Energy Research & Social Science 46 (2018) 86–102

Contents lists available at ScienceDirect

Energy Research & Social Science

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

Original research article

Low-carbon transition via system reconfiguration? A socio-technical whole system analysis of passenger mobility in Great Britain (1990–2016)

Frank W. Geels

Sustainable Consumption Institute, Manchester Institute of Innovation Research, University of Manchester, UK

A R T I C L E I N F O

Keywords:
System reconfiguration
Socio-technical transition
Passenger mobility
Multi-level perspective

A B S T R A C T

Low-carbon transitions in whole systems (in energy, mobility, agro-food) are an important, yet understudied topic in socio-technical transition research. To address this topic, the paper builds on the Multi-Level Perspective, but stretches it to address developments in multiple regimes and multiple niche-innovations. This 'zooming out' strategy changes the conceptualisation of transition dynamics from *bottom-up disruption* (driven by singular niche-innovations) to *gradual system reconfiguration*, which represents a more distributed, multi-source view of change that includes cumulative incremental regime change, shifts in relative sizes of regimes, regime alignments, component substitution, and symbiotic adoption. To illustrate the reconfiguration approach and empirically explore the topic of whole system change, the paper investigates unfolding trajectories in UK passenger mobility. This analysis, which addresses developments in auto-mobility, train, bus and cycling regimes and five niche-innovations (biofuels, electric vehicles, smart cards, compact cities, home working), aims to assess if and how the mobility system is reconfiguring in low-carbon directions. It also aims to provide an interpretive assessment of the 12.7% *decrease* in domestic transport-related CO_2-emissions between 2007 and 2013. This decrease is attributed to reduced auto-mobility (due to the financial-economic crisis), incremental engine efficiency improvements in new cars, some modal shift from cars to trains, and biofuels. Radical niche-innovations (smart cards, compact cities, electric vehicles) did not (yet) greatly contribute to emission reductions. CO_2-emissions increased again since 2014, which suggests that further low-carbon transitions require deeper system reconfiguration.

1. Introduction

This paper aims to contribute to the socio-technical transitions approach, which was developed to understand *system innovation* [1,2], i.e. changes in entire systems (in mobility, electricity, heat/buildings, agro-food), which were argued to be necessary to address persistent environmental problems, like climate change. The socio-technical transition approach has shown that system changes involve not just technological changes, but also transformations in consumer practices, policies, cultural meanings, business models and infrastructures [3–5]. These changes are enacted by various social groups (firms, consumers policymakers, wider publics, civil society organisations) who have different preferences, strategies and resources and engage in many forms of agency [6] (e.g. sense-making, search, learning, collaboration, struggle, competition, investing, purchasing), in the context of rules and institutions [7,8].

A widely used framework in the socio-technical research tradition is the Multi-Level Perspective [9,10], which distinguishes three analytical levels: niche-innovations (radical novelties emerging in protected spaces), socio-technical regimes (the institutional structuring of existing systems), socio-technical landscape (exogenous developments that influence niche and regime dynamics). Radical niche-innovations usually face uphill struggles against entrenched regimes, which are stabilized by various lock-in mechanisms [11]. To "counter the bias towards technological novelty" ([10]: 1261), the MLP suggests that transitions happen through alignments between ongoing processes within and between the three analytical levels: "a) niche-innovations gradually build up internal momentum (through learning processes, price/performance improvements, and support from powerful groups), b) changes at the landscape level creates pressure on the regime, c) destabilisation of the regime creates windows of opportunity for niche-innovations" ([12]: 400).

Many research papers in the socio-technical transitions tradition have focused on the emergence of disruptive niche-innovations like solar-PV [13], wind turbines [14], electric vehicles [15–18], community energy [19], hydrogen and fuel cell vehicles [20]. One drawback of these niche-focused studies is that they often have a bottom-up bias and represent a 'point source' approach [21], which conceptualises

E-mail address: frank.geels@manchester.ac.uk.

https://doi.org/10.1016/j.erss.2018.07.008
Received 19 March 2018; Received in revised form 3 July 2018; Accepted 6 July 2018
2214-6296/ © 2018 Elsevier Ltd. All rights reserved.

transitions as a singular disruptive process with new technologies as driving force. Secondly, the focus on niche-innovations is somewhat limited compared to the original interest in system innovation. Thirdly, the prevalent focus on radical niche-innovations may lead transition scholars to underestimate the potential of incremental change: "Preoccupation with disruptiveness (…) risks marginalizing and overlooking (…) mundane, incremental and continuity-based innovation, and possibilities for adapting existing systems" [140]: 235. An exclusive focus on radical niche-innovations may thus lead to simple or normative views of transitions: "One sometimes gets the idea that the change that really matters is truly dramatic change, the overturning of big systems. (…) Yet we should take care here. Our concern should be solving societal problems not tilting at 'systems'" ([22]: 337).

Against this background, the paper's motivation is to return to the founding interest in system change and to elaborate a reconfigurational understanding of transitions, which accommodates both radical component substitution and incremental system improvements. This whole system reconfiguration approach builds on recent developments in the socio-technical transitions literature, which have started to broaden the analytical scope of the MLP by addressing wider topics. One new research stream investigates niche-regime interactions [23–25]. The primary interest, however, often remains the emerging niche-innovation, which is selectively translated into the regime [26], which builds connections with regime actors to draw in more resources [23], or which encounters dominant institutional logics that hinder cooperation between new entrants and regime actors [27]. Another research stream has broadened analytical attention to *multiple* niche-innovations [28–33] and how these may compete, complement or build on each other. Yet another research stream has started to investigate interactions between multiple regimes in transitions [32,34–37].

The paper's focus on whole system reconfiguration aims to make a next step in this trend of broadening the MLP to address wider topics. Combining the earlier contributions, I propose that addressing this topic requires some extensions in the MLP such as investigating both *multiple* niche-innovations and *multiple* regimes. The precise conceptualisation of these extensions is likely to vary between systems. Whole system analysis for electricity, for instance, could focus on regimes in power generation, transmission/distribution and electricity consumption as well as various niche-innovations (e.g. wind turbines, solar-PV, biomass, smart meters, storage, LEDs) and their relations [38]. Whole system analysis in agro-food could focus on multiple commodity regimes (wheat, fruit, pork, beef, dairy, coffee), which are often organised as international chains (input suppliers, farmers, processors, retailers, consumers), in which supermarkets have powerful coordinating positions [39,40]. Mobility systems can be divided into air, land and water and into freight and passengers. Whole system analysis of land-based passenger mobility, which is the focus of this paper, could focus on multiple transport regimes (auto-mobility, train, bus, cycling) and multiple niche-innovations (electric cars, biofuels, tele-working, compact cities). These differences imply that MLP-extensions for whole system transitions probably need to the domain-specific.

Nevertheless, most whole system transitions are likely to involve multiple regimes and multiple niche-innovations. Consequently, I propose that this topic requires a change in transition 'imagery': instead of conceptualising whole system transitions as breakthroughs of singular *disruptive innovations*, they are better understood as *system reconfigurations* resulting from multiple change mechanisms. Geels et al. [41] suggest that system reconfiguration could involve not only the adoption of niche-innovations within existing regimes, but also incremental regime improvements, changes in the relative size of regimes, or new combinations between niche and regime elements that change system architectures. System reconfiguration thus makes it possible to go beyond the (Schumpeterian) dichotomy of radical versus incremental change, which still permeates much of the transition debate. "Investigation of system reconfiguration creates opportunities for developing a broader repertoire of change mechanisms" ([21]: 226).

Table 1
Mode share of trips in passenger kilometres and number of trips in England in 2016 ([74]: 2).

Transport mode	% of passenger kilometres	% of number of trips
Car/van (driver + passenger)	78	62
Rail	8	2
Bus	4	5
Bicycle	1	2
Walk	3	25
Other (e.g. tram, subway)	5	3

To further elaborate this whole system reconfiguration approach, this paper has two specific goals. First, it aims to extend the MLP to make it suitable for analysing whole system reconfiguration in passenger mobility. Second, it aims to empirically illustrate and explore the potential of this system reconfiguration approach by analysing unfolding low-carbon transitions in UK passenger mobility. From a peak in 2007, CO_2-emissions from total UK (domestic) mobility, including freight, decreased by 12.7% until 2013, but increased again during the last three years (Fig. 3 below). Although a quantitative disaggregation of these emission reductions is not my goal, the paper's analysis of whole system reconfiguration aims to offer an interpretive assessment of contributing developments in land-based passenger mobility.

The paper is structured as follows. Section 2 extends the MLP to conceptualise whole system reconfiguration in passenger mobility. Section 3 discusses methodological considerations. Sections 4–6 apply the MLP extensions to UK passenger mobility. Section 7 discusses the findings and Section 8 concludes.

2. Extending the Multi-Level Perspective (MLP) to understand mobility system reconfiguration

The (land-based) passenger mobility system is interesting (and challenging), because it contains multiple transport regimes of which auto-mobility is, by far, the largest in England (and most other Western countries), both in terms of passenger kilometres and number of trips (Table 1). Rail, bus, and cycling are "subaltern regimes", which are smaller than the dominant auto-mobility regime, but relatively stable in terms of "specific communities of actors that have developed institutionalised practices, beliefs, capabilities" ([42]: 473).

To conceptualise whole system reconfiguration in passenger mobility, I propose three extensions of the MLP-logic, which use relevant insights from the multi-niche and multi-regime literatures, referenced above, and from recent discussions of the landscape level.

2.1. Multiple landscape dynamics that differentially affect transport regimes

Transition research that accommodates the landscape level often focuses on single shocks or external pressures that destabilize the regime (see [43], for an exception). Unfortunately, this carries risk of teleology and selection bias, because it leads analysts to focus on landscape pressures that positively contribute to transitions and ignore those that go in the 'wrong' direction. Consequently, counter-veiling trends have remained under-investigated in transition studies (see [44], for an exception), which carries the risk of wishful thinking about 'inevitable' developments (see [45], for an example of this). Based on this assessment, the first extension is to investigate *multiple* landscape developments that may differentially affect various transport regimes.[1] This also implies that transport regimes may pushed and pulled in multiple directions, which need not all be low-carbon. Whole system analysis should therefore include the possibility that trajectories are not

[1] Oil price rises, for instance, are likely to strongly affect the auto-mobility and bus regimes, but have less direct effects on cycling and railways.

Download English Version:

https://daneshyari.com/en/article/6557114

Download Persian Version:

https://daneshyari.com/article/6557114

Daneshyari.com