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Process supporting strategic decision-making in systemic transitions☆

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ABSTRACT

This paper introduces a process for supporting strategic decision-making and policy planning in systemic transitions related to grand challenges such as climate change. The process uses the multi-level perspective (MLP)[1] as an underlying theoretical framework and combines various methods and tools from the fields of foresight, impact assessment, simulation modelling and societal embedding. Decision-makers such as public sector authorities and politicians are the main target group, accompanied by other stakeholders and interest groups whose involvement throughout the process is stressed.

The process is presented as a stepwise methodological working process and demonstrated by a theoretical case study. The demonstration explores the vision of 'emission-free transport in cities by 2050' in the context of motorised passenger transport in the Helsinki metropolitan area in Finland. The case study serves as an example of how to implement the process and how to make case-specific selections from the methods and tools from suggested fields.

1. Introduction

Responding to the grand challenges related to the environment, natural resources, security or demographics requires systemic transitions. In order to understand both the local and global impacts of such transitions, political, economic, social, technological and environmental dimensions and their complex interrelationships need to be analysed. Systemic transitions unfold over long periods of time, and hence a long-term perspective is important in developing, assessing and making decisions on strategies and measures to aid the transitions.

Currently decision-making systems do not adequately take into account the complexity of the operating environment, its dynamics, rapid change and rebound effects. Although various actors of e.g. energy or transport systems are aware of these challenges, decision-making is yet based on fragmented information on the operating environment and wider societal impacts. Also, ability and sensitivity to changes are often lacking (Loorbach and Rotmans, 2010).

Strategic planning and decision-making in transitions can be supported by interdisciplinary, systemic and integrated research approaches that present alternative future visions and pathways (Tuominen, 2009; Tuominen and Ahlqvist, 2010; Gibbons et al., 1994; Nowotny et al., 2001; Jasanoff, 2004; Lemos and Morehouse, 2005; List, 2004). In the fields of foresight and impact assessment new methods are emerging to combine systemic perspectives with deeper participation and policy support approaches. Also, the framework for socio-technical change provides one such approach (Geels, 2004; Elzen et al., 2004).

Socio-technical change and the concomitant approach of transition management have recently gained a great prominence

☆ A case study of emission-free transport in cities by 2050.

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[1] MLP, multi-level perspective (Geels, 2004).

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in the European research agenda. So far, research efforts have focused largely on building theoretical frameworks to understand transitions, and to use these to interpret historical chains of events in retrospect, e.g. (Geels, 2004; Elzen et al., 2004; Geels, 2012; Kemp et al., 1998; Smith et al., 2005; Smith, 2007; Verbong and Geels, 2007). Forward-looking application areas, such as topics linked to climate change, have been identified, but practice-oriented processes and tools to facilitate and support hands-on decision-making and policy planning have not been introduced. Integration of approaches and tools from different theoretical backgrounds, to support transitions through the framework of socio-technical change, has not been common either.

In this paper we aim to expand the scientific discussion on socio-technical change and to narrow down the gap between theoretical advances and practical decision-making and policy planning. The challenge is addressed through the following research questions:

1. How can the fields of foresight, impact assessment, simulation modelling and societal embedding be integrated to study and understand transitions in complex socio-technical systems?
2. How can the methodologies from these fields be put to use to support strategic work of decision-makers such as public sector authorities and politicians in practice?

We present a process supporting strategic decision-making and policy planning in systemic transitions related to grand challenges. The proposed five-step process begins by scoping the decision-making situation and by applying theoretical tools to build an understanding of the system. Measures and actions to influence the system are developed, and their impacts are assessed using simulation modelling.

We demonstrate the stepwise workflow of the process through a case study of urban passenger transport in the Helsinki metropolitan area in Finland. The demonstration gives a concrete example of our approach when applied in the socio-technical system of transport, where a systemic transition is required to address harmful transport emissions. The case study stems from an ongoing Finnish research project STRADA (aiding strategic decision making and steering transformation) that aims to develop methods and tools to support decision-making in complex transition contexts such as healthcare, transport and bioeconomy.

The paper starts with an introduction to the theoretical background of the developed process. First, key concepts of socio-technical systems and transition processes are discussed. Short descriptions of foresight, impact assessment, simulation modelling and societal embedding are provided, together with overviews on selected key theories and tools from these fields and their potential in supporting societal change. As a platform deepening each of these fields and integrating them into one another we use the multi-level perspective (MLP) approach (Geels, 2004). The core of the paper presents the developed process and tools involved. Each of the five steps of the process is presented first from the methodological perspective, followed by a demonstration of how it was implemented in the case study on the transport system. The case study shows how the process was applied and how one possible selection of tools was employed. Contributions of the work carried out and implications for further research are then discussed.

2. Theoretical background

2.1. Socio-technical systems and transitions

The notion of transitions in socio-technical systems is central to our approach. According to Geels (2004), socio-technical systems involve the interaction of production, diffusion and use of technology. Geels (2004: 900) articulates that a socio-technical system consists of "the linkages between elements necessary to fulfil societal functions" like transport or communication. The elements in the socio-technical system are production, distribution (consisting of markets, networks and infrastructure) and use of artefacts. The socio-technical system is thus a web consisting of these three elements and resources to endorse them, like knowledge, capital, labour and cultural meaning. A major shift in a socio-technical system is realised when structural changes take place in the elements of the system. These socio-technical transitions entail co-evolution and multi-dimensional interaction between industry, technology, markets, policy, culture and civil society (Geels, 2004; Loorbach and Rotmans, 2010; Tuominen, 2009; Tuominen and Ahlqvist, 2010; Elzen et al., 2004; Geels, 2012; Kemp et al., 1998; Smith et al., 2005; Smith, 2007; Verbong and Geels, 2007). A socio-technical system and its transition from one configuration to another can be studied using the MLP (Geels, 2004). The concept of the MLP is best summarised by Geels (2007: 642) as follows: "The MLP distinguishes three analytical levels: the niche-level that accounts for the emergence of new innovations, the socio-technical regime level that accounts for the stability of existing systems, and the socio-technical landscape that accounts for exogenous macro-developments." Our research approach builds on the concept of the MLP, which we use as the platform to deepen methods and tools from various disciplines — namely foresight, impact assessment, simulation modelling and societal embedding — and to link them together. The MLP is thus employed in an instrumental manner, providing structure and interfacing between methods and tools within the process that we introduce.

As an example and the object of our case study, we use the socio-technical system fulfilling the need for mobility: the transport system. In Fig. 1 we picture the key components of a socio-technical system of transport in the 'three-level transport system framework' (Auvinen and Tuominen, 2012). The components are users, vehicles and transport infrastructure. In addition, in the middle of these components is a fourth: transport system organisation, governance and regulation. Each of these components is further elaborated into key elements that characterise them. For example, transport vehicles and other means of transport rely on various manufacturing technologies and materials and require maintenance. Different vehicle solutions make use of fuels and other energy carriers resulting in different types of environmental impacts. Furthermore, the use of vehicles involves behavioural patterns and business models, and different types of solutions are available concerning issues such as vehicle ownership. The interaction between any two components as well as between

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