Energy Policy 114 (2018) 499–507

Contents lists available at ScienceDirect

Energy Policy

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

South-South technology transfer: Who benefits? A case study of the Chinese-built Bui dam in Ghana☆

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ARTICLE INFO

Keywords:
China
South-South technology transfer
Hydropower
Sustainability transitions
Socio-technical systems

ABSTRACT

The literature on technology transfer has focussed on North-South transfer and has analysed transfer as a largely technical process. This is despite the increasing influence of rising powers in technology transfer, specifically in the area of energy generation. China is an important player in this field. This article has two aims: firstly, it adds to the small but emerging literature on South-South technology transfer by exploring the role of Chinese actors, using the Bui dam in Ghana as a case study. Secondly, the article develops an expanded notion of technology transfer by arguing that technology transfer is not only a technical process, but it is inherently political as it includes crucial issues on decision-making regarding the type of technology that is transferred, who is granted access to the decision-making process, and who benefits from the new technology. In examining technology transfer from this perspective, the article draws on the sociology of technologies approach and the sustainable transitions literature arguing that technology transfer is a contested process that takes place within complex political, economic, social and cultural settings and actor networks. This determines the technology that is transferred, who benefits most, and who is marginalized in the process.

1. Introduction

The technology transfer literature has focused on North-South technology transfer. This is despite the prominence of South-South cooperation. In the energy sector, Chinese companies are not only the world's most prolific dam-builders; but China is also increasingly important in South-South climate finance, making it an important player in sustainability transitions. Evidence of this is China's foray into the field of rural electrification, but also the sums mobilized and institutions created to enable this. It includes a three-year programme launched in 2011 to support small island nations and African countries (China Daily, 2015). More recently, it includes the US$3.1 billion South-South Climate Cooperation Fund, although little is known how this will operate (Lema and Lema, 2012; Gallagher, 2014; China Daily, 2015; Arkin, 2017).

Large hydropower is key for renewable energy technology transfer, although its sustainability merits are contested. Not only do large hydropower dams contribute a significant part of the Kyoto Protocol's Clean Development Mechanism (CDM) Pipeline; but also, 'in the renewables sector, *with the exception of large scale hydropower*, technology transfer has been constrained by the lack of investment and high costs' (Moreira, 2000: 243–244, emphasis added).

In addition to focussing on North-South transfer, the technology transfer literature styles transfer as largely technical. Hard and soft aspects of transfer are debated, including the process of transferring hardware, and then the ways in which transfer leads to local technological innovation. The literature, however, lacks systematic explorations of the wider setting in which transfer occurs, including the politics of decision-making and the political, social, economic and cultural ramifications of introducing a new technology into a specific environment.

This article develops an expanded notion of technology transfer by employing the argument of the literature on the sociology of technologies that technology is not simply an artefact but a social institution. In doing to so the article brings the technology transfer literature into a conversation with the sociology of technologies and sustainability transitions. The focus on South-South transfer is achieved by using the Bui dam as a case study. This allows both an examination of a Chinese project within South-South technology transfer, and it allows recasting technology transfer as a political process rather than as a technical and non-political process.

It is beyond the scope of the article to examine differences between

Abbreviations: BPA, Bui Power Authority; CDM, Clean Development Mechanism; CSR, corporate social responsibility; EPC, Engineering, Procurement and Construction contract; ERM, Environmental Resources Management; ESIA, Environmental and Social Impact Assessment; GIZ, German Agency for International Cooperation; IPCC, Intergovernmental Panel on Climate Change; RPF, Resettlement Planning Framework; IPCC, Intergovernmental Panel on Climate Change

☆ This article is part of a Virtual Special Issue entitled 'South-South Technology Transfer and Cooperation for Low Carbon Energy Technologies'.

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https://doi.org/10.1016/j.enpol.2017.12.039
Received 1 August 2017; Received in revised form 30 November 2017; Accepted 23 December 2017

North-South and South-South technology transfer. Rather, the article has two aims: firstly, it contributes empirical material to the small but growing literature on Chinese involvement in South-South technology transfer by examining the actors and processes that are involved in such transfer. Secondly, it develops an expanded notion of technology transfer by arguing that transfer is not simply a technical process but inherently political, starting from the decision on the technology to be transferred to the engagement with people in whose environment the technology is introduced. Thus, technology transfer does not end with the transfer of hardware and the raising of domestic innovation. Instead, it continues by creating new power dynamics between government, users and other affected groups that require domestic institution-building and multi-actor engagement for equitable access to its benefits and for inclusive development.

The article first surveys the literature on technology transfer. It then introduces the literature on sustainability transitions and the sociology of technology. It then outlines methods, after which it examines the case of the Bui dam.

2. Technology transfer

The literature on technology transfer has explored transfer mechanisms (including foreign direct investment, trade and joint ventures), barriers to transfer (including investment policies, infrastructure, and cultural differences), distribution of technologies (including reach amongst the population in the host country), and the quality of technology transfer. The latter includes the extent to which technology transfer raises domestic knowhow and increases the ability to innovate (Maskus, 2004; Schneider et al., 2008; Hammar et al., 2012; Lema and Lema, 2013; Ohimain, 2013). The quality of transfer is in turn dependent on the quality of domestic institutions, which includes corruption and the presence and enforcement of environmental policies. The literature generally acknowledges that technology transfer includes both hard and soft aspects (De Coninck et al., 2007: 445) or in Lema and Lema's (2013) words narrow and a broad views of transfer. The narrow view comprises physical aspects (the technology itself, cross-border movements, and transaction agreements); the broad view includes the creation of domestic skills and capabilities for innovation to drive technological change. The broad view is key and could be seen as the ultimate goal of technology transfer. In other words, technology transfer can be judged based on the extent to which physical or hard aspects serve the realization of soft aspects. This addresses the importance of domestic absorption of a new technology.

Despite arguments on quality and domestic absorption, Phillips et al. (2013: 1595) maintain that the literature has ignored how domestic politics and power relations influence ‘what types of technology get transferred and on whose terms.’ Indeed, stakeholders in technology transfer include a range of actors on multiple scales, including international institutions, private and state-owned companies, domestic governments, and – especially in the case of large hydropower dams – local communities who face the environmental, cultural, social, and economic impacts of the technology. Some of these issues have been articulated by the literature on technology transfer the Kyoto Protocol's CDM. Exploring the environmental sustainability of CDM-sponsored technology transfer, several authors have argued that the sustainability results of CDM technology transfer are questionable (Cosbey et al., 2005). This is partly because the CDM's market mechanism distorts the original environmental and social sustainability goals (Pearson, 2006). Another reason is the presence of technologies that are of doubtful sustainability, in particular large hydropower dams, which make up a significant portion of the CDM Pipeline. Given the centrality of environmentally and socially sustainable economic growth to the legitimacy of the CDM (Schreuder, 2009; Olsen, 2007), the high number of large dams funded through the CDM is problematic, with often deleterious impacts on the livelihoods of local communities (Rousseau, 2017).

2.1. Technologies as social institutions

The mainstream definitions of technology transfer are inherently technical, despite the importance of soft aspects. The debates on soft aspects, however, revolve around capacity-building such as through training and education to raise a new generation of engineers capable of devising, operating and maintaining new technologies. The debate therefore does not probe into the political and social settings within which technology transfer occurs.

In contrast to the mainstream definitions Cromwell (1992: 979) applies a more encompassing notion of technology transfer. He argues that sustainable transfer goes ‘beyond information sharing and training’ and requires ‘extended periods of local development, risk sharing and institution building’ with the ‘involvement of project partners and beneficiaries in continual reassessment and response.’ As a consequence, ‘[t]ransfer is not exclusively concerned with adapting technology to given socioeconomic and technical environments. It is also the development of suitable mechanisms within the destination environment whereby a technology can be successfully adopted and exploited – adaptation of the destination environment itself’ (p. 979). This includes equitable access to the benefits of the technology for poor communities (p. 984).

Adaptation, thus, becomes a key part of technology transfer. The issue of power, marginalization and equitable access in technology transfer processes has been highlighted by the Intergovernmental Panel on Climate Change (IPCC, 2000: 113). Arguing that the needs of local communities are often ignored in technology transfer, the IPCC drew attention to the importance of local knowledge systems and the inclusion of local stakeholder perceptions of technologies and technological solutions to development questions: ‘Participation of the main stakeholders in the assessment stages can help establish a process that will produce a technology selection better matched to local needs’ (p. 115). However, as the report continues, ‘current processes of technology selection often work against involvement and consultation of local communities’ (p. 115).

In a similar vein, Urban et al. (2015a) pointed to a lack of social sustainability policies in hydropower technology transfer, resulting in continued marginalization of the rural poor who suffer from the economic and social impacts of a transferred technology but receive few or none of the benefits. Phillips et al. (2013: 1595) argued that technology transfer processes are laden with power relationships that influence ‘what types of technology get transferred and on whose terms.’ Not only does this apply to the decision-making process itself; but the introduction of a technology into a specific social, economic and cultural setting engenders social change in destination environments. It is in this context that Fahim (1981: 4) – a trained anthropologist – argues in his analysis of the Aswan High Dam that large dams ‘are not just engineering works but also constitute social institutions.’ In the process of their creation they give rise to new power configurations, redrawing rules for access to water, land, food and energy (Siciliano and Urban, 2017).

The literature on sustainable transitions and sociology of technologies has captured these processes with the notion of socio-technical systems, a term describing the complexity of human-technology interactions during transition processes (Pfaffenberger, 1992; Malerba, 2002; Verbong and Geels, 2007; Geels and Schot, 2010). For Geels (2004) a socio-technical system incorporates innovation and development of knowledge; but it also includes the diffusion, use, *impacts* and *societal transformations* initiated by the technology. As a consequence, sustainable technological transitions need to emphasise both innovation *and* users (p. 898). They not only include people interacting in the direct context of a technology, but also temporally and spatially remote agents, supply chains, hardware and software, and the wider social, financial and political setting (Wilson, 2000). In this view, technologies are more than mere artefacts. They are ‘formed by, and embedded within, particular economic, social, cultural and institutional structures