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Meeting the Problem of Growth in the Anthropocene - The Cultural Political Economy of Research & Innovation

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Introduction

The 2020s will be marked by the many unprecedented environmental challenges of the Anthropocene. It is urgent and imperative that we transform prevailing modes of life globally so that they remain within planetary boundaries. Moreover, we must do so in ways that maximize social justice and equity (as in 'just transition' (Raworth 2017); see Jacobsen, this volume). Chief amongst the ensuing issues is the growth paradox.

On the one hand, we have one planet and finite resources, especially if we are not to interfere catastrophically in natural cycles sustaining life. On the other hand, the current dominant system of political economy at global scale is capitalism. Capitalism is a system with a growth imperative, so that it is either growing or collapsing. Moreover, that growth has to date predominately, and always to some significant extent,[1] taken the form of an increase in consumption of material resources, founded in exploitation of the 'free' (or 'cheap' (Patel & Moore 2017)) 'gifts' of nature (Woods 2002).

Yet it is also the case that realizing a future socioeconomic structure that is ecologically sustainable – let alone regenerative – will involve significant unplannable sociotechnical ingenuity and experimentation from free individuals, and mass deployment of their practical ideas. It also demands that social order does not break down in the meantime, not least because that would frustrate both of these processes of innovation. Growth, however, on some widely-motivating definition, is always needed as a primary integrating element of social order, and especially in a society that is dynamic in fact, as is contemporary capitalism, and/or in aspiration, e.g. aiming for the unprecedented goal of deliberate global just transition.

We thus cannot live without growth because it is needed for both formulation of a new sustainable society and socioeconomic reproduction in the meantime. But we also cannot live with growth because it is killing the planet.. Confronted by this paradox, or what Bateson (1972) calls a double bind, what then can be done?

In this context, a key criterion to judge different perspectives on these issues is the extent to which they enable a loosening of that deadlock, towards more constructive engagement with the growth paradox and its flipside of just transition. The cultural political economy of research & innovation (CPERI) is an emerging approach for strategic thinking on major societal challenges involving technology and innovation.

In this chapter, we will explore how a CPERI approach is particularly promising in opening up ways forward through this strategic paralysis. The usefulness of CPERI hinges on two inter-dependent factors: one substantive; the other modal. First, this approach foregrounds a complex system perspective that admits, and seeks to work with, the complexity of the issues. In

particular, substantively CPERI foregrounds the parallel evolution of the *dominant regime of political economy* and the *dominant model of innovation* in any given case. Secondly, it adopts a mode of engagement that privileges a strategic and ethical stance, rather than a literalistic and objectivist one.[2]

Taken together, CPERI illuminates ways in which prevailing social arrangements and/or, crucially, influential conceptualizations of the issue underpin unwelcome emergent outcomes. This, in turn, offers insights into ways to change these conditions, establishing an iterative and productive momentum exploring new possibilities for ongoing strategic response, but never presuming to present definitive, timeless and universal prescriptions. CPERI is thus essentially a way to enable processes of deep conceptual learning through reflexive strategic enquiry, tailored for an age of complex systems characterised by sociotechnical novelty and macro-scale power structures.

CPERI thus advances our practical understanding not by directly telling us what we should do next. Instead, it offers ways forward by first taking a step back to examine the predicament itself and the way in which one contributes to the seeming paradox in the very way one conceptualizes and/or enacts it. Indeed, this approach is so counter-intuitive, and especially to those most concerned with urgently solving the problem, that it can appear, at best, indistinguishable from familiar critical approaches or, at worst, a needless detour.

To illustrate the benefits and importance of a CPERI approach we will thus compare it with two other theories that ostensibly occupy much the same substantive positioning as CPERI —, namely Degrowth and Responsible Stagnation (RS). CPERI shares with both these approaches: i) a fundamental critique of the capitalist growth imperative and its *prima facie* incompatibility with a finite Earth; ii) thereby also a strong orientation to a critical political economic analysis; and iii) a motivating sense of the urgent need for deep change and for the agency to bring it about. Altogether, these three criteria also make these approaches 'radical' vis-à-vis a pro-growth mainstream; indeed, sometimes self-consciously so. Furthermore, with RS, CPERI shares a focus on innovation as a primary lever of social change.

Yet in its two key characteristics – of a complex system analysis of the relations amongst political economy and sociotechnical change, and its quintessentially strategic stance – CPERI offers insights and reaches conclusions that are quite different to those of these other perspectives. Moreover, it also sidesteps many problems that arise for them.

The rest of the article thus proceeds as follows. In Section 2, we introduce CPERI in more detail. In Section 3, we then turn to a key case study that raises particularly challenging elements of the problem of growth as we actually confront it in the 21st century, namely China. In Section 4, after briefly introducing Degrowth and RS, we then compare all three perspectives regarding two key issues raised by the Chinese case. Finally in Section 5, looking forward, we close by considering the broader agenda regarding sustainability transition that is opened by CPERI, but is as yet barely touched upon.

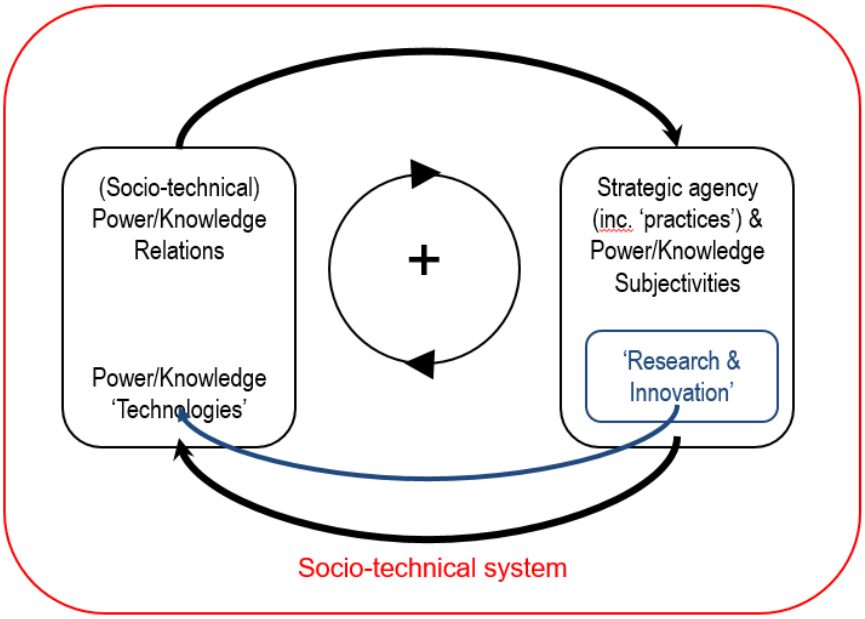
2 Introduction to CPERI

The cultural political economy of research & innovation (CPERI) starts with a step back from any issue of concern, asking 'what is the strategic predicament in which we find ourselves?' Its answer is that we are always already situated within a complex system – and one currently racked with systemic dysfunctions, wicked challenges and crises, epitomized by the growth paradox. We can thus specify the challenge as the endless process of *learning to govern these complex systems well* (Tyfield 2018). A crucial starting point is thus a theorization of complex systems precisely focused on strategically enabling that skilful government.

This remit is met in theorizing complex social systems drawing on the later works of Foucault (e.g. 2009, 2010) on power/knowledge. This approach understands power as the asymmetrically distributed but ubiquitous capacity of agents to act in certain ways given the specific arrangement of social relations. Power is thus active and dynamic, not a thing held by some agents over others. These 'power relations' are also *constitutive* of particular social arrangements, not an extra factor imposed on social realities that already exist objectively.

Moreover, these relations are of *power/knowledge*, since power and knowledge are two sides of the same coin, if often (and crucially) analytically distinguishable. Power inevitably has knowledge characteristics in terms of the knowledge it uses to govern (well or badly) and dominate. Conversely, knowledge realizes power in forms of authority it legitimates and propagates. The resulting complex, dynamic constellations of these power/knowledge relations are constantly enacted by diverse acts and practices of living persons. But these forms of agency, and even subjective identities, are themselves constituted and shaped in turn by those power/knowledge relations.

Figure 1: Complex Socio-technical Power/Knowledge Systems



The result is an emergent system that is never at rest but always actively reproducing and transforming itself (see Figure 1). As constellations of dynamic power/knowledge relations, the difference between a good and a bad society is precisely the extent to which that specific arrangement is capable of working with power and knowledge together to govern itself well.

If we start from the strategic-ethical predicament of complex system government, this incorporates the following key issues. First, it admits the positioning of any analyst as always already situated within the system at hand and indeed themselves constituted by it. In both respects, then, there can be no clear and definitive endpoint to the analysis. One also starts, therefore, from a position of explicitly admitted real ignorance about the actual future, or even any definite conclusions of what it 'should' be.

This marks a significant break with prevailing common-sense approaches; and the more so the more they are focused on solutions. The usual mode of enquiry aims first to get our understanding right before then turning to practical questions. Seemingly sensible, this approach necessarily negates in practice the radical incompleteness, uncertainty and imperfectability of knowledge implicit in a situated complex systems perspective. Instead, the absence of any *ex ante* well-specified goal forces one to adopt a primarily strategic approach where the challenge is always to start from 'here' by illuminating existing power/knowledge relations and the openings therein.

CPERI thus asks '*how* are things as they currently are and, hence, how might one act strategically, here and now?' In contrast, the conventional scientific approach asks 'what is definitively the case, and why?' before then asking a second, separate and speculative question of 'what should be done to resolve the problems, thus defined?' For CPERI, 'solutions' thus emerge iteratively (and always imperfectly) through trying out courses of action that present themselves to this strategic gaze, rather than in formulation of a plan to get from bad 'here' to good 'there'.

Adding flesh to the bones of this approach, one may also acknowledge the emergence, now to unprecedented heights, of a particularly efficacious form of agency that acts directly on the transformation and introduction of *new* levers, or 'technologies', of power/knowledge, namely 'research & innovation' (R&I). By incorporating R&I so centrally into this strategic framework, *innovation-as-politics* is identified as arguably the key substantive concern for any such strategic analysis in the early 21st century (Tyfield et al. 2017a, Callon 2009). Specifically, the dominant cultural, political and economic model of R&I (in any given place and time) is highly significant in the trajectory of change of the complex socio-technical system as a whole, since these two phenomena evolve in parallel.

From here a more fully-fledged cultural political economy of R&I may be developed. In this respect, it is also different to, and transcending of, most political economy and STS, each of which tends to neglect the other (Tyfield et al. 2017a). In CPERI, critical political economy and R&I assume equal and inter-dependent billing. This allows analysis of contemporary

capitalism as essentially dependent upon the power/knowledge fecundity of R&I. Equally, existing R&I dynamics (dominant and alternative) are unintelligible where the systemic drive to constant capital accumulation (i.e. growth) is not taken into account. These two complementary perspectives are connected by the conceptual bridge of a specifically *cultural* political economy, as a transdisciplinary project inspired by synthesis of the works of Gramsci and Foucault (Jessop & Sum 2006).

Altogether, then, CPERI enables analysis of the crucial contemporary dynamic of the parallel and inseparable evolution, possibly over a *longue durée*, of specific *dominant regimes of capitalism* and *dominant innovation models*. Through empirical examination of the latter, a window is opened for a genuinely open-ended strategic investigation of the former and so the system as a whole. Harnessing the capacity of empirical enquiry for surprise, and so learning, this even allows for more concrete rethinking of goals, values and worldviews to emerge in the analysis. Nothing, therefore, need be presumed from the outset.

3 Illustration: Chinese digital innovation-as-politics

CPERI has been used to illuminate various key elements of contemporary socio-technical and environmental challenges, including: geo-engineering or negative emission technologies (Markusson et al. 2018); carbon capture & storage (Markusson et al. 2017); the Brazilian bio-economy (Garvey et al. 2015); local government responses to climate emergency (Yuille et al. forthcoming); and 'digital rebound' (Kunkel and Tyfield forthcoming). Approaches of similar inspiration have also explored the assetization of the bioeconomy (Birch 2016), innovation for sustainable cities (Castan Broto 2019), the management of water resources in Africa (Whaley et al. forthcoming), diverse socio-technical controversies (Flyvbjerg et al. 2012), and a wide range of issues in the 'political economy of science' (Tyfield et al. 2017b). We illustrate its value here, though, regarding the central issue of the growth paradox, as something of a 'hardest case'.

Even stated in the abstract terms above, the problem of growth is paradoxical, demanding a new approach. Yet seeking to tackle it in practice as it actually presents itself reveals even greater complexity, with multiple other factors also intervening. One particularly illuminating and important concrete example of this concerns the likely impact of China in tackling the climate emergency.

China is the rising superpower regarding both global economic growth and, arguably, various environmentally significant technologies (whether with good or ill effect). China's response to the problem of growth is thus set to have an outsized effect at global scale. The likely trajectory of that impact, however, is confusing and unclear. Merely scratching the surface on Chinese innovation and its environmental credentials reveals an arena of strikingly contradictory and confounding evidence; from the largest industrial sector for renewable energy through to the single greatest global source of greenhouse gases in Chinese coal, regarding production, trade, consumption and, increasingly, foreign direct investment (Green and Stern 2017, Hilton 2019). Moreover, situated amidst exceptionally high geopolitical stakes that are ever clearer and more

polarized, debate on the positive or negative environmental effect of Chinese innovation is essentially contested. This lack of clarity is a significant hole in current understanding regarding the growth paradox.

CPERI, however, is particularly illuminating in two key regards. First, exploring contemporary Chinese innovation as a complex power/knowledge system, and from a strategic perspective, can turn these seeming obstacles of politically charged and contested dynamics to its advantage. For CPERI precisely enables a comprehensive empirical examination of this confusing field in terms of a still-unfolding dynamic of innovation-as-politics (Tyfield 2018a, 2018b). This in turn elicits a fourfold analysis that can accommodate all the contradictory evidence and positions into a synthetic overview from which emerges the broad systemic tendency of the turbulence of Chinese innovation (for more details, see Tyfield 2018a,b). Specifically, it transpires that Chinese innovation is thus best understood as a process of exceptional, world-making dynamism precisely because its characteristic, non-linear innovation model (Breznitz & Murphree 2011) *feeds and is fed by systemic disruption* – i.e. the current global predicament – to exceptional degree (Tyfield 2018a,b).

This emergent tendency then raises a second point. With its focus on the co-evolution of political economic regimes and innovation models, CPERI foregrounds the contemporary systemic context as unique strategic circumstance situated in a moment of epochal inter-regnum:. the domination of American financialized neoliberal globalization is disintegrating while a new hegemony has yet to emerge and stabilize (Arrighi 2007). This framing is crucial for insight into the titanic momentum with which Chinese socioeconomic activity is challenging this incumbent regime of capitalism at global scale at this specific juncture (Tyfield 2018a,b).

Moreover, what this incumbent model is changing *to* also becomes embryonically traceable, and as something qualitatively new and surprising vis-à-vis existing orthodoxies. Indeed, plausible, if by no means guaranteed, trajectories of power/knowledge emerge that may deliver a future of sustainable transition (even a 'just transition') in some form. Essential to this outcome, however, is precisely the heightened geopolitical tensions *elicited by Chinese (digital) innovation and infrastructure projects* that are usually discussed purely in terms of being unwelcome developments. For this is what may drive an historically unprecedented process of harnessing socio-technical dynamism to tame global capitalism's environmental impact, in the emergence of a qualitatively new regime of global political economy (Tyfield 2018a,b). What this (Chinese-propelled) sustainable transition is not, then, is any linear and rationally-planned process of ecologizing existing models of economy and innovation.

This approach thus unfolds the surprising and idiosyncratic dynamic of China's disruptive innovation-as-politics, and global responses thereto, both welcoming and antagonistic, as a plausible candidate and process to drive emergence of a new regime of – in the first instance – a Sino-centric greening, digital capitalism. And this new and illuminating understanding of the dynamics of increasing global political tension regarding Chinese innovation is a genuine

expansion of the understanding of the problem with which we started, and from which the paradox of growth arises.

So a CPERI analysis offers particular insight into a key – and otherwise confounding – concrete issue for the growth paradox. But, the Chinese case also raises two critical considerations regarding humanity's actual confrontation with the problem of growth at this point in history. These concern the 'rear-guard' and 'vanguard' of this encounter respectively.

First, the problem of growth is especially fraught in so-called developing countries and regions concentrated in the Global South, including (parts of) China and many countries entering into deeper economic and/or industrial relations with China. Global environmental challenges generated by economic growth affect these poorer countries disproportionately (Roberts and Parks 2006). Conversely, economic growth is still a prerequisite for the building of capacities to mitigate those very hazards.

Secondly, while transforming existing political economies to more sustainable models undoubtedly requires significant innovation, this can only be achieved by exploiting socio-technical possibilities that currently present themselves. The incumbent model of innovation is thus of utmost significance. Today the most dynamic field of such socio-technical change, not least in China, is digitalization. In fact, the capacity for digitalization to deliver sustainable transition remains at best utterly unproven (Hickel & Kallis 2020, Kunkel & Tyfield forthcoming). Regardless, both exploration and mass adoption of promising possibilities for such innovation to deliver new sustainable ways of life depends heavily on economic growth and profit. Whether digitalization reduces or heightens the growth paradox is thus a potentially definitive aspect of that challenge.

As a self-consciously strategic approach, however, CPERI should be judged against its capacity to enable productive thinking with precisely these issues. To illustrate how it does so, and thus the difference it makes, we turn finally to consider each issue in turn, comparing CPERI with two apparently similar perspectives that nonetheless lack the two key characteristics of this framework.

4 Comparison

Before proceeding, we must first introduce the other two perspectives for our comparison. The argument for Degrowth is a simple syllogism of realist, critical political economy (Kallis et al. 2020, Hickel 2020; Chertovskaya, this volume). Growth is killing the planet that is our one and only home and on which we are entirely and asymmetrically dependent. Humanity wants a future. Therefore we must stop growing, and even 'degrow', especially in rich countries and amongst rich groups that already live well beyond planetary means. In contrast, wholesome, slower, post-capitalist futures that are not just environmentally sustainable but qualitatively nourishing and satisfying are proposed. These futures would prioritize considerations of *sufficiency* as against the maximized *efficiency* of capitalism.

Degrowth also marshals growing evidence, compiled on methodologically nationalist grounds, of the possibility of still-high standards of living while meeting the hard limits of planetary boundaries (Hickel 2019 *Cf* O'Neill et al. 2018). In this way, the world will wake up to the catastrophic consequences of (endless) growth, and its dysfunctional hypertrophy of material consumption in the Global North. Degrowth thus dispenses with the problem of growth by denying it is a paradox at all, since it claims that a better world order that neither has nor needs economic growth is a clear and present alternative. Growth, it is argued, is a mistaken and dispensable fetish of modern capitalist society. We might say that the key challenge is thus not so much 'degrowing' as 'de-growth-ing', a neologism akin to decolonizing or decontaminating: i.e. rejecting the malevolent domination of the *ideology* of growth.

Our second perspective, 'responsible stagnation' (RS) (de Saille et al. 2020), tackles very similar ground but based primarily in critical science & technology studies (STS). Although RS is a very new perspective, it is significant as an immanent critique of 'responsible innovation' (RI), a political/policy discourse that has achieved considerable popular purchase over the last decade. Emerging out of increasing political concern regarding numerous technoscientific scandals over several decades, by the late 2000s a new discourse of 'responsible innovation' began to take shape (Guston 2015, von Schomberg 2013, Stilgoe et al. 2013).

'Responsible innovation' presents itself as the optimal outcome for society. Here 'innovation', with a dynamic, prosperous, creative society, is set against 'stagnation', its apparent opposite. Conversely, RI differentiates 'responsible' and 'irresponsible' forms of both in terms of their attentiveness to major negative impacts and externalities. RS embraces the most ambitious interpretation of the agenda of RI. But it also points out the existence of a curious and neglected possibility in this set-up, namely 'responsible stagnation'.

Attending seriously to this possibility opens up two key moves. First, it simultaneously clarifies and emphasizes that it is '*responsibility*' – the 'R' – that is the normative term here, not 'innovation'; and that there is at least the possibility that in some instances the 'responsible' thing to do is *not* to 'innovate' but to slow down, change or reverse course and/or even close down certain lines of sociotechnical possibility (*Cf* Szerszynski et al. 2013 on SRM geoengineering). 'Stagnation' is thinkable as 'responsible', then, where it connotes a necessary space for pausing and possibly renewing (*Cf* Harraway 2016), while continued 'innovation', assuming dominant forms, collides with intransigent and real limits.

In its second move, this in turn opens up space for rethinking the 'I' of innovation; ironically precisely the original agenda of 'RI'. RI itself, though, seems increasingly co-opted as gloss for *de facto* 'business-as-usual', shackled by its foundational attachment to 'innovation', always already understood in particular prevailing ways (de Saille et al. 2020). Conversely, thinking through 'responsible stagnation' enables a 'growth agnostic' approach (de Saille et al. 2020, pp.57, 86, 137) of empirical enquiry that can marshal a generation of STS scholarship to explore different types of innovation otherwise largely overlooked. For instance, RS

foregrounds non-market, organization and/or social innovations (Amanatidou with Gritzas 2020) and/or possibly from diverse places including the Global South (Pansera et al. 2020), not just established 'cores' of hi-tech innovation.

RS thus follows longstanding constructivist STS literatures on R&I democracy (e.g. Jasanoff 2011). This approach notes that there are multiple perspectives and no single 'true' position regarding the impact of new innovations, nor only one 'rational' way to organize and shape them. It follows that what is needed is to 'open up' (Stirling 2008) such sociotechnical trajectories to maximally democratic oversight in pluralistic, inclusive debate. Arguing likewise, the primary goal for RS is discussion and fleshing out of the ethics of 'responsibility' for innovation in such participatory ways. Given essential inclusion of responsible *stagnation* (thus defined), it is also clear that this ethic should at least prioritize 'living gently' and 'restraint' (de Saille 2020, p.19), which RS scholars to date have summarized in terms of an 'ethics of care' (Medvecky 2020, pp.67 et seq.).

4.1 Incorporating the Global South

It may seem that acknowledging continued growth in the Global South – whether purely as descriptive fact and/or as normatively defensible necessity – is a *prima facie* challenge for Degrowth arguments. Indeed, the challenge is explicitly admitted (Kallis et al. 2020, p.103, Rodríguez-Labajos et al. 2019). Yet Degrowth may marshal arguments in its defence. Most importantly for our purposes, understood as 'de*growth*ing', there is a strong case– as legion post/de-colonial and post-development scholars have argued – that 'growthism' (Hickel 2020, p.99) is particularly pernicious in its effects on the Global South. Hence 'degrowthing' is arguably to place the concerns of the majority world as paramount.

Problems remain, however, but the reasons for this hinge *not* primarily on the substantive arguments presented so much as the type of argument and forms of reasoning Degrowth deploys. At its most general, Degrowth's whole programme of identifying realist problems,[3] self-evident goals and straightforward ways forward (e.g. 'simple legislation' for a '*genuinely* rational…economy' (Hickel 2020, p.209, original emphasis)) is radically at odds with the palpable complexity and challenges of strategic decision-making and manoeuvring in conditions of relative lack of power. Degrowth's simplistic policy conclusions incorporate no sense at all of even such crucial conditions as the challenges of social order and government, and their diverse and complex specificities. Yet, of course, it is (countries, institutions and persons in) the Global South that are most exposed to these challenges.

Turning to RS, we find work that explicitly highlights the importance of considering the Global South, and multiple bottom-up perspectives therefrom (e.g. Pansera et al. 2020 and references therein). Thinking through 'RS' invites recognition that the dominant, emerging narrative of 'RI' *per se* is overwhelmingly a narrative of and for the existing 'core' of hi-tech, proprietary, corporate innovation (MacNaghten et al. 2015, de Saille 2020). Indeed, RS seeks to leverage the conceptual possibility of a 'responsible stagnation' to challenge the "universalistic 'global' conception of responsibility" (Pansera et al. 2020, p.99) *per se*. This includes "allow[ing] the

flourishing of multiple spaces of critical reflection" (*ibid*., p.105) that are inclusive of voices, and examples, from the Global South.

But two issues still loom large, as for constructivist STS more generally. First, RS seems so focused on specific localized issues of participatory innovation politics that, at the all-important scale for the growth paradox of the global, political economy is dropped. Secondly, RS explicitly adopts a particular ethics of 'responsibility', namely an ethics of care, as its normative foundation. But this particular ethics may be no less a prematurely universalistic imposition than the supposed mainstream it replaces, albeit from a more maternalistic (Medvecky 2020, p.69) than paternalistic standpoint.

This manifests, for instance, in a tendency only to celebrate the emancipatory potential of greater inclusion of voices and examples from the Global South. This stance largely overlooks the diverse, locally-specific and significant – indeed, often *much greater* than in the Global North – challenges of participatory processes and innovation politics in such locations (e.g. Whaley et al. forthcoming). Ironically, the result of such an approach is not to enable and recognize thwarted agency, but rather to ignore and leave unilluminated the multiple complex strategic hurdles in that place for self-governed innovation politics.

Turning to CPERI, though, we find neither set of problems. Here, the agenda within the Global South remains simply to examine and optimally illuminate with local stakeholders both: the actual incumbent power/knowledge relations (at all/any relevant scale) shaping and shaped by socio-technical change; and strategic possibilities, emergent from such action research, to draw the entire socio-technical system in 'positive' directions.

CPERI makes no presumption, in whichever particular Global South case study is at hand, that capitalist growth is less of a motivation for innovation than in the Global North, nor that conditions there are necessarily uniform and/or more promising for alternative, sustainable innovation. Nor is there any *ex ante* prescription of less growth or even 'degrowthing'. Certainly, CPERI too cannot escape the predicament of presuming an ethics in order even to formulate the purpose and method of its (participatory) research. Yet the conflict here is significantly less intense. For CPERI imposes no *substantive* characterization as ethical programme (as do, for instance, both Degrowth and RS), even as it is certainly not – and does not claim or aspire to be – value-neutral. Rather, its research can proceed simply by affirming the meta-ethical stance emergent from acknowledging the inescapable predicament of being a strategic agent situated amidst power/knowledge relations. This demands only acknowledgement that each and every agent values what they value, and should be enabled to pursue that strategically and/or to learn and amend their values in attempting to do so.[4]

CPERI analysis thus aims to enable stakeholders in the Global South, as anywhere, to participate in a strategic-ethical learning process; a practical and directly empowering education *for themselves* regarding the incumbent power/knowledge relations in which they find themselves and the strategic openings *they see* therein. Crucially, how best to effect such

research is *itself* an open question for localized consideration. In this way, CPERI can actively assist programmes tackling injustices in the Global South in ways the other two struggle to deliver.

4.2 Momentum of (Digital) Innovation

The second key issue concerns the momentum of contemporary innovation and digitalization specifically. Under this rubric are two potentially contradictory issues: first, the manifest need for massive and dynamic socio-technical change if we are to meet the challenge of Just Transition with sufficient urgency; and, secondly and conversely, the question of how actual and existing momentum in innovation can and/or will affect that challenge. Any approach to Just Transition must grapple with both of these concerns. But while the former is widely admitted, much less is done to address the latter. In particular, literature that explores the potential – and dangers – regarding the contribution of what is clearly the most dynamic arena of current innovation, i.e. the digital, to sustainability is slight and only just emerging (WBGU 2019; see also [Lippert, this volume).

First, given its 'equal billing' of political economy and R&I, a CPERI approach is well placed precisely to acknowledge whatever emergent and/or dominant forms of innovation present themselves and to explore how such socio-technical change is co-evolving with broader systemic forms, as in the China illustration above.

For Degrowth, though, the focus directly and specifically on the realist 'problem' and associated 'goal' frustrates engagement with such key questions of means and process. Innovation *per se* is not a primary concern of Degrowth literatures in general, and digital innovation even less so. To the extent either gets discussed it is generally as meat for further critique of capitalism. Illuminating discussion, for instance, has presented the lack of evidence that digital technologies enable the decoupling of GDP growth and material throughput widely presumed by establishment opinion (Hickel & Kallis 2020). In standard critical political economy form, though, Degrowth literature tends to reduce (socio-)technical change to the underlying and unchanging social relations of production, typically those of capitalism.

Moreover, Degrowth argues that it is the state, not private enterprise, that is dominant in driving and shaping innovation trajectories (e.g. following Mazzucato 2011). Such points are well-made, in that a seismic political reversal from prevailing neoliberal orthodoxy against public investment is a *sine qua non* for any sustainable transformation (e.g. on finance and sustainability transition, see Naidoo 2019). Still missing, though, is engagement with the challenges of the existing socio-technical momentum of digital innovation, let alone its political power and undetermined onto-political destination. Nor is there consideration of how neoliberalism, and the dominant forms of digital innovation fashioned in its image, have completely changed the very nature and structure of states from the idealized post-WW2 conception these arguments still mobilize (Goldstein & Tyfield 2018).

How can the existing, dominant trajectory of digital innovation be redirected and harnessed to support Just Transition? *How* can the ongoing, massive growth of digital technologies contribute to Just Transition, rather than greatly exacerbating the problems (e.g. of energy/resource use and waste)? *How* can the ongoing transformation of power relations and forms of state enabled by the parallel evolution of digital technologies now be grasped as an opportunity, not just a clear and present danger – a hyper-neoliberalism of digital, rentier monopoly power – to Just Transition? These are essential, central questions for tackling the growth paradox (Kunkel & Tyfield forthcoming) yet they are simply not asked, nor even readily conceptualized as questions, by a Degrowth perspective.

Founded in discussions about innovation, RS is on much surer ground. Yet in RS work itself, as for RI, we find that the digital falls between two pillars that are its explicit interest, respectively: explicitly low-tech, subaltern and neglected modes of innovation; and controversial new-to-the-world frontiers, as in biotech, nanotech or AI.[5] What is missing, therefore, is broader engagement with power/knowledge processes of socio-technical change as it actually is taking place, as against a form of analysis that is explicitly normative in starting point and configuration.

More fundamentally still, there are major questions about the effectiveness and scalability of the slow, 'care-ful', inclusive deliberation RS advocates, and especially regarding such powerful sociotechnical juggernauts as digitalization. The problems also seem especially grave when grounded in an ethic of care. For such a foundation hands a normative veto to an infinite list of considerations, i.e. anything insofar as it is something someone 'cares' about and/or could feel hurt by. While, conversely, it asserts that the primary lever through which to compel a course of action is an individual agent's conscience. Taken together, such a process will tend to be: at best, paralysed in reaching a decision and ineffectual in enforcing it given interminable debate about what 'care' demands is valued, and how much, with what prioritized over what; at worst, coercive via collective emotion, where 'care' is mobilized as the outraged right not to be offended. In short, RS offers little in terms of productively regulating socio-technical developments that already have significant power momentum.

5 (Interim) Conclusions: Towards a Post-Secular-Materialist Strategic Learning Process

We have considered three possible ways to grapple with arguably *the* socio-environmental challenge of the moment, the problem of growth and its flipside of just transition. All three ostensibly share significant common ground in motivation and theoretical/political inspiration. Yet digging deeper, we have found major differences in both substantive argument or conclusions and, inseparably, strategic efficacy. At the heart of these differences is the initial orientation to the problem of growth assumed by each perspective.

The combination of a complex systems perspective and a strategic approach goes beyond the separate contributions of the two key building blocks of CPERI. It goes beyond coproductionist STS in enabling analysis that can incorporate issues of political economy across all relevant scales, from local to global. Conversely, it transcends critical political economy by opening up

sociotechnical change as a key window into qualitative change of political economic regimes and with a view to strategic intervention therein.

Is degrowth (or 'degrowing') needed, especially in the Global North, which has grossly exceeded its fair share of global resources? Undoubtedly. And the case for 'degrowthing' is even stronger and effectively universal. Similarly, it is unarguable that we need responsibility in our sociotechnical ingenuity as never before, in ways that then deliver both 'responsible stagnation' *and* 'responsible innovation'. But tspecifying these crucial, but partial, goals *ex ante* as the primary orientation in exploring how to tackle the growth paradox and related challenges fatally hobbles such admirable programmes.

Degrowth and RS assume substantive positions asserted as literally truthful descriptions of the world; respectively realist and constructivist in ontology, consequentialist and deontological in ethics. In contrast, CPERI works from an explicitly strategic starting point founded in the primacy of a perspectivalism that is always already, and so inescapably, situated in dynamic complex systems of power/knowledge relations.[6] A CPERI analysis can thereby accommodate a deeper and more effective learning process, and both by any given stakeholder and collectively. This process is intrinsically more strategically enabling, exploring the entire strategic predicament of that agent as it presents itself. And it is capable of more profound rethinking of the substantive conceptual understanding from which one starts the investigation. That pre-existing understanding, however, is precisely what sets up the conditions for (the strategic emergency of) the *paradox* of growth. It follows that CPERI is also capable of grappling constructively with the underlying challenge, i.e. of epistemic upgrade so as to elude that paralysis, in ways the other two are not. In other words, a CPERI approach 'solves' the paradox by aiming to provide optimal conditions of support for transcending it altogether, with new, emergent and dispersed understanding and practice that redefines the 'growth' to which society is oriented and committed.

Yet the learning process outlined above is, surely, only the beginning – the embryonic inklings – of the paradigm shift in commonplace, practical thinking actually needed for timely attainment of just transition. Indeed, a deeper exploration reveals precisely such profound challenges to the entire worldview from which this investigation begins (Tyfield forthcoming, Rosa 2020). In pursuing a strategic CPERI approach wholeheartedly, one is inevitably led to question one's understanding of the *goal*, and with that even the conceptions of 'good' and 'real', to which one had thus far presumed to be strategizing. In particular, in its strategic-ethical orientation, the goal emerges as the progressive cultivation, individually and together, of a situated practical wisdom, or phronesis (Flyvbjerg et al. 2012, Tyfield 2020). The 'reality' and 'value' of such a goal, however, is radically at odds with the objectivist secular materialism generally assumed to underpin any sensible discussion of climate emergency (*Cf* Taylor 2007).

Immanently unfolding a worldview (or rather 'lifeview' (Schweitzer 1932)) that is not thus limited, however, reveals clear and significant benefits for just transition. Given literally insatiable appetites for material wealth and socio-technical advancement, secular materialist

social progress must eventually clash with limited planetary resources, whatever its political economy, right or left, 'fast' or 'slow'. So for humanity successfully to transcend to forms of flourishing that do not literally cost the Earth seems impossible insofar as understanding of reality and the good life is confined to a secular materialist framing.

Degrowth demands 'prosperity *without* growth' (Jackson 2009), and RS suggests 'responsibility *beyond* growth' (de Saille et al. 2020). CPERI can instead present an enlivening vision of 'strategic wisdom *as and through* growth', providing a strategic learning process for immanent redefinition of 'growth', in terms of growth *of learning* and *of the collective mind of humanity* (likely enabled by the global interconnection via digital technologies) to as-yet undreamt of futures. In short, and counter-intuitively, the primary problem with these other perspectives is not that they are too radical, but they are not radical enough.

Notes

[1] i.e. only ever, at best, delivering 'relative decoupling' of economic and material growth (Hickel & Kallis 2020).

[2] By this key term 'strategic' here we are drawing on the specific sense of this term elaborated in the later works of Foucault (2009, 2010) and taken up more recently by the 'real social science' movement of 'phronesis' (Flyvbjerg et al. 2012, Tyfield 2020). A strategic orientation is thus one that recognizes as primary, and is itself primarily interested in, clarification of one's given situatedness vis-à-vis others in terms of power relations, and with a view to (and assessed against criteria of) practice and action, not knowing and understanding. To inquire into one's strategic predicament in this way is thus to ask questions that are 'strategic' in terms of both substance and mode of enquiry.

[3] By 'realist' here we connote an approach that aims for definitive representations of phenomena or problems 'in the world', and hence as 'real'; as opposed to 'pragmatist' approaches, that treat such representations as beholden primarily to pragmatic or strategic criteria. This approach thus tends to privilege causal-explanatory modes of enquiry on the understanding that these are then conclusive and objective, and where their 'reality' frequently entails normative conclusions (e.g. 'growth is bad, degrowth is good').

[4] To clarify, this would also apply to the values of capitalist actors pursuing *ir*responsible innovation. But this hardly undermines the approach and its goals in that: i) such an agent is most unlikely to feel compelled to engage in such novels ways of thinking, as already likely empowered; ii) in any case, the empowering of *diverse* interest groups and values serves to contain and shape such actors significantly more than would otherwise be the case (hence, as opposed to comparison with some contrived 'perfect' situation where existing power/knowledge relations and imbalance are somehow absented); and iii) engaging seriously with this approach is likely to raise difficult and immanent contradictions, and so *shift* understanding, in a productive learning process *even for such powerful actors*, and especially where this involves collective exploration with others. As such, it is actually a strength that *no one* is excluded from such activity and from the benefits of engaging with it, since it actively undermines the dualism of us/them, good/bad, that leads to stalemate and hence the default outcome of reaffirmation of the power status quo.

[5] i.e. at best, the most SciFi and avant garde technoscientific reaches of 'digital innovation', but neglecting the much larger and more socially significant issues of percolation of digital technologies ever more deeply into everyday life. For an arguable exception, exploring ongoing efforts on automated driving, see Stilgoe (2018).

[6] NB this is not the animistic 'perspectivism' of Danowski and Viveiros de Castro (2017) and the broader 'ontological turn' of contemporary anthropology and indigenous ethnography (e.g. Descola 2013), but builds instead on the work of eco-philosophers such as Skolimowski (1994) and Schweitzer (1932).

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