Research Policy xxx (2016) xxx–xxx

Contents lists available at ScienceDirect

Research Policy

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

Governing sustainability transitions through business model innovation: Towards a systems understanding

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ARTICLE INFO

Article history:
Received 13 March 2014
Received in revised form 9 May 2016
Accepted 13 May 2016
Available online xxx

Keywords:
Business model innovation
Sustainability transitions
Energy services companies
Energy governance
Decentralised energy

ABSTRACT

This paper examines the role of innovative business models in the transformation of socio-technical systems. Focusing on decentralised energy technologies, we explore business model innovation in the context of a transition towards a more sustainable energy system. We conduct an empirical study of two Energy Services Company (ESCo) models for the deployment of combined heat and power with district heating (CHP/DH) infrastructure in the UK. Based on these case studies we illustrate the different ways in which Local Authorities develop business models to create and capture value from more efficient resource use and to deploy sustainable technologies. Drawing from systems theories in the business model and socio-technical literatures, we analyse the interfaces between business models, energy infrastructure and institutions. We propose that a systems based approach to the analysis of business models as embedded in their socio-technical contexts can offer new insights into the dynamics and governance of sustainability transitions.

1. Introduction

A growing body of literature on sustainability transitions is concerned with the long term transformation towards sustainability of socio-technical systems (e.g. electricity, transport, water infrastructure) relied upon to satisfy basic human needs (e.g. warmth, nutrition, mobility) (Smith et al., 2010; Markard et al., 2012). In parallel a related strand of research has focused explicitly on business models and sustainable development, which contains a much stronger firm-level focus, examining how the development and implementation of novel business models can create and capture value from sustainable innovations (Boons and Lüdeke-Freund, 2013). There has in recent years been a growing interest in how these two strands of work might be synthesized to offer insights into how business model innovation could act as a catalyst for system-wide sustainability transitions (Loorbach et al., 2010; Boons and Lüdeke-Freund, 2013; Wells, 2013a; Foxon et al., 2015; Hannon et al., 2013; Lüdeke-Freund, 2013). Situating business models in a broader socio-technical system context and analyzing "the relationships between sustainability. . ., government policy and regulation, and innovative business models", Wells argues, presents: "an important future research agenda" (Wells, 2013b: p. 238).

This paper aims to further advance these efforts by drawing on systems theories in the business model and socio-technical literatures to examine how novel energy business models have been utilised to deploy sustainable technologies. Specifically it examines the ways in which the Energy Services Company (ESCo) model has been used by Local Authorities to develop combined heat and power with district heating (CHP/DH) systems in the UK. The ESCo model is innovative in the sense that it is centered on the efficient provision of energy services as opposed to units of delivered energy, as per the underpinning logic of the incumbent utility model of energy supply (Richter, 2012). Similarly, decentralised CHP/DH systems differ from the incumbent nationwide centralised electricity and gas infrastructure in the sense that smaller scale CHP plants are located close to centres of demand, creating the opportunity to capture waste heat from the thermal generation process and distribute it locally via a network of distribution pipes. The move to a localised CHP/DH system represents a transformation of the current configuration of the socio-technical system, which the novel ESCo model has been used to govern and facilitate.

It has been argued elsewhere that system-wide change rather than the implementation of individual technologies, institutions or business models will be necessary to realise a sustainability tran-

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http://dx.doi.org/10.1016/j.respol.2016.05.003

sition (Geels, 2004; Bolton and Foxon, 2015). There are however different conceptualisations of 'systems' in the business model and socio-technical literatures. From an analytical perspective the novelty of the paper lies in the deployment of three different systems perspectives from across these two literatures to make sense of the relationship between business model innovation and socio-technical change. From the business model literature we draw from Zott and Amit's 'activity system' approach (Zott and Amit, 2010) which views a business model as ". . .a set of interdependent organisational activities" (p. 217), and from the socio-technical systems literature we draw from both Hughes' large technical systems (LTS) approach (Hughes, 1983) and the multi-level perspective (MLP) (Smith et al., 2010).

What these three approaches have in common is an emphasis on interdependencies and interactions between different system components; but there are important differences, for example in terms of the relative emphasis on actor agency, the materiality of systems and the influence of politics and institutions. Rather than proposing a unified analytical framework, we discuss how the activity system, LTS and MLP approaches illuminate different aspects of the co-evolutionary relationship between business models and socio-technical transitions, and how an understanding of these approaches provides novel insights for the governance of sustainability transitions.

The paper is structured as follows: In Section 2.1 we provide an overview of the socio-technical systems literature, with a particular emphasis on the LTS and MLP perspectives, and following this in Section 2.2 we discuss business model literatures and introduce the activity system approach. In Section 3 we outline our approach to implementing three different systems perspectives and the paper's methodology. Section 4 presents two case studies of how the ESCo model has been used to deploy CHP/DH systems in the UK, emphasising how this contrasts with the UK's incumbent configuration of the UK energy infrastructure and markets. In Section 5 we draw out comparisons between the two cases and in Section 6 draw on the business model and socio-technical systems perspectives to analyse the empirical study. In the final section we draw conclusions and discuss the wider relevance of our paper for studies of sustainability transitions.

2. Theoretical background

In this section we introduce both the business model (BM) and socio-technical systems approaches, highlighting key insights relevant to our study. In the socio-technical section we focus in particular on the multi-level perspective on transitions (Smith et al., 2010, Markard et al., 2012) and the literature on large technical systems (Vleuten, 2004). Our overview of the BM literature begins by summarising fundamental insights from the management and strategy fields (Zott et al., 2011), and more recent studies which examine sustainable business models (Boons and Lüdeke-Freund, 2013).

2.1. Socio-technical approaches

2.1.1. Transitions and the multi-level perspective

Scholars in the field of socio-technical systems and sustainability transitions are concerned with the transformation of technical systems, such as the supply of electricity, gas and water to consumers or the provision of housing and transport (Steward, 2012). The core unit of analysis is the socio-technical regime which is composed of various actor groups, institutions and infrastructures aligned around the secure and predictable delivery of a particular societal function, such as heating, shelter or mobility. Drawing on earlier insights of evolutionary economists (Nelson and Winter, 1977), Rip and Kemp (Rip and Kemp, 1998) view regimes as constitutive of cognitive routines, search heuristics and engineering practices aligned around a particular dominant design (e.g. the internal combustion engine), which span firms and sometimes industries. Subsequently Geels broadened this framing to encapsulate a wider range of social groups, including suppliers, users, and public bodies, with regimes as "the semi-coherent set of rules that orient and coordinate the activities of the social groups that reproduce the various elements of socio-technical systems" (Geels, 2011: p. 27).

The transition from one regime type to another involves a fundamental reordering and realignment of both the social and technical components of systems. Systems are viewed in dynamic co-evolutionary terms, the causal interactions between actors, institutions and material infrastructure shape system change. In transitions studies this is framed in terms of a 'multi-level perspective' (MLP) (Geels, 2002) which theorises change as a dynamic within and between three levels – niches, regimes and landscapes. These are delineated by their degrees of socio-technical structuration. Meso level regimes, as outlined above, are highly structured and established alignments of actors, institutions and technologies. Incumbent actors can modulate co-evolutionary dynamics in line with their own capacities and interests; innovation is managed and predictable, with incremental change along a relatively well defined technological trajectory. Micro-level niches, on the other hand, are spaces where socio-technical interactions are less well structured, thus more radical innovations are possible. Activities in niches and regimes are influenced by an external 'landscape', which is largely beyond the control of the system actors, e.g. climate change and globalisation. Given the right landscape conditions, radical niche innovations can begin to influence and potentially overthrow dominant regimes. 'Transition pathways', which vary depending on the nature and timing of interactions between these levels, have been developed by Geels and Schot (2007).

2.1.2. Large technical systems

This MLP approach sits alongside earlier work of historians of large technical systems (LTS). Most notable and relevant is the work of Thomas Hughes whose history of electricity infrastructure charted the emergence of highly integrated and centralised systems from their earlier origins as fragmented localised networks (Hughes, 1983). Hughes argued that centralised energy infrastructure was achieved through the alignment of artefacts - technical (e.g. generation facilities, distribution network) and non-technical (e.g. energy companies, laws and regulations) system components. This alignment around a shared system goal, such as optimising the utilisation of large hydro and thermal electricity generators, is achieved by 'system builders'.

System builders are central to the LTS analysis. They construct systems by breaking down previously well demarcated boundaries between scientific knowledge, technologies, institutions, users etc., enabling interactions to become increasingly fluid and systematised – Hughes referred to this as a 'seamless web' (Hughes, 1986). In Hughes' words "One of the primary characteristics of a system builder is the ability to construct or to force unity from diversity, centralization in the face of pluralism, and coherence from chaos" (Hughes, 1987: p. 52). Inventor-entrepreneurs, financiers and managers are influential during different phases of a LTS, their relative influence depends on the nature of problems that need to be addressed to expand a system, whether technical, organisational or financial. Hughes referred to such system challenges as 'reverse salients' (Hughes, 1979). Once these have been overcome systems acquire 'momentum' and grow by drawing in resources from and influencing their environment.

Please cite this article in press as: Bolton, R., Hannon, M., Governing sustainability transitions through business model innovation: Towards a systems understanding. Res. Policy (2016), http://dx.doi.org/10.1016/j.respol.2016.05.003