



Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

Beyond the disruption narrative: Varieties and ambiguities of energy system change

Mark Winskel

Science, Technology and Innovation Studies Group, School of Social and Political Science, Chisholm House, High School Yards, University of Edinburgh, and UK Energy Research Centre (UKERC), Edinburgh EH1 1LZ, United Kingdom

ARTICLE INFO

Keywords:

Energy
Innovation
Continuity
Disruption

ABSTRACT

For many observers we are entering an age of heightened disruption in energy systems – a ‘disruption narrative’ is now prominent and seemingly widely-shared. The energy disruption narrative often goes beyond the merely descriptive: it is also often used in a normative way, in that system disruption is seen as a necessary and welcome enabler of the shift to more sustainable and more rapidly decarbonised energy systems. While not denying that there are significant changes underway in the operation and governance of energy systems, I reflect here on the assumptions associated with the disruption narrative and its value as a guide to policy and research. I firstly review some theoretical and empirical research on disruptive innovation, consider some empirical evidence on historic energy system change, and then reflect on the value of a disruptive narrative in ‘energy futures’ research and policy. The disruption narrative is a contestable framing for researchers, across both ‘whole systems’ analysis and more specific technological and organisational level study, and is a problematic guide for policy. Researchers and policymakers should be sceptical of uniform narratives about change, and seek more balanced attention to both disruptive and continuity-based dynamics of energy system change and sustainable transitions.

1. Introduction

For many observers we are entering an age of heightened disruption in energy systems – among energy professionals and analysts a ‘disruption narrative’ is now prominent and seemingly widely-shared. The President of the UK Energy Institute recently suggested that ‘today’s energy system is undergoing a quiet revolution, driven by an ever changing global political landscape, climate change challenges and a range of innovations influencing energy consumption’ ([1], p. 4). The International Energy Agency, in its most recent analyses of global energy system change, has concluded that this is ‘a momentous period for global energy’ [2] and ‘the energy mix is being redefined’ [3]. The consultancy firm PricewaterhouseCoopers has articulated a vision of rapid and dramatic change: ‘the pace of technology-driven change is accelerating well beyond the speed the power sector believed possible. From a scale-driven, centralised and standardised model, the sector is set to evolve to one that is digital, distributed and personalised’ [4].

The energy disruption narrative often goes beyond the merely descriptive: it is also often used in a normative way, in that system disruption is seen as a necessary and welcome enabler of the shift to more sustainable and more rapidly decarbonised energy systems, and an essential means of escaping the locked-in unsustainabilities of incumbent systems. This carries significant policy and regulatory implications: it

implies that policymakers and regulators should seek to actively unleash disruptive forces (perhaps by destabilising and dismantling incumbent interests) so as to clear the path for the sustainability transition.

While not denying the significant changes underway in the operation and governance of energy systems, I want to reflect here on the assumptions associated with the disruption narrative and its value as a guide to policy and research. I firstly consider the theoretical and empirical background to disruptive innovation, review some historic empirical evidence on energy system change and then reflect on the value of a disruptive narrative in ‘energy futures’ research and policy. I argue that the disruptive innovation is a disputable framing for researchers, across both ‘whole systems’ analysis and more specific technology- and organisational-level study, and is a problematic guide for policy. I conclude that energy systems researchers and policymakers should be sceptical of uniform narratives about change, and should offer more balanced attention to both disruptive and continuity-based dynamics of energy system change and sustainable transitions.

In their benchmark collection of research on energy technology innovation, Wilson and Grubler ([5], p. 7) define ‘radical’, ‘breakthrough’ and ‘disruptive’ innovations as those novelties that strongly deviate from prevailing technological and institutional norms, while ‘incremental’ or ‘continuous’ innovations are defined as improvements

E-mail address: mark.winskel@ed.ac.uk.

<https://doi.org/10.1016/j.erss.2017.10.046>

Received 30 September 2017; Received in revised form 18 October 2017; Accepted 23 October 2017
2214-6296/ © 2017 Published by Elsevier Ltd.

without any fundamental novelty in end-use service provision. Although these definitions capture the essence of research and policy debates on disruptiveness, they also reflect the compound and ambiguous character of the objects of analysis here, spanning a mix of social & technical, and upstream & downstream concerns. Rather than aiming explicitly at any more precise definition of disruptive and continuous innovation (an ultimately futile pursuit given the multiplicities of voices and framings involved), my aim here is to explore the tensions and ambiguities involved in their application – ambiguities which were evident in the workshops which were the genesis for this series of articles [6].

2. Theoretical and empirical backgrounds

Disruptive and radical innovation are longstanding preoccupations in applied social sciences such as innovation studies, technology studies, organisation studies and business studies. Much of this research is focused on firms and organisations rather than larger systems, and much of it takes its inspiration (knowingly or implicitly) from Joseph Schumpeter's work in the early and mid-twentieth century. Schumpeter understood broad patterns of industrial and economic change as reflecting a 'perennial gale of creative destruction' [7].

The most prominent recent contributor to disruptive innovation research has been Clayton Christensen. In his 'Innovator's Dilemma' [8], Christensen argued that it was profoundly difficult for incumbent firms to direct sustained effort and resource on disruptive innovation. Firm capabilities, forged within 'value networks', are deeply oriented to 'sustaining innovation', and are more specialised and path dependent than is commonly assumed. Disruptive technologies present intrinsic conflicts – they rarely 'make sense' to large established companies – and so tend to be left to small outsider firms to develop.

Christensen's thesis has been repeatedly challenged; Daneels [9], for example, criticised it for a selective reading of empirical evidence, for only picking 'winning' disruptive technologies and for overstating the innovative inertia of incumbent firms. It has also been frequently misapplied – Christensen et al. [10] recently stated that 'disruption theory is in danger of becoming a victim of its own success ... the theory's core concepts have been widely misunderstood and its basic tenets frequently misapplied'.

Nevertheless, the thesis still often sets the terms for contemporary debate on disruptive innovation, with many other relevant studies over the past 30 years often left unreferenced. Rather like Christensen et al.'s recent contribution, much of this under-examined work seeks a more nuanced and heterogeneous account of innovation, spanning both disruptive and continuity-based dynamics. Contributors here can be traced back to well before Christensen's debate-defining account. Many of the theoretical claims involved are based on detailed longitudinal studies of multiple firms and industry sectors; a few such studies are now briefly reviewed.

Abernathy and Clark [11] suggested that disruptive innovation was a problematic and ambiguous term. Rather than any universal or essential properties, disruptive innovation forces were highly relative and situated, and analysis needed to consider their varied influence on producers, users and markets. Drawing on innovation patterns in the US auto industry, Abernathy and Clark distinguished between 'architectural innovations' (which are both technologically and socially disruptive), and 'regular innovation' (which builds on established competences). The latter, they concluded, although 'almost invisible', can have a dramatic cumulative effect. While the analytical gaze tends to be drawn to novel innovations, novelty (and scientific advance more generally) may carry less significance, over time, than relatively mundane changes.

Tushman and Anderson [12] noted that technological discontinuities were not necessarily organisationally disruptive – indeed some could be 'competence enhancing'. Based on detailed longitudinal studies of computing, cement and airline industries, they concluded

that such were the varieties and complexities of innovation dynamics at firm and sector level, disruptive innovations (and dominant designs) could only be identified in retrospect. Anderson and Tushman [13] distinguished between eras of ferment and incrementalism, and considered how some organisations were able to develop 'ambidextrous' competences to prosper in both. Tushman and Rosenkopf [14] saw discontinuities as 'rare and unpredictable', and again, not knowable in advance.

Some analysts offer more explicit criticism of Schumpeterian-based accounts of economic and technological change. For the technology historian David Edgerton much scholarship is uncritically focussed on novelties, with an 'enormous rhetorical emphasis' on innovation in studies of public technology policy [15]. (For a 'long history' of the emergence and deployment of the term 'innovation', see [16]). For Edgerton [15] such accounts offered a 'narrow progressivism', with innovation-deterministic theory often standing in for detailed empirical study. Schumpeterian-based economic and technology histories, he concluded, were often 'absurdly' innovation-centric. Edwards [17] has also been critical of the preoccupation with novelty and emergence in much technology studies.

As readers of this journal are likely to be aware, these debates are also played out in more contemporary (and futures oriented) innovation studies debates, especially sustainable transition studies. Disruptive innovation plays an important role in transitions theory, reflecting its origins in constructivist sociology and evolutionary economics [18–20]. For example, Andrew Van de Ven et al.'s 'Innovation Journey' [21], an important influence on transitions theory, explicitly invoked Schumpeterian 'creative destruction' in developing an emergent-centric model. For Van der Ven and many other innovation studies theorists, the key actor perspective is that of the disruptive entrepreneur or niche firm, rather than any wider institutionalist or structuralist framework.

Although later versions of transitions theory have been more attendant to wider societal structures and institutions, many transitions theorists still often presuppose that disruptiveness is a necessary requirement for system innovation (e.g. [22]), with incumbents typically defined by their commitment to inherently limited incrementalism (e.g. [23]). It should also be noted that some empirically-based transitions scholarship *has* recognised that the technological and organisational constitution of disruptiveness (and the role of incumbents in transitions) varies greatly according to context (e.g. [24,25]).

Another prominent strand of sustainable innovation studies, Technological Innovation Systems (TIS) theory, also has its origins in evolutionary understandings of innovation which emphasise firm-level variation and selection [26]. According to Suurs and Hekkert ([27]: 154) for all 'quasi-evolutionary theories' (listed as strategic niche management, the multi-level perspective, technology innovation systems and transition management), 'a transition is *regarded* as a regime shift ... through an accumulation of niches that interact with a destabilising regime' (emphasis added).

From an energy systems perspective, the suitability of Schumpeterian based accounts for closely coupled and network-based systems needs to be questioned. In Van de Ven's terms [21], such systems may be thought of as being heavily conditioned to *convergent* rather than *divergent* innovation (i.e. based around standards and interoperability). Tushman and Rosenkopf [14] noted that innovation in systems-based technologies had a distinctive emphasis on hierarchy. Raven [24] suggested that given their tight coupling and high entry barriers, regime hybridisation (rather than niche accumulation) may be the route for system change in infrastructure-based technologies; as Robert Fri noted, innovation in such sectors is typically 'incremental, cumulative and assimilative' [28].

This is not to deny that energy system lock-in and path dependency can present barriers for sustainable innovations and transitions. System lock-in is a well-recognised concern among some technology systems historians and theorists. Hughes [29] noted that as socio-technical

Download English Version:

<https://daneshyari.com/en/article/6557666>

Download Persian Version:

<https://daneshyari.com/article/6557666>

[Daneshyari.com](https://daneshyari.com)