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Original research article

# Innovating innovation—Disruptive innovation in China and the low-carbon transition of capitalism

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## ABSTRACT

Disruptive innovation offers significant promise regarding expedited global low-carbon transition, set against currently inadequate efforts. In order to appreciate its significance, however, disruptive low-carbon innovation must be analysed in the light of three key shifts in perspective: to an analysis of system transition and low-carbon innovation itself in terms of power/knowledge; to appraisal of the significance of digital innovation (similarly reconceptualised) and its embryonic convergence with disruptive innovation; and to a geographical focus on innovation happening not (just) in locations usually presumed as leading in hi-tech, but to developing countries and especially China. Indeed, exploring disruptive innovation in this way shows that assenting to the commonplace discourse through which Silicon Valley Tech innovation is identified as ‘disruptive’ is to conflate problem with solution. Conversely, this approach shows just how significant disruptive innovation is likely to prove to low-carbon transition, effecting a disruption of innovation itself, and thence of capitalism, from which any such transition must ultimately emerge.

## 1. Disruptive low-carbon innovation revisited

Wholesale low-carbon transition is urgently needed to stay within 1.5 °C limits, but remains elusive [1]. Could disruptive low-carbon innovation (DLCI) help regarding this imperative?

The idea of DLCI was first raised 10 years ago [2], and subsequently taken up with special focus on developing countries [3], especially China [4,5]. What is DLCI and why is it important? Against the stream of current discussion [6], our starting point here is the seminal work of Christensen [7]. While addressing a business strategy readership and not specifically concerned with low-carbon transition, Christensen’s work nonetheless furnishes a broad but rigorous definition of ‘disruptive innovation’ (DI). This concerns “cheaper, easier-to-use alternatives to existing products or services often produced by non-traditional players that target previously ignored customers” [2] and/or their use in novel contexts and combinations. This contrasts disruptive innovation with ‘sustaining innovation’ along existing, stabilized techno-economic trajectories. The former thus effects a *social* redefinition of existing technologies through recombination, thereby offering possibly *lower* functionality against existing metrics initially. Over time, though, such innovation may ‘disrupt’ at varying levels, as new low-cost offerings attract not only users previously unable to afford these technological affordances, but also increasingly the incumbent ‘mainstream’ market.

The particular promise of *low-carbon* DI rests in precisely these

characteristics: low-cost, rapid (driven by its own spontaneous demand) global deployment of existing technologies in novel combinations (and incremental improvements thereof) can be favourably compared with the default (and stalling) model of low-carbon transition. The latter focuses on supply or production of high-cost new-to-the-world technologies from high-risk, slow and uncertain RDD & D processes. Aligning with and corroborating criticisms of this dominant technofetishistic narrative, a focus on such DLCI, and its *social* redefinition of (probably existing) technologies, also directly opens up the importance of *socio*-technological and *systems* issues [8].

These arguments are still pertinent today, and I welcome that DLCI is getting a new and arguably more high-profile hearing, amplified through Future Earth and this SI. But in this paper I also want to go beyond restatement of this original case to update and extend that argument in light of both more recent, clearer evidence of challenges and positive trends, and developments in theoretical understanding. In brief, this involves three key steps, set out in much greater detail in [9]:

- Reframing understanding of low-carbon transition and innovation, including DI, as not just a socio-technical system process but one of *power/knowledge*.
- From this perspective, appraising the nature and importance of *digital* innovation to both low-carbon innovation and disruptive innovation (and their conjunction).
- Illustrating and developing these arguments with the contemporary

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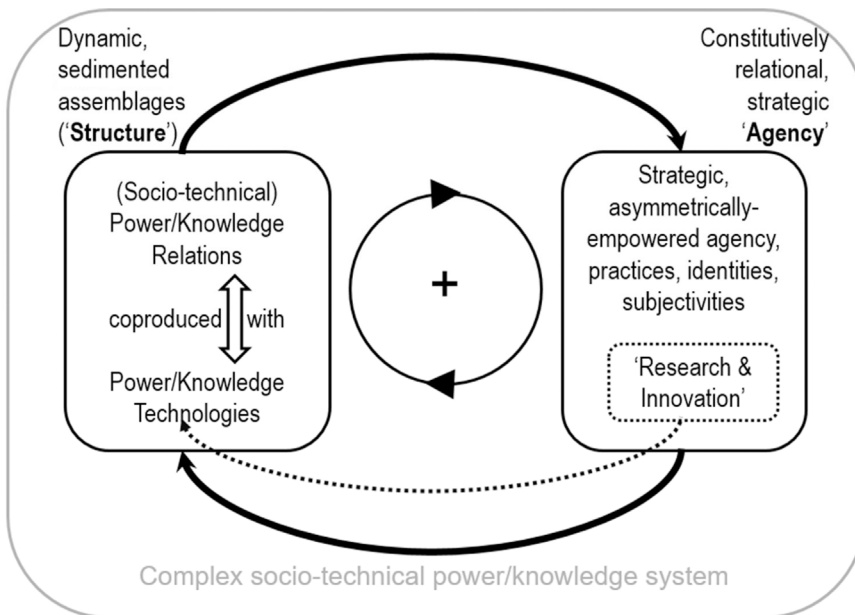


Fig. 1. Complex socio-technical power/knowledge systems.

The grey box denotes the system as a whole (grey text).

The two black boxes denote the constant relational co-production of ‘structure’ and ‘agency’ (black arrows), with the former including the co-production, in turn, of power/knowledge relations and technologies.

The dashed box denotes R&I as a subset of ‘agency’ that directly acts on and transforms socio-technical power/knowledge technologies (dashed arrow).

In the case of system transition, cycles of positive feedback can generate increasing power momentum over time.

geographical exemplar of such disruptive (digital and/or low-carbon) innovation, namely China.

Along the way I also not only reaffirm the Christensen point that there is a specific *form* of innovation that merits its own label – ‘disruptive innovation’ – and that conflating this with innovation *per se* is to evacuate the term of any useful rigorous analytical meaning. But also, and stronger, I argue that the predominant contemporary manifestation of that conceptual laxity – in which Silicon Valley ‘Tech’ is widely imagined as the archetype of ‘disruptive innovation’ – is not merely obfuscating but actively complicit in reproducing the problem low-carbon transition is trying to tackle. In short, if we accept this commonplace (mis)interpretation, then ‘disruptive innovation’ is part of the problem, not the ‘solution’.

Given that the public sphere is (rightly!) more powerful in determining the meanings of terms than academic argument (which may of course participate in the former), it is tempting to drop ‘disruptive’ innovation altogether and replace it with another term (e.g. ‘game-changing’, or, in Chinese, ‘*poju*’ (see [4]<sup>1</sup>). But given that this special issue – and broader initiative – is aiming to illuminate the crucial role that DLCI could play in the greatest challenge of our time – let alone that it was Christensen’s coining initially – it seems legitimate still to fight for the meaning of ‘disruptive innovation’, as I do here.

## 2. Complex power/knowledge systems, their government and their transition

Our first contention is that to understand DLCI and its importance, and indeed low-carbon transition itself, we need to adopt a complex

<sup>1</sup> In the Chinese board game *Go*, a move that completely subverts the passage of play to that point is described as ‘*poju*’ or, literally, ‘game-breaking’.

power/knowledge systems (CPKS) perspective. This conceptualizes the problem field of low-carbon transition, and innovation more generally, not just as multi-agent, multi-factorial (and hence socio-technical) and multi-levelled (e.g. [10], hence ‘MLP’) systems, as is increasingly the orthodoxy in innovation studies. They are also, and essentially, composed of complex, dynamic assemblages of relatively sedimented *relations and technologies of power/knowledge* [11,12,13].

I use the combined term ‘power/knowledge’ to indicate the specific conceptualisation of power drawn on in this perspective, inspired by the later work of Michel Foucault. In brief, this presentation aims to shorthand how power and knowledge are different but inseparable aspects of the same (strategic, relational and practiced) phenomenon, not completely different issues. Hence even academic knowledge must be primarily assessed in terms of what it *does* and *enables* (or disables) in the world and *how*, not just in terms of the representative truth of what it *says*; while conversely, even the heights of ‘power politics’ must be analysed in terms of *how* they manipulate and successfully dominate others, not least through their deployment and development of particular knowledge claims and practices, as ‘power/knowledge technologies’. For example, Google’s or Facebook’s proprietary algorithms and software are essential to their domination of their respective aspects of the digital political economy. International IP laws, technoeconomic paradigms, sociotechnical imaginaries of development or norms of high-status consumption are also all power/knowledge technologies.

These complex assemblages (or dynamic ‘structures’) of power/knowledge relations and technologies are then co-produced, in interactive parallel, with strategic agency, including (everyday) practices and even the very subjectivities of agents themselves (Fig. 1). The systems are thus not just transformed or ‘transitioned’, but *constituted and conducted* through the constant cycling of this co-production of ‘structure’ and ‘agency’, where both are conceptualized as constitutively relational, dynamic and strategic.

As such, it is not that ‘power’ enters the picture only to ‘change’ a

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