purposes, thus always being conscious of the authorship and purposes of these sources (Asdal and Reinertsen 2022). During the analysis, we attended not only to human actors but also explored the influence of non-human actors, such as laboratory animals or pricing formulas. In addition, we conducted supplementary online interviews with three key actors in the development, manufacturing and pricing of Luxturna in the USA.

We analysed our material through a process of abductive analysis, moving between the empirical material and theoretical abstractions in a dialectic fashion (Tavory and Timmermans 2014). We first gained an overview of the 'career' of Luxturna: taking the pricing debate as our starting point, we sought to trace its origin story. This process soon demonstrated that the story of Luxturna did not evolve as a purely sequential process and that its career could have taken different turns at multiple points in time. From this realisation, we developed an analytical interest in the relationship between temporality and valuation, eventually identifying three key moments of valuation that, according to stakeholders, were incisive for the therapy's becoming. While the three moments are rooted in the empirical material, they are also the product of a particular temporal framing conducted by us, as analysts. Digging more deeply into our data, we realised that these moments were not only crossroads into potentially different careers of Luxturna; they also contained multiple temporal layers as they drew on different and sometimes hypothetical timelines. This insight, in turn, triggered an interest in the actors who mobilised these layers. As we now turn to the analysis, we present the negotiations that occurred

at these three moments to settle the 'goodness' of what eventually became Luxturna and the temporal layers that emerged as a result of these negotiations.

First moment: Entering into clinical trials

We enter the story of Luxturna at a time when genetic research dramatically changed its status in public debate from innovative and hopeful to risky and unethical. In 1999, the tragic death of 18-year-old Jesse Gelsinger, who served as a research participant in a gene therapy trial at the University of Pennsylvania, turned the whole field into a site of heated public debate. While the Gelsinger trial was not targeting inherited eye disease, it nonetheless impacted the research activities that laid the ground for Luxturna.[3] The Gelsinger tragedy appears as a landmark in popular books around genetic research (e.g. Lewis 2012), but it was also emphasised by our informants as a problematic past that made genetic research challenging. According to Professor Jean Bennett, one of the leading genetic scientists behind Luxturna, who worked at the same university, 'it was a very difficult time to continue moving forward'. She elaborated:

> The whole field was rightly criticised, and it came to a screeching halt. Every trial that was started at that point was halted, and money that was being devoted to gene therapy dried up. Companies that had been started to help move gene therapy forward went broke (Prof. Bennett, pers. comm. 2022).

Gelsinger's death made clear that gene therapy research was not universally good. While its scientific potential carried hope, it was also risky – and, according to some, potentially skewed by economic interests or prestige in scientific milieus. Notably, Gelsinger's father described people promoting gene therapy as part of 'a heartless and soulless industry (…); they are doctors so blinded in their quest for recognition that they can't even see the dangers anymore' (Gelsinger 2002). To Bennett and her team, who had developed the techniques with which to assess the expression of recombinant DNA in the retina in the early 1990s and demonstrated the first proof-of-concept of a gene therapy-mediated intervention in a mouse model in 1996 (Bennett 2014), the tragedy shook the ground of their lifework. It also raised serious doubts about the possibility of moving from animal models to human trials. How did researchers succeed in transforming Luxturna from promising animal research to human testing for a non-lethal disease in the shadow of Gelsinger's death? To understand this, we pause at a decisive moment of valuation in the career of Luxturna: an

[3] A few years after the Gelsinger tragedy, five cases of leukaemia occurred in another gene therapy trial, putting an additional damper on the field (Lewis 2012).

assessment undertaken by the National Institute of Health's (NIH) Recombinant DNA Advisory Committee (RAC), which constituted an 'obligatory point of passage' (Callon 1984) for NIH-funded researchers to start genetic research with human subjects.[4]

At the RAC meeting in December 2005, concern about risks for trial subjects rooted in past research experiences was pitted against future prospects of curing blindness. Prof. Bennett recalls:

> The RAC held a public meeting because nobody had ever enrolled children in a gene therapy study for a non-lethal disease. (…) Basically, children are considered vulnerable subjects. They may not necessarily understand all the details of what they're agreeing to and so we had to justify the approach we were using – the dosing, the safety, how we would assent the children and get parental permission, and so forth. We were grilled about this for a whole day (Prof. Bennett, pers. comm. 2022).

With Gelsinger's death lingering large as a problematic past, patient representatives at the meeting shared what Guyer (2007) and Sharp (2014) would call a 'prophetic' framing: their testimonies enacted the hope of a future cure. Eliciting the future social 'good' that this research could convey, some for example argued that 70% of children with blindness end in unemployment. A family told the story of their long-awaited one-year-old child with the LCA-diagnosis to convey the hope that this research represented to them:

> The bicycle I couldn't wait to buy him will be instead a white cane to help him get around. (…) Seeing the pain in our parents' eyes when they come to see their grandchild is devastating (…) This is why I urge you to let those wonderful doctors perform their trial for gene therapy of LCA in children (Transcript, RAC 2004).

In these narratives, the future value of sight is temporally layered with many years of waiting for a healthy child, mobilising particular pasts as a powerful backdrop to the projection of a better future. While it turned out that none of the patients who shared testimonies at the RAC meeting was a candidate for the specific gene therapy, their temporal layering of past pains and future hopes weighed heavily on the day. In the words of a relative at the RAC meeting: 'This study is the first step on the way to the moon in curing blindness. Then people with other forms of Leber's and eventually people with other forms of blindness.' This temporal layering was not unproblematic. For example, a spokesperson for the National Federation of the Blind criticised the framing of these narratives for downplaying blind

[4] The RAC was a public forum with scientific and non-scientific members that reviewed the safety and ethics of experiments involving DNA. Although having no official power, it informed FDA approvals of human trials (Lewis 2012).

people's capacity, stating that high unemployment rates among blind people are rather due to 'society's low expectations for the blind' (Zhang 2017). In any case, these layers of pain and hope alone could not fully convince the RAC; the recent, troubled past made vividly concrete by Jesse Gelsinger's death could not be framed out of their decision. In the end, however, even sceptics were convinced. If not by the explanations offered by scientists and the horizons of hope enacted by patients, then by the playful presence of a photogenic dog.

Rather than remaining as an abstract and prophetic future, the many hopes and aspirations of patients and researchers materialised in a cob of three blind puppies that Bennett and her team managed to give sight to. As research models, dogs were valued by scientists because of the anatomical similarities between dog and human eyes that made translations potentially viable. Yet, it was the dogs' ability to embody hope in the present even against future risks of experimental research that became their overriding quality. Instead of being euthanised at the end of the experiment, some of the laboratory dogs were adopted by researchers and came to constitute living examples of the potential of gene therapy. One of the dogs, named Lancelot, appeared on popular news media such as Good Morning America (Lewis 2012). Lancelot also became a key actor at the RAC meeting where Bennett and her team showed videos of him and his relatives. Inviting the audience to compare a particular past – the untreated puppy, who 'walks around very tentatively', 'wanting to play' but bumping into other dogs instead – with the presently treated dog who engaged in playful activities, researchers sought to make visible the effectiveness of the treatment. In response to a comment about the risk of testing the treatment in children, a member from the research team responded: 'if this was a study only in adults, Lancelot and the incredible results in the dog model would not be required.' The dog's playful attitude became a compelling manifestation of the 'goodness' of making blind children see, which concretised a hopeful future in the present. With this, the scientific efforts of the researchers coalesced with the hopes of patients and their families into a particular temporal layering that enabled the RAC committee to see the future potential of the experimental therapy. The dogs came to animate painful pasts, future hope and present scientific state of the art at once.

At the beginning of Luxturna's story, concern about questionable research practice and risks to trial subjects grated against the innovative potential of experimental gene therapy and put the research field to a halt. However, against this temporal layering, a horizon of future hope was evoked through the arguments of researchers, testimonies of patients and, most importantly, through a relatively unusual 'valuation device': a freshly sighted dog. Thus, hope came to overshadow a problematic, recent past and enabled the transformation of Luxturna from animal model to experimental human treatment: the

RAC unanimously voted in favour of conducting research with human subjects, and recommended the inclusion of children age eight and above in phase I, if safety could be demonstrated in the initial adult participants.

Second moment: Establishing a start-up

Fast-forward eight years to another negotiation of Luxturna's 'good'. At this moment, the researchers prepared for Luxturna to become a marketable product to benefit more patients. Yet, the future market potential of the therapy grated against concerns about financial conflicts of interest of researchers – concerns that were rooted in problematic experiences of the recent past, particularly Gelsinger's tragic death. To deal with this issue, researchers actively sought to distance market and scientific valuations – and the particular layers of pasts and futures on which they drew – from each other.

Two temporal considerations were central for the research team: speed of market access and patient reach – that is, how quickly the therapy could be made available on the market and how many patients it could reach in the future. Professor Katherine High, who had a central role in this process, recalls:

> Sometimes I was getting pretty discouraged about moving forward with Luxturna. I was thinking: we could just do it forever under an Open IND[5] and never get the product licence. But in the year after Luxturna was approved, we treated more people than in the ten years of clinical development! (Prof. High, pers. comm. 2022).

Until this point, research on Luxturna had been funded through grants from public institutions and charities. However, the research team could not secure sufficient funding through these sources for the expensive phase III trials. Moreover, they were aware that research alone did not ensure that patients would benefit from the therapy. The research team had several offers from large pharmaceutical companies to drive the project further but found it too risky to allow a large company control the testing of the therapy, in case it would shelve the project for some reason – a particular expectation based on past experiences of other biotechnology start-ups. Hence, to realise the scientific and social 'good' of the gene therapy, researchers decided to create a start-up enterprise; a process that required mobilising the therapy's future market value to attract investors. This process inherently draws on specific – but always uncertain – futures, discounted into the present (Doganova 2018, 2024).

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[5] Open IND: Investigational New Drug Application, where the product is not on the market but is allowed to be used for investigational purposes (FDA 2022).

Spark Therapeutics was established in 2013, but while preparing for Luxturna's market entry, researchers found it necessary to stay clear of 'any taint from the company' on the future scientific project (Prof. Bennett, pers. comm. 2022). One of the problems in the Gelsinger case had been the (suspected) entanglement of economic and scientific interests. Gelsinger's father ended up suing leading actors in the trial to which he lost his son, and his attorney described the field of genetic research as plagued by 'NASDAQ[6] medicine' (Milstein in Kimmelman 2009: 36). Indeed, after Gelsinger's death, the leading researcher of the trial received $US13.5 million in stock for his 30 per cent share in the company that stood to gain from the research (Lewis 2012). To avoid any accusations of economic interests in Luxturna and comply with conflict of interest policies at their university, as well as being able to maintain direct patient contact, Prof. Bennett and her spouse and collaborator, Prof. Maguire, decided to waive any future financial gain from the start-up company (Bennett 2014). They even relinquished economic gain from the patents associated with Luxturna:

> I'm Albert Maguire, the PI for this proposal. (…) In order to eliminate any potential conflict of interest related to my participation in this and other trials, I forfeited any financial benefit related to a pending patent based on this therapy. And likewise, my spouse and collaborator, Dr Bennett has waived any financial interest as well (Transcript, RAC 2004).

Here, the researchers framed their present and future engagement with the company through a clear break with a problematic past. As a result, the potential of future economic gain was distanced from the contemporary scientific practices of researchers – temporal layers in this case were kept well apart.

The establishment of Spark Therapeutics may be considered the 'market moment', the valuation of its scientific results informs the valuation of its market potential. However, rather than a sequential replacement of one mode of valuation with another, the 'market moment' was anticipated earlier in Luxturna's career. For instance, more than ten years before the launch of the start-up, Prof. Bennett had what she describes as the 'Eureka moment', when she saw the potential of their research and thought: 'wow, we can make blind puppies see – we should try to make blind children see!' At this point, the next step for the research team was to write a patent application. She recalls: 'Somebody had mentioned to me that it's really important to get intellectual property on this, because if you end up needing sponsorship from a company, they will want to be able to license the intellectual property.' This patent application, taken out in the early

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[6] NASDAQ: The National Association of Securities Dealers Automated Quotations Stock Market, an American stock exchange based in New York City (www.nasdaq.com).

days of Luxturna's career, foreshadowed a market future for the gene therapy; a temporal layer that foregrounded an unreleased market potential of a therapy-to-be. The patent application was continuously renewed from 2001 to 2007 when it was finally approved (Acland et al. 2012). The 'market moment' can thus be seen as a continuous process, building up a temporal layer of past market projections. While this market future only crystallised long after the start-up was established, its role in investment valuations was prepared early on in Luxturna's career.

This insight complicates Moreira and Palladino's (2005) juxtaposition of a financialised and future-oriented 'regime of hope' and a scientific and past/present-anchored 'regime of truth'. In our case, both the economic and scientific trajectories were temporally layered 'present-past-futures' that developed in parallel. As Sharp (2014: 154) argued, 'Experimental scientists are focused on the longue durée – a stance that facilitates side-stepping the near future. In contrast, investors inevitably desire "rapid" and "timely" results and profits'. Because of careful efforts to keep these two trajectories apart, it was possible to care for two different, though overlapping, temporal layerings at once – one selectively framing the potential cure and the other its market potential.

Third moment: pricing a gene therapy

How do you set a price for a therapy if there is no past experience with which to compare it? As the first gene therapy for an inherited disease to be approved by the FDA, this was a key question to the team at Spark in setting the price of Luxturna. While, in the previous valuation moment, researchers had sought to keep the economic and scientific trajectories apart, these were brought together in the health economic evaluations that informed the price in accordance with the idea of 'value-based pricing', as recently examined by Doganova and Rabeharisoa (2024). According to the idea of value-based pricing, the price should reflect the expected economic benefit of the treatment set against the alternative of no treatment and a lifetime of disability. This pricing method involves a peculiar temporal layering that is ostensibly future-oriented but relies on assumptions and costs selectively drawn from the past. This mobilisation was strongly contested by critics who strove instead to bring the past funding streams from patient organisations and public research institutions into view. Accordingly, two conflicting temporal layerings came into tension in the attempts to settle on a 'good' price for Luxturna.

In their price calculations, the start-up company employed an economic model that mobilised particular healthcare costs of the past from which to extrapolate a hypothetical economic future. The pricing and reimbursement team tested different assumptions: indirect cost

(e.g. the cost of educating a blind child), 'quality of life' measures, and direct medical costs over a patient's estimated lifetime. These calculations suggested a price that exceeded US$1 million per patient. This price was then tested against other approaches such as compensation paid out under long-term disability policies in the American insurance industry (anonymous, pers. comm. 2023). Based on these calculations, the final price tag of US$425,000 per eye as a one-time treatment was summarised within the logic that: 'Instead of renting a house, you are buying it' (Green 2019) – a valuation that relied on extrapolating selective past costs into a distant patient future.

Yet, this distant future became a point of contention. Uncertainties remained about the therapy's long-term effects. Luxturna does not cure blindness; rather, it stops the deterioration of the illness, and in many cases it brings substantial improvement to sight, especially in lower light, which is a central problem for patients with LCA (Maguire et al. 2021). Yet, in the phase III clinical trial, only half of the patients (52%) met the FDA's threshold for clinically meaningful improvement (FDA 2017).[7] Further, two patients (5%) experienced permanent vision loss due to the administration of the therapy, and at the time of the price-setting, some uncertainty over the continuation of long-term improvement persisted, based on data from competing trials (Darrow 2019). Demonstrating the contingent nature of the temporal layers informing value-based pricing, different future horizons were mobilised in the cost-effectiveness calculations in different countries: in Sweden, it was assumed that Luxturna's effect would last ten to 15 years (TLV 2019: 40); in Norway, the future horizon was 15 years (Nye Metoder 2020: 25); the American-based Institute for Clinical and Economic Review (ICER) assumed an effect of ten years plus a ten year waning period (ICER 2017), and in England, a lifetime horizon of 85 years was employed (NICE 2019). These temporal orderings inevitably influenced what counted as 'good value'.

As a way of settling the uncertainty related to the one-time treatment's future horizon, Spark Therapeutics decided to deploy a particular version of value-based pricing: outcome-based payment. This implied that payers would not have to pay the full amount for the therapy for patients who did not benefit sufficiently from the treatment. As a valuation device, the payment model also offered an additional temporal layer compared to value-based pricing models. Rather than relying on a projection of selected past costs into a distant future, the payment model served to convert the uncertainty about future costs and benefits into a calculable risk to be discounted into the

[7] The FDA's definition of clinical meaningfulness was improvement by two light levels, but a number of the patients entered the trial already able to pass at the next to lowest light level, which they could only improve by one light level. Thus the test had a "ceiling effect" that may have operated against the trial design (High, personal communication; Russell et al. 2017).

present (Doganova 2024). Furthermore, to the start-up company, the payment agreement came to signal a dedication to innovation that pitted the company's pricing strategy as a 'good' alternative to the conventional practices of 'big pharma'. But it was exactly this break with the past that, according to an expert involved with the pricing, made it difficult to push the new payment model through:

> There is a very big resistance to change in the US and people keep talking about how they want to make change. In reality, there is a lot of people who want to keep the system the same because a lot of people make money from the system in the way that it is (anon., pers. comm. 2023).

Thus, by employing the peculiar temporal layering of outcome-based pricing, Spark Therapeutics cast a historically accumulated layer of economic valuation as an undesirable past. This broke with firmly established industry notions that one-time treatments would not create sustainable sources of continuous income (Lewis 2012; Roy 2020).

The particular temporality of the outcomes-based payment agreement allowed the start-up company to move from a focus on the price per se to negotiations about pricing principles and to distance themselves from 'greedy' pharma pricing practices. Yet, this temporary settlement on what was 'good' was still challenged upon Luxturna's market debut, with a public that kept 'grinding on about the price' (Prof. High, pers. comm. 2022). Rather than being portrayed as a 'good' therapy at a 'good' price, Luxturna was highlighted in some news media as the most expensive medicine being sold in the US at the time (e.g. Feuerstein et al. 2018). Critics argued that a value-based pricing strategy prompts decision makers to ask the wrong questions about the temporalities involved in pharmaceutical innovation:

> We didn't pay for the polio vaccine based on the future cost savings for kids who didn't need to live in iron lungs (…) The question in drug pricing isn't how much is a life worth; it's what makes a fair return on an investment in R&D and an accessible price (Patients for Affordable Drugs 2019).

Here, value-based pricing is challenged on the basis that hypothetical futures should not colonise current market value. In open groups on Facebook, similar critique was voiced, although some patients who had received the treatment pushed back, stating that Spark Therapeutics 'is not some big pharma company' but an alternative who 'laughed, cried and celebrated with us' – mobilising a past layer of shared experience between the company and patients. Arguing that price setting should be informed by R&D investments, Patients for Affordable Drugs also mobilised selective pasts: the actual costs of drug development. Thus, while the temporal framing of value-based pricing highlights the potential savings in the future (based on

selective past costs), the alternative framing made by the patient advocacy group brought forth past and typically long-obscured layers of research investment. These competing temporal valuations underlying rare disease development prolong controversies over a 'good' price.

At the time of writing, the question of whether Luxturna's projected market future has come to pass remains unsettled. The start-up managed to secure more than US$122 million in venture capital funding (Crunchbase 2023) and sold the licence of Luxturna to Novartis for commercial activity outside the US for about US$170 million, before EMA approval of the therapy in 2018 (Sagonowsky 2018). Shortly thereafter, Spark was acquired by Hoffman-La Roche in a US$4.8 billion deal (Morrison 2019).[8] However, according to the expert involved in the pricing of Luxturna, its actual profit is uncertain: 'No one's making a lot of money out of Luxturna, there's not enough patients (…) [Luxturna] was a good proof of concept. It was good to get the first gene therapy approved, but it is not this big money-making machine that is going to keep gene therapy alive' (anon., pers. comm. 2023). Indeed, in 2021 Roche reduced the accounting value of Luxturna, citing 'reduced sales expectations' (Dubnow 2021).

Clearly, in the case of Luxturna, the notion of 'good' entails shifting and multiple temporal layers that bring together selective experienced pasts and possible futures, but that continually come into conflict with alternative temporal layering, making any settlements unstable.

Discussion and conclusion: a temporal lens in valuation studies

The notion of 'the good economy' invites attention to the normativeness enacted in a given economy and how this may shift over time (Asdal et al. 2023). Such attention to historical contingencies makes it clear that 'goodness' depends on efforts to promote and enact particular notions of the 'good'. Building on this perspective, our analysis suggests that the 'goodness' of pharmaceutical innovation and pricing is not merely a story of fairness versus greed, as suggested in the opening quote of this article. Rather, various conceptions of and ways to pursue 'good' converge and clash in the career of novel therapies. We suggest that these conceptions are temporally layered. We argue that moments of valuation consist of multiple such temporal layers of past experiences and future expectations that are rendered visible – or left obscure – depending on how these layers are mobilised by various actors. In our analysis, we showed the different and often

[8] Spark also had other trials underway considered to have high net book value (Roche 2020).

controversial efforts of temporal layering during three particular moments of Luxturna's 'career': in the first, a problematic past was selectively blended out through future prospects of curing blindness conveyed through the present playfulness of a photogenic dog. In the second, distinct layers were kept apart, which made it possible to care for two parallel futures at once – the potential cure and the potential market. And in the third, value-based pricing models established the therapy's future potential as the temporal layer that mattered for the price setting rather than past production costs, which were evoked by contesting actors. Overall, our analysis highlights that a gene therapy's career is not a linear story about how scientific value accumulates and then becomes financialised in biopharmaceutical markets (Chiapello 2015). In contrast to a sequential conception of stages where different forms of valuation replace one another, as suggested by the image of the pipeline, we propose that objects' careers are shaped by valuations where various past and future horizons are brought into play as actors pursue various and often conflicting forms of 'good'.

The controversies along Luxturna's career are not unique. Indeed, similar discussions are regularly brought up in relation to pharmaceutical innovation (Bourgeron and Geiger 2022). Still, current development and marketing of gene therapies make a temporal analysis of such debates particularly pertinent as these therapies are often expected to be one-time treatments with potentially lifelong effects whose pricing is justified based on such, necessarily uncertain, future 'horizons of expectations' (Bryant and Knight 2019). Lifetime cures are longed for by patients with rare diseases and could radically change individual futures. Yet, in resource-constrained healthcare systems, the expected increase in advanced, high-cost therapies inevitably raises questions about how to balance patient access in the present with the promissory horizons of a cure for a few (Green et al. 2023). In the pharmaceutical sector, such discussions are likely to become more prevalent as advanced one-time therapies will continue to present prophetic potential without much past precedent, leading, as we showed, to highly contestable temporal layerings. Clearly, these different configurations of 'the good' will remain open to critique and contestation as long as actors draw on differing pasts and futures. While our case demonstrated a few such mobilisations of temporal layers, we could have pointed to others, by other actors or in other places.

A temporally sensitive analysis thus produces new openings for critique as it points to the contingency of existing practices in these markets and may allow the excavation of those that had been 'layered over'. For instance, it is not a given that the best possible outcome of a start-up is to be acquired by bigger pharmaceutical companies. If the future beyond the typical three-to-four-year payback horizon for venture capital was made more visible, it would render present

economic valuations vastly different (Doganova 2024). It is not a given that drug prices are increasingly tethered to speculative stock market expectations (Roy 2023), or that the main economic incentive structure of pharmaceutical innovation consists of 20-year patent monopolies (Geiger and Bourgeron 2023). If in these and other cases the temporal layering built into certain models of innovation are made explicit, they can be challenged more easily. For example, past public R&D investments, which are often obscured in price negotiations, could serve to strengthen public bodies' negotiating power. Alternatively, the peculiar economic temporality imposed by patents could be replaced with nearer-term innovation prices or R&D vouchers that would compensate firms for actual innovation efforts rather than future market returns (Mazzucato and Roy 2019).

Overall, our analysis demonstrates how temporal layers are mobilised and come to count in the valuing of objects, often against alternative layerings. We propose this analytical sensitivity as one way to advance critique of economies that claim to be 'good'. While Asdal and colleagues developed their concept of the 'good economy' mainly in relation to environmental concerns espoused through the 'bioeconomy', this article focuses attention on how the 'goodness' of medical goods is promoted and contested in the pharmaceutical sector – as another 'bioeconomy' (Birch and Tyfield 2012; Mittra and Zoukas 2020). In both fields, the juxtaposition of 'bio' and 'economy' already hints at the temporal controversies that may arise when questions of 'bios', of life, spanning (sometimes multiple) lifetimes, are brought into the vicinity of economic calculations, with their concerns firmly rooted in the present and (often near-term) futures (Adams et al. 2009). Indeed, at the core of this amalgamation is a 'desire to generate new types of value from the monetisation of … biological processes and technologies' (Mittra and Zoukas 2020: 3), a desire that at its core is promissory but is also sourced from creating certain continuities and breaks with the past. We maintain that a fine-grained temporal analysis can provide new openings to questions of valuation in these bioeconomies. These range from exploring explicit contestations over temporal horizons of 'bios', such as in Kinsella's (2020) case of nuclear waste, to those where temporalities directly feed into actors' economic valuation processes, as in Kragh-Furbo et al.'s (2023) case of 'temporal prospectors' in electricity aggregation. Attention to temporalities may also help explain how the promissory politics surrounding bioeconomies may hide present assetisation processes (Birch 2017). How do normativities in the form of past experiences and visions for the future shape what temporal layers are rendered visible in such contestations of 'the good'? How is value established in the present when actors draw on incompatible temporal layers, all claiming to be concerned about these economies' (and their objects') 'goodness'? And most

importantly perhaps, how can those temporal layers that lie obscured be unearthed through critique?

Attention to the temporal orderings made locally by different actors to determine what is 'good' cannot be seen in isolation from broader political and economic conjunctures. Newer contributions within valuation studies have started to 'politicise' the field (Helgesson et al. 2017). Our article demonstrates that these contributions can be enriched through a temporal sensitivity, which not only shows how 'things could have been otherwise', but which additionally draws attention to the fact that 'things can still be (layered) otherwise' by bringing different horizons of experience and expectations into view.

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The research protocol that forms the basis of this work has been reviewed and approved by the Institutional Review Board of VIVE – the Danish Center for Social Science Research.

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Theme issue contribution

On Green Swans and Catastrophic Futures: Climate change as risk and uncertainty in central banking

Stine Engen

Abstract
This article analyses how central banks understand the financial risks thought to arise from climate change as uncertainty within complex systems rather than risk as something statistically measurable. In line with pragmatic sociology, I investigate what this uncertainty enables, instead of taking it to be an epistemological limit to knowledge. Analysing a 2020 publication by the Bank for International Settlements and Banque de France called 'The green swan', I show how 'climate risk' is framed as a 'black swan', a conceptualization taken from the field of complexity theory, meaning unlikely, extreme events that cannot be predicted, implying a critique of economic expertise. In the figure of the green swan, however, the statistically improbable climate crisis is additionally framed as a certainty. I argue that 'the green swan' through this tension works to include critique and value financial climate risk as a 'good' in order to provoke a precautionary response on this risk instead of proposing more explicit political measures on climate change. This demonstrates that while uncertainty challenges economic expertise, it also enables the linking together of the 'good' of the climate and the 'good' of the financial system, bringing them together in the politics of climate change.

Keywords: climate risk; green central banking; document analysis; finance; uncertainty; critique

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Introduction

To the financial mind, a recent consensus has emerged that the future is not only catastrophic but that we are living on the very brink of several crises, happening all at once and intersecting in complex ways.[1] This entails acknowledging the acuteness of the so-called European energy crisis, the war in Ukraine, the Covid-19 pandemic, and most detrimental of all, the climate crisis. It also means that these so-called crises should be understood as threats towards creating a *financial* crisis. Climate change especially is increasingly taken to be such a threat to the financial system, and accordingly, many central banks have started to include climate change in their operations as a specific form of financial risk in order to avoid a climate-induced financial crisis.

Central banks' work on climate change should be understood, more generally, as part of an increasing intermingling of financial and climate concerns (Bridge et al. 2020; Chiapello 2020). To understand this intermingling, the notion of 'climate risk' is important as it is one of the key concepts around which finance organizes its work on climate change (Christophers 2017, 2019; Täger 2022; Engen and Asdal 2024). Central banks have also been called on to act on climate change, and it has been noted how 'green central banking' holds promises to fill the green transition's identified 'investment gap' in the form of a 'Green Keynesianism' or 'Green New Deal' (Langley and Morris 2020). It is, however, not immediately obvious how climate change has come to be an issue for central banks, and it is a development that must be viewed together with a broader change in financial regulation that has been taking place since the 2008 financial crisis – an event which spurred a new form of crisis management in central banking (Langley 2015). Although a fundamental societal role of central banks is the management of currency within some country or monetary union, central banks have in recent years taken on a role as a form of ultimate lender in times of crisis, through which they have arguably also gained greater importance and structural power (Harvey 2011; Bowman et al. 2013).

Tied to this change in roles, the framing of climate change as a form of financial risk that can be managed by central banks also follows a changed understanding of the notion of risk itself. For example, after the financial crisis, the Bank of England went through a problematization and questioning of what exactly constituted financial risk, leading to a broadening of the term, so that the bank started to include not only climate change but also cyber security and Brexit into their risk analysis (Morris 2018). Writing immediately after the 2008 crisis, Tellmann (2009: 17) noted how 'the catastrophic nature of the

[1] For example, the 'Global risks report 2023' by the World Economic Forum was introduced in an accompanying article with the headline: 'We're on the brink of a "polycrisis" – how worried should we be?' (Torkington 2023).

financial crisis' was perceived by the Basel Committee on Banking Supervision as a result of lacking risk estimation, not as faulty calculations, but as a 'failure of imagination' about what the future held in store (Basel Committee on Banking Supervision 2009: 17, cited in Tellmann 2009). The financial future was now 'uncertain', 'complex', and 'unknown', made up of 'fractals', 'fat tails', and 'tipping points' (Tellmann 2016). Catastrophe was hence expected, Tellmann (2016: 75) writes, as 'the future is not an indeterminacy to be seized, but an incalculable event with potentially catastrophic bearings which are to be anticipated and prepared for'. To deal with such catastrophic uncertainty, Cooper (2011: 373) has noted how discussions on regulatory reform after the financial crisis included calls to integrate 'complex systems theory', which is 'interested in how systems adapt, evolve and self-organize not in spite of crisis but *through the very means of crisis*'. In this way, according to Cooper, central banks found a way to pre-empt crisis, even when it was established that it could not be predicted through calculative devices. Contrary, then, to what economists like Friedrich Hayek predicted, complex systems theory has led not to the demise of the centralized economic governance of central banks, but rather to a change in their institutional authority, fuelled by the threat of crisis (Cooper 2011).

This article follows these identifications of a shift to uncertainty and complexity theory within central banking and shows how the theorizing of risk as uncertainty within complex systems is now being used by central banks to understand and work on climate change. More concretely, I analyse a 2020 publication by the Bank for International Settlements (BIS) and Banque de France called 'The green swan: Central banking and financial stability in the age of climate change' (Bolton et al. 2020).[2] I show how the risks thought to arise from climate change are framed as 'black swan events', a conceptualization taken from the field of complexity theory, meaning unlikely yet extreme events that cannot be predicted. The black swan theory, in this way, implies an explicit critique of the economic knowledge and expertise of central banks. I show how, through a twist of uncertainty, 'the green swan' turns this critique from a critique of expertise to a critique of modelling, where expertise is in fact crucial to reframing the issue to make it knowable and so pre-empt the crisis. As I argue, 'the green swan' thus separates the authority of central banks' expertise from the models they make use of. In making this argument, I follow Tellmann (2016) in taking uncertainty not as indicative of an epistemological limit to knowledge, but rather as a pragmatic 'tool of critique' that enables 'shifting epistemologies and changing regimes of governing the future'. I further show how, to manage uncertainty, 'the

[2] Since the document itself plays a significant role in the analysis, it will be referred to not by the standard 'author, date', but as 'The green swan'. The full reference can be found in the reference list as Bolton et al. (2020).

green swan' turns the statistically improbable climate crisis into a catastrophic certainty. I argue that the tension that arises between uncertainty and certainty is indicative of a dilemma central banks face in wanting to incorporate the critique of modelling while not wanting to step out of an 'expert', 'non-political' role. As an alternative to this, I argue that 'The green swan' document works as a 'tool of valuation' (Asdal 2015) that aims to make financial climate risk into a 'good', and value it as such a 'good' so that such risks are taken into consideration by both financial and political actors, thus relieving central banks of having to take explicit climate action. I propose to understand this move as a governing of climate change in the form of a 'good economy' (Asdal et al. 2023), first turning climate change into financial risk and then managing this risk by valuing it as a 'good'. Importantly, this 'good' is at once composed of the stability of the climate system and the financial system. As this demonstrates, even if uncertainty complicates economic expertise, it may also be used to tie together different issues and the normativity that comes with them, making financial climate risk into a 'good' to be dealt with in the politics of climate change.

While Banque de France, one of the two institutions behind 'The green swan', is perhaps familiar to many as the central bank of France, the Bank for International Settlements (BIS) remains a more obscure institution. The activity most closely associated with the BIS is the Basel Committee on Banking Supervision, which is the primary global standard setter for banking regulations, creating so-called 'soft law'. This 'Basel system' saw the light of day in 1974, when, after the tightly regulated Bretton Woods system had been dismantled, the new stream of global and deregulated finance was seen to cause instability in financial markets and ultimately banking crises (Borio et al. 2020). In more common terms, the BIS is often called 'the bank of central banks' (Hayes 2022) and even 'the secret bank that runs the world' (LeBor 2013). A more sobering understanding of the BIS is laid out by Westermeier (2018: 171), who proposes to think of it as 'an influential think tank within the community of financial policy-makers', and so an important part of 'the epistemic community of central bankers'. This view echoes how the BIS presents itself: on the question of whether it is a 'research institution', their in-house podcast 'BISness' established that 'it is, and it always has been' (BIS 2020). This is how I will think of them here.

Following from this, I analyse 'The green swan' as a product of these two institutions but also, more broadly, as tied to a larger network of central banks and the ongoing knowledge creation on the interlinkages of climate change and the financial system. In this article, I focus on how the issue is presented and modified in the document and not on the document's audience or how it has circulated and been put to work more concretely after being published. More specifically, I

analyse 'The green swan' following a practice-oriented method of studying documents (Asdal and Reinertsen 2021), drawing on lessons from material semiotics, which highlights how documents are not simply text, but should be analysed as material tools that take part in shaping the issues they present. To give some indication of its reach as a knowledge object, however, it should be noted that 'The green swan' has amassed more than 700 citations on Google Scholar in the five years since it was published.

The article proceeds as follows. The first section delineates the different streams of literature my analysis builds on. A primary literature deals with how central banks since the 2008 financial crisis have begun working with a notion of risk oriented towards uncertainty, trying to foreshadow crisis. A second literature offers a theoretical framing by pointing to how risk and uncertainty can be taken to be performative notions that create and frame issues, rather than simply describe them. Finally, an additional literature, on which the article is methodologically based, is oriented towards the use of studying documents to investigate these questions. The next three sections move into the document, unpacking the theoretical underpinnings of the green swan figure, showing how uncertainty as critique is used actively to modify the issue. Through these three sections, I analyse three different forms of uncertainty which are mobilized in the figure of the green swan: uncertainty as a black swan, uncertainty as an epistemological obstacle, and uncertainty as the certainty of crisis. In this last section, I also analyse what form of 'good economy' can be said to emerge and reflect on what this means for 'green central banking'.

Uncertainty and risk after the financial crisis

It is broadly recognized that the 2008 financial crisis marked a shift in the understanding of risk within central banking. The Bank of England, for example, started focusing on analysing a future thought to be different from the past and 'a concern for extreme or possible financial events, rather than normal or probable ones' (Morris 2018: 1). Studying one response to the crisis, the US Treasury's Supervisory Capital Assessment Program (SCAP), Langley (2013) has noted how this so-called 'stress-test' marked 'a very public turn to anticipatory techniques designed to ensure preparedness for low-probability, high-impact events'. It was a rejection of more traditional, calculative, and statistically based risk modelling, which was now put under critique, as it was not just the future-oriented aspect of stress-tests and scenarios that made them attractive as modelling alternatives, but also that they were thought to be 'non-statistical' (Langley 2013: 12). These new models were, however, no less concerned with seeking truth and leaving the uncertain future open. In fact, the European Central Bank

used stress-testing as a 'truth operation' to assess if banks could withstand the 'stress' of a financial crisis (Violle 2017). In this sense, it has been said that the government and regulation of the 2008 financial crisis provided 'a significant spur to the development of techniques that govern through, as opposed to against, uncertainty' (Langley 2015: 11).

This shift to governing *through* uncertainty has, however, not been viewed as wholly unproblematic. Many economists have, for example, noted how this new focus on 'uncertainty' and 'future-oriented systemic risk' has led central banks into new territory, both in terms of underdeveloped economic science (Goodhart 2015; Thiemann 2019) and in terms of their expert status (Thiemann et al. 2021: 1434). The political scientist Jacqueline Best (2022: 2) has called such situations 'uncomfortable knowledge' because 'central banks' authority is linked to their expertise, the knowledge that is often most uncomfortable for them is the fact of their own ignorance in the face of an uncertain economy'. In this take on things, uncertainty becomes a category representing a limit to knowledge, which hinders the economist from successfully using traditional calculative methods (Bronk 2009; Beckert 2016; Beckert and Bronk 2018).

If uncertainty represents such a limit to expertise, what are we to make of the fact that it is introduced as a critique from within the ranks of central banks themselves? Bear (2020: 2) has recently noted this critical tendency, specifically within central banks that 'question formal equilibrium models and explore the human foundations of economic action'. It is a critical trait that, according to Bear, is recognizable in that it has been internalized in the very practices and institutions that are the subject of critique. The analysis echoes the argument, famously made by Boltanski and Chiapello (2018), that *capitalism*, which they understand to be 'capital accumulation', gains its legitimacy by transforming itself in accordance with the criticisms it is faced with. This has the perhaps discouraging consequence that the same ideas that offer a substantial critique of economic order can also be used to legitimize and uphold it (Boltanski and Chiapello 2018: 20). To examine how such criticisms function, Bear (2020: 2) suggests analysing them as 'technologies', where such technologies can be anything from, for example, promotional brochures, international agency reports, or risk analyses, which are 'deployed to anticipate the future; to stimulate its emergence; and to control it' (Bear 2020: 8).

The question then becomes what this turn to uncertainty entails and enables, shifting the focus away from what it proposedly limits. In this way, following Tellmann and more broadly the pragmatic approach, 'uncertainty and unknowability is but a name for a reorganization of knowledge production' (Tellmann 2016: 67). Doganova (2024) has made a similar shift in her analysis of how the staging of the financial future as 'uncertain' has worked to devalue the future through

discounting it, the most detrimental consequence of which is the political inaction on climate change. Similarly, in his studies on risk, Power (2016) has underlined how risk is not something out there, but rather that 'riskwork' is the work occupied with the making of things into risk, and linked to this, legitimizing who should manage it. This indicates that risk management is highly performative in that 'the ability to package it and make it visible and institutionally acceptable must be understood as an outcome of varied forms of riskwork rather than a starting point or presumption' (Power 2016: 8).

There are clear parallels between Tellmann, Doganova, and Power's understandings of how the management of 'uncertainty' and 'risk' is performative. Importantly, this entails that the stark separation between these two terms, often held up in economic theory and attributed to the economist Frank Knight, is a misleading route to follow in understanding how riskwork functions, since this separation is arguably part of the very riskwork itself. Moreover, it points out how framing risk as uncertainty does not have to be uncomfortable for central banks but can be used actively and strategically to organize governance on certain issues. The central banks' work on turning climate change into a certain form of uncertainty or risk – for example 'a green swan' – can in this way be seen as such performative riskwork, where the shaping of the issue as a specific risk issue both brings the figure of the green swan into being and negotiates who should work on and manage this risk.

In line with other work (Engen and Asdal 2024), this article investigates the ongoing shaping of climate change as a certain type of risk, treated as an empirical object, 'asking when and how uncertainty [or risk] is mobilized and by whom, what forms it takes, and what effects it produces' (Doganova 2024: 170). This pragmatist take consequently also means paying attention to the ambivalences and 'mess', as John Law (2004) would put it, that appear in the effort to theorize climate risk. As I will show, such mess is quite present in the figure of the green swan. Investigating how uncertainty works as a 'tool of critique' (Tellmann 2016) is hence oriented towards paying attention to how negotiating uncertainty is a way of organization, or alternatively, how economics is not mainly a theoretical endeavour but a means of administration (Langley 2015: 9).

In this article, I study central banks' work on climate change through publicly available, published documents. Others have more generally noted the importance of looking at written material produced by central banks and understanding these documents as part of their governing strategy. For example, Hall (2008) has suggested that the governance mechanisms of central banking, which are based on the task of creating, valuing, and destroying money, are more social than mechanical, and make use of 'discursive practices.' Holmes (2013) has similarly argued that the communications of central banks work

performatively and subsequently create an 'economy of words.' By studying the document analysed in this article in a practice-oriented way (Asdal 2015; Asdal and Reinertsen 2021), the aim is to tie this discursive layer to a material semiotic insight into how documents may also work as tools for reorganizing knowledge production on climate change. More generally, practice-oriented document analysis springs from the turn to practice in the social sciences, and specifically actor-network theory, material-semiotics, and Foucauldian governmentality studies, where the proposed separation between what is called 'the discursive' and 'the world outside of the text' is renegotiated (Asdal and Reinertsen 2021). In that sense, 'documents are tools through which the world is modified and transformed, and these specific and ongoing modifications are made into our objects of study' (Asdal and Reinertsen 2021: 217). Following this take on documents, I use the notion of 'tool' in the material-semiotic sense, referring to the green swan as both the semiotic figure that is set up and the document of the same name. It is in this sense that I take 'The green swan' to be a 'tool of critique' and a 'tool of valuation', meaning a material-semiotic tool which facilitates the reorganization of knowledge production around climate risk within 'green central banking', and the financial sector more broadly.

Uncertainty as a black swan

The BIS websites are sober, mainly clad in dark red and grey. By following a drop-down menu to 'research and publications,' among a vast number of publications on central banking and the global financial system, one finds 'The green swan'. Indeed, when opening the file, a swan with bright green feathers is swimming on the front page of the document, its head slightly bowed down.

Figure 1: The front page of 'The green swan'.
Source: The green swan (2020).

As I have already briefly mentioned, the green swan is a twist of the 'black swan,' a highly influential concept developed by risk analyst and financial trader Nassim Nicholas Taleb (2007). Taleb's black swans are part of a theorizing of risk that is oftentimes grouped together in a field called complexity theory, which aims to understand the complexity of systems. In Taleb's use, black swans are events that are highly unlikely and unpredictable, but which should nonetheless cause concern, as they will have extreme consequences if they do occur. That such unpredictable events exist at all poses a great problem to those who aim to know the future, be it for reasons of financial speculation or otherwise. The knowledge problem the existence of black swans leads to is, in this sense, a classical one, echoing David Hume's problem of induction: how can we know that what has happened so far is indicative of what will continue to happen? Or as Taleb begins his book, 'Before the discovery of Australia, people in the Old World were convinced that all swans were white, an unassailable belief as it seemed completely confirmed by empirical evidence' (Taleb 2007: xvii). The discovery of black swans – which do exist in nature – broke the former belief that all swans were white. To Taleb (2007: xvii), the existence of black swans

> illustrates a severe limitation to our learning from observations or experience and the fragility of our knowledge. One single observation can invalidate a general statement derived from millennia of confirmatory sightings of millions of white swans. All you need is one single (and, I am told, quite ugly) black bird. (Taleb 2007: xvii).

As a financial trader, Taleb (2007: xxvii) uses the figure of the black swan to point to what he calls 'the structure of randomness in empirical reality', which to him indicates that calculative efforts to measure risk are futile and that 'the reason free markets work is because they allow people to be lucky, thanks to aggressive trial and error, not by giving rewards or "incentives" for skill' (Taleb 2007: xxi). In this way, Taleb's black swan not only serves to repeat Hume's inductive problem but also puts forth a harsh criticism of economic experts, which Taleb scorns throughout the book as 'empty suits' (Taleb 2007: xx) that are 'phenomenally skilled at self-deception by burying the possibility of a large, devastating loss under the rug' (Taleb 2007: 43). A list of 'experts who tend to be … not experts' even explicitly mentions 'Bank for International Settlements staff' (Taleb 2007: 146–147), making the fact that the BIS has brought Taleb's black swan into its own work somewhat surprising. By making use of the notion of the black swan, which so explicitly challenges central bank expertise, the green swan document hence makes its first move as a tool of critique, internalizing the critique of expertise that this uncertainty brings with it.

'The green swan' document presents 'black swans', in line with Taleb's definition, as made up of three characteristics: (i) they are unexpected and rare, thereby lying outside the realm of regular expectations; (ii) their impacts are wide-ranging or extreme; (iii) they can only be explained after the fact. (The green swan 2020: 3). More technically put, black swans fit so-called fat tailed probability distributions (The green swan 2020: 3). Unlike Gaussian distributions, where extreme events are relatively rare, a fat tailed distribution places a higher probability on such events. Thus, a fat tailed distribution of financial losses means that large and potentially ruinous losses may occur with an unacceptably large probability. Due to their fat tails, a further problematic quality of such distributions is the inability to quantify this uncertainty in estimated losses since the variation of losses can be infinite (Hayes 2023). To look at the world as filled with 'black swans' is hence to look at the world as both catastrophic and unmeasurable, a dire situation that calls for 'alternative epistemologies of risk, grounded in the acknowledgment of uncertainty' (The green swan 2020: 3).

However, instead of representing a limit to the expertise of central banks, the figure of the black swan, and the theorizing of uncertainty it brings with it, is presented in the green swan document as something

that is meant to aid in 'framing the problem' that climate change poses to central banks (The green swan 2020: 6). Climate change is hence represented as a 'green swan' – that is, a 'climate black swan' (The green swan 2020: 3) – indicative of 'radical uncertainty associated with a physical, social and economic phenomenon that is constantly changing and involves complex dynamics and chain reactions' (The green swan 2020: iii). It is 'a new type of systemic risk' made up of 'interacting, nonlinear, fundamentally unpredictable, environmental, social, economic and geopolitical dynamics' (The green swan 2020: 6).

To define such 'climate risks', 'The green swan' makes use of the now highly referenced speech, 'Breaking the tragedy of the horizon', given in 2015 by former governor of the Bank of England, Mark Carney. Speaking in front of the insurance and reinsurance market, Lloyd's of London, considered to be the heart of the global insurance industry, Carney (2015) made the claim that climate change poses the risk of creating financial crisis if not taken into account by financial professionals. To explain how climate change could create financial crisis, Carney's speech established two main subcategories for how 'climate risk' should be understood, 'physical risks' and 'transition risks', which 'The green swan' also makes use of. Physical risks 'represent the economic costs and financial losses due to increasing frequency and severity of climate-related weather events (e.g. storms, floods or heat waves) and the effects of long-term changes in climate patterns (e.g. ocean acidification, rising sea levels or changes in precipitation)' (The green swan 2020: 17). Transition risks, on the other hand, 'are associated with the uncertain financial impacts that could result from a rapid low-carbon transition, including policy changes, reputational impacts, technological breakthroughs or limitations, and shifts in market preferences and social norms' (The green swan 2020: 18). Notably, while the so-called physical risks are related to changes in the climate itself and the so-called transition risks are related to changes in the political climate (be it policy reforms or shifts in social norms), what these risks are fundamentally about is how climate change can create potentially extreme financial losses. Related to the final category, transition risks, the main issue is 'stranded assets' (The green swan 2020: 18), meaning, for example, fossil fuels that cannot be taken out of the ground as a result of political changes and therefore become 'devalued' (The green swan 2020: 19).

The possibility of such a large-scale devaluation is then why climate change may create a financial crisis; again, 'The green swan' quotes Mark Carney who called it a 'climate Minsky moment' (Carney 2016: 2). Such a 'Minsky moment', named after the economist Hyman Minsky, refers to the paradox that when markets seem stable, the perception of this very stability may fuel excessive risk-taking and speculation, creating an internal market dynamic that consequently

may lead to an abrupt and unexpected crash (Ganti 2024). There is some kinship between the notion of black swans and the Minsky moment in that they both build on the idea of extreme and detrimental events happening in situations where prior events have not held signs of warning. In fact, in *The Black Swan*, Taleb (2007: 78) refers to Hyman Minsky as someone who, like him, emphasizes 'fundamental uncertainty' and, because of this, has become a sort of misfit, placed 'outside the mainstream economic departments'. In the green swan, the connection between the two notions is also made by saying that 'green swans' are both 'climate black swans' (The green swan 2020: 3) and 'climate Minsky moments' (The green swan 2020: 42).

What these different conceptualizations of uncertainty show is that even if uncertainty may function as a critique of central bank expertise, it is put to work in 'The green swan' to highlight instead the importance of central banks. Presented as a form of uncertainty that can create a financial crisis, climate change becomes an issue for central banks, as central banks have a mandate to uphold financial stability and therefore need to deal with the instability caused by climate change. As it is put, the uncertainty of the issue, or in more technical terms, the existence of 'fat tailed probability distributions', suggests a need for regulation in financial markets (The green swan 2020: 3). However, building from a theory that to a large degree refutes this type of expertise, it is not clear how to proceed, even if governing climate change has been fitted into central bank mandates. As we will see, a twisting of the uncertainty is needed to make it not an ontological problem but a knowledge problem, solvable by expertise.

Uncertainty as an epistemological obstacle

The uncertainty inherent in the black swan theory does pose some quite serious concerns for the possibility of modelling the economic consequences of climate change. Building on this, 'The green swan' develops a critique of a variety of economic solutions to climate change, largely denouncing the viability of economic modelling, precisely because the issue is thought to be too complex and uncertain to fit into these models. Nonetheless, this critique is not presented as a limit to central bank expertise. Rather, 'The green swan' turns the critique of the black swan from a critique of expertise to a critique of modelling, where expertise is in fact crucial to reframe the issue to make it knowable.

Developing on what the understanding of uncertainty means for the possibility of economic modelling, 'The green swan' puts forward a critique of the proposed solutions to climate change made by 'mainstream economics' or 'economic textbooks' (The green swan 2020: 6–7). This so-called mainstream view is presented as one that

takes climate change to be 'an externality that, as such, should be dealt with through publicly imposed Pigovian carbon taxes in order to internalise the climate externalities' (The green swan 2020: 6). Taking climate change to be a negative externality that can be given a price has indeed been a standard way of addressing climate change economically. Defined in economic terms, a negative externality refers to some negative effect that a transaction of an economic good has on a third party who did not take part in the initial transaction (Kenton 2024). While this solution would work in 'a perfect Walrasian world' – meaning a world where markets work perfectly according to equilibrium theory – it is not likely that it will be possible to find the right data to set a correct price on carbon, 'The green swan' argues, because of the 'complexity' and 'uncertainty' of the issue (The green swan 2020: 6). The criticism of pricing externalities is then a criticism of state-based solutions, which aim at imposing carbon taxes, but also of market-based solutions, which rely on such pricing.

Instead of trying to find the right data to set a correct price, 'The green swan' notes that 'A consensus is emerging among central banks, supervisors and practitioners' to use 'future-looking, scenario-based methodologies' to work on climate risks (The green swan 2020: 22). In fact, one of the main ways climate change has been taken into central banking is through the so-called 'scenario mappings' developed by another central bank nexus, the Network of Central Banks and Supervisors for Greening the Financial System (NGFS), of which both Banque de France and the BIS are founding members.

Since it saw the light of day in 2017, the NGFS has become an influential actor in financial spheres and has published a significant number of reports on how climate change can lead to financial crisis and therefore needs to be taken into consideration by central banks (NGFS 2018).[3] Their proposal for how to take in climate risks has been through these scenario mappings, which 'The green swan' describes as seeking to 'set up plausible hypotheses for the future', contrasting 'traditional' or 'probabilistic approaches to financial risk management' (The green swan 2020: 22). It is beyond the scope of this article to go into detail on how the NGFS 'scenario mappings' are set up (but see for instance: Täger 2022; Violle (forthcoming)). For our purpose here, it suffices to note how these scenarios are attempts to model the economic consequences (or risks) of climate change into the future and move away from a type of modelling that works with historical data.

[3] NGFS was established under the One Plant Summit, held in Paris on 12 December 2017, exactly two years to the day after the Paris Agreement, with a stated focus on developing financial solutions for aiding the green transition. Since its inception, it has grown quickly, and as of 29 May 2024, NGFS consists of 141 members and 21 observers (NGFS 2019c).

The focus on uncertainty is also phrased quite explicitly in the 'scenarios portal' of the NGFS (2024), where the visitor is met with the words: 'The future is uncertain. The NGFS climate scenarios provide a window into different plausible futures.' In the NGFS reports, climate change is also presented as uncertainty as opposed to measurable risk, related both to the development of the physical impacts of climate change itself and to the way these changes will affect the economy through 'complex transmission channels' (NGFS 2019a). Following on from this, the NGFS puts forth a critique of 'macroeconomic models', which are thought to be unable to 'accurately predict the economic and financial impact of climate change' (NGFS 2019a: 4). One particular set of models that is critically scrutinized are integrated assessment models (IAMs), which have long been standard when analysing connections between economic activity and climate change on a systemic scale. These models cover a variety of approaches and are widely used (for example, by the IPCC) to show how changes in our climate affect the economy and vice versa. Generally, they combine climate science, showing how greenhouse gas emissions affect temperature increases, with an economic module that links these temperature increases to economic outcomes and policy (see, for instance, Cointe et al. 2019). Ultimately, these models are meant to show how the economy and the climate coevolve.

Several criticisms of IAMs are presented in the NGFS reports, related to the models' treatment of uncertainty, explained technically in that 'IAMs are typically recursive dynamic general equilibrium models solved deterministically' (NGFS 2019b: 4). Specifically, the fact that they are equilibrium models indicates that they assume a state of normality, which is no longer taken to hold under uncertainty. 'The green swan' follows up on this criticism of IAMs and is even more denouncing, stating that 'the deep uncertainty related to physical and transition risks means that both the neoclassical approach of most IAMs and alternative approaches such as demand-led and non-equilibrium models will remain unable to capture many forces triggered by climate change' (The green swan 2020: 27). As it is put, IAMs 'can be used to obtain almost any result one desires' and are thus 'grossly misleading' (The green swan. 2020: 71). Finally, even if the establishment of the NGFS is brought out as a positive development, the NGFS scenario mappings are also placed under critique because, since they build on IAMs, they 'inevitably inherit all the limitations of the climate-economic models' (The green swan 2020:

33). The conclusion becomes that what is needed is to go 'beyond models' (The green swan 2020: 43).[4]

In this way, 'The green swan' performs a fundamental critique of the ability to economically model climate change, including solutions proposed by central banks; but this does not mean that it presents the issue as *unknowable*. Rather, what we are faced with is an 'epistemological obstacle' (The green swan 2020: 21). This reference to the French philosopher of science Gaston Bachelard (1993) indicates that the current problem with developing models is not immediately a technical problem tied to 'the difficulty or complexity inherent to the object studied (e.g. measuring climate-related risks) but to the difficulty related to the need of redefining the problem' (The green swan 2020: 21). Put differently, the epistemological obstacle does not indicate that the uncertainty of the issue is so great that it can *never* be known, but that the current understanding of the problem poses a hindrance to knowing it. Or, the models are the obstacle, since 'scientific methods and intellectual habits that were useful and healthy under certain circumstances' have now become increasingly 'problematic' to the extent that they 'hamper scientific research' (The green swan 2020: 21).

One way to understand this move in 'The green swan' is to see how it moves the critique of uncertainty from marking a limit to the possibility of knowledge, and hence the possibility of expertise on this knowledge, to a critique of models. Unlike the notion of uncertainty put forth by the black swan, which questions not only knowledge but also expertise, uncertainty as an epistemic obstacle upholds the importance of expertise and places the problem with current methods. This latter uncertainty is then of a different sort than the one we find in the figure of the black swan, as it does not characterize a form of precondition to knowledge as such, but only within the current way of thinking about the issue (a reference to Kuhn's (1997) paradigm shifts is used to make its point (The green swan 2020: 21)). 'The green swan' hence works as a tool of critique by twisting the critique of expertise to separate the authority in this expertise from the models it makes use of. The ambivalence that arises in simultaneously promoting and criticizing the NGFS can be taken to be a result of this separation, commending the authority of the network and their way of working but not the specific models. In fact, the separation showcases an interesting effect of 'The green swan's use of critique as it allows for being critical of the modelling behind scenario-mapping while equally promoting the future-oriented work done by central banks.

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[4] It should be noted here that there exist several different types of IAMs and that the original models developed by Nordhaus, for instance, differ from the current models used by the IPCC. In 'The green swan', different IAMs are mentioned, but since they are all subjugated to the same critique, their differences are not elaborated on here. See, for instance, Cointe et al. (2019) for more on the heterogeneity of IAMs.

Uncertainty as the certainty of crisis

So far, I have shown how 'The green swan' puts forth a critique of economic solutions to climate change, taking care to separate it from the authority of central banks. The critique of modelling, however, leads to another problem as it pushes central banks into a more explicit political role, which is highlighted as problematic in 'The green swan'. I argue that to resolve this 'The green swan' works as a 'tool of valuation' that aims to make financial climate risk into a form of general 'good' that must be managed by financial actors and by climate policy makers. I propose to understand this move as one setting up a 'good economy', which turns climate change into a financial risk issue and further proposes to govern this risk as a 'good' rather than through either modelling or more explicit political climate action on the part of central banks.

I have so far not touched on one element of the figure of the green swan, which makes it quite different from what Taleb had in mind when conceptualizing his black swans. Because even if green swans fit the image of black swans in that they are unlikely, extreme, and unpredictable, 'The green swan' states that the effects of climate change will materialize with 'a high degree of certainty' (The green swan 2020: 3). That is, even if green swans are both unlikely and unpredictable, they are also to some extent certain, and thus the figure of the green swan takes a somewhat paradoxical shape. Not only is there 'certainty about the need for ambitious actions despite prevailing uncertainty regarding the timing and nature of impacts of climate change', but it is also the case that 'climate catastrophes are even more serious than most systemic financial crises: they could pose an existential threat to humanity, as increasingly emphasized by climate scientists' (The green swan 2020: 3). The certainty is thus presented as both an epistemological question (something we know will happen) and a normative question (an existential threat). Whether this construction holds theoretical sense, particularly in saying that something certain cannot be predicted statistically, will not be the issue here. The goal is rather to follow the figure of the green swan and see what effects this construction creates.

A first thing to notice is that since the form of economic governance that relies solely on modelling has been established as faulty, the certainty of the climate crisis and the consequent need for action push central banks towards taking more explicit climate action, which is framed as problematic in 'The green swan.' As it is put, central banks 'cannot resort to simply measuring risks (hoping that this will catalyse sufficient action from all players) and wait for other government agencies to jump into action', as 'this could expose central banks to the real risk that they will not be able to deliver on their mandates of financial and price stability' (The green swan 2020: 47). Conversely, it is framed as problematic if central banks, as a result of this, start

entering a more political role that actively supports green fiscal policy, for example by conducting 'green quantitative easing' (The green swan 2020: 47), that is, making non-green capital more expensive. Even if there is a 'growing social demand' for this, as it is put, extending the central bank mandate into this role is presented as unwanted because it can 'overburden' the mandates and requires 'new sociopolitical equilibria, reputation and credibility' (The green swan 2020: 47). Instead, the stated goal is to allow central banks to work on climate change with the objective of preserving their proposed non-political role (The green swan 2020: 48).

As I suggest in this article, 'The green swan' document itself can be understood as an attempt at governing climate risk without either modelling or explicit climate action. Rather, by stating that climate risks are certain, 'The green swan' aims to *value* the financial risks from climate change. It is in this way that I propose that the document can be taken to be a 'tool of valuation', aiming to value financial climate risk as a 'good' to create a performative response to this valuation and thus manage these risks more broadly. This move can be seen not just in how 'The green swan' uses normative language to promote precaution on climate change, but also in how stating the certainty of crisis is assumed to provoke a precautionary response. Believing in the certainty of the climate crisis is, in fact, made out to be a risk management exercise, or, as it is put, 'a hedging strategy against the possibility of green swan events' (The green swan 2020: 8). The strategy to manage risk based on 'faith' is attributed to the French philosopher, mathematician, and physicist Pascal, who argued that 'rational people should believe in God as a "pari" or bet. They would incur small losses of pleasure (by accepting to live a life without excessive pleasures), which would be more than offset by infinite gains (eternity in heaven) if God existed' (The green swan 2020: 8). Thus, 'a pure self-interested risk management strategy recommends buying the proper insurance of ambitious climate policies as a kind of precautionary principle' (The green swan 2020: 8). Another alternative risk management strategy that 'The green swan' brings in is 'Enlightened doomsaying' (*catastrophisme éclairé*), taken from the French philosopher of science Jean Pierre Dupuy (2012). And it could be read as precisely what 'The green swan' attempts to do: 'imagining oneself in a catastrophic future to raise awareness and trigger immediate action so that this future does not take place' (The green swan 2020: 8). It is in this way, I argue, that 'The green swan' works as a tool to value the future as a form of moral horizon to spur a precautionary response even in the absence of precise knowledge.

An apt question is then who is imagined to take this precautionary action. After 'The green swan' was published in 2020, an annual conference has been held in its name, gathering prominent speakers ranging from Al Gore to Joseph Stiglitz to Zhou Xiaochuan, the

former Governor of People's Bank of China. In the opening address at the first edition of the conference in 2021, Luiz Pereira da Silva, who was then Deputy General Manager of the BIS and one of the authors behind 'The green swan', listed the actors the conference gathered: 'policymakers, the community of central banks and regulators in Europe, Asia, Africa and the Americas as well as international financial institutions and development banks. … investors, asset managers, insurance and commercial banks, innovators, researchers in academia, engineers, consumers and, of course, *you* in the audience' (BIS 2022: 4). The extensive list effectively made the point that managing the financial risks of climate change is not the task of central banks alone, rather, the figure of the green swan makes climate risk out to be a more general 'good' for all these actors.

It is this framing of the financial risks from climate change as a 'good' that I have suggested to call a 'good economy', in order to highlight how it both turns climate change into an economic issue, as a financial risk, and aims to govern this risk performatively by making it into a general 'good'. Importantly, the 'good' at stake is at once the stability of the climate and the financial system. 'The green swan' states this quite explicitly: 'financial and climate stability are two increasingly interdependent public goods' (The green swan 2020: 66). This demonstrates a salient effect of how 'The green swan' mobilizes uncertainty. While uncertainty complicates modelling, it also enables the linking together of different issues, since in a world of 'complex adaptive systems', nothing is separate from anything else, and everything must be dealt with in relation to everything else. This interconnection of issues is why climate change becomes an issue for central banks to begin with. It is also why maintaining the stability of the financial system can become a 'good' tied to the normativity inherent in stabilizing the climate, bringing financial risk into the politics of climate change as a 'good economy'.

Conclusion

In this article, I have shown how climate change is now being considered an issue for central banks, following a shift in the understanding of financial risk that has been identified following the 2008 financial crisis. I have shown how central banks, faced with questioning what exactly constitutes financial risk and with a delegitimization of the probabilistic future, understand climate change through the lens of complexity theory and uncertainty, rather than as measurable risk. Through a detailed analysis of a document published by the Bank for International Settlements and Banque de France (2020) called 'The green swan: central banking and financial stability in the age of climate change', I have shown how climate change here takes the shape of a specific form of risk – a 'green swan'. I have

detailed how this figure builds on the influential notion of the 'black swan' developed by complexity theorist Nicholas Nassim Taleb (2007), referring to an unlikely and extreme event that cannot be predicted. In my analysis, I have specifically sought to draw attention to the critique implicit in this notion. Taleb, and to some extent the field of complexity theory more generally, have, with their view of the world as uncertain, questioned the possibility of economic expertise; since the future is viewed as fundamentally unmeasurable, economic modelling – and the central bank experts who make use of them – will fall short in predicting it. As I have shown, this critique is twisted in the figure of the green swan, turning the uncertainty into a critique of modelling but not of expertise as such, hence separating authority in the expertise from the models it makes use of. In this way, I have shown how the uncertainty present in 'The green swan' is no longer a limit to knowledge but an 'epistemic obstacle', where this expertise is in fact needed to fend off crisis and to make climate change knowable.

As I have shown, uncertainty changes in the figure of the green swan to make the point that even if statistically improbable, the climate crisis will happen with catastrophic certainty. This opens for a dilemma where central banks are made to choose between a 'non-political' or 'expert' role, working with models (which have been deemed faulty), and a more explicitly political role, supporting green policy and actively funding the green transition. To avoid this, I have argued, 'The green swan' document uses the certainty of crisis to propose a third route by working as a 'tool of valuation', aiming to make financial climate risk into a 'good' so that these risks are taken into account by both financial and political actors. I have suggested to understand this move by 'The green swan' as one aiming to set up a 'good economy' to deal with climate change. It is a 'good economy' in the sense that it first turns climate change into an economic issue about financial risk, and second proposes to work on this issue by valuing it as a 'good'. With this, I have sought to make the point that uncertainty should not be taken to be something simply standing in the way of economic knowledge. Rather, the flexibility of an uncertain world can be mobilized to turn things into economic issues, and to make these new economic issues 'good' by entangling them with the 'good' of other issues. 'The green swan' shows how climate change has become an issue for central banks but also how they are working to make financial risks from climate change important in the broader politics of climate change. What will come of these efforts, and whether the 'good' of the climate and the 'good' of the financial system are in fact in accordance with one another, is, of course, yet to be seen. And so too are the ambitions of green central banking, which are consequently in the process of being laid out.

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