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How perceived uncertainties influence transitions; the case of micro-CHP in the Netherlands

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Abstract

Transitions, or socio-technological transformations, towards sustainability can be considered as a long-term transformation at the level of society as a whole, which in turn consists of a sequence of short-term innovations. The direction and speed of transitions are largely determined by the collective innovation decisions of various actors. A crucial characteristic of transitions is that they involve many uncertainties. The uncertainties that actors perceive greatly influence their innovation decisions. Namely, perceived uncertainties might stimulate some actors to fulfill certain key activities that are crucial for achieving a transition, while blocking other actors from undertaking these activities. In order to understand and manage transitions, insight into the types of perceived uncertainties that dominate the innovation decisions is essential. Furthermore, we need to understand if perceived uncertainties block or stimulate transitions by analyzing how actors respond to perceived uncertainties.

This article focuses on the first transition phase: the pre-development phase. An interesting case to study the role of uncertainties in this phase is the introduction of micro-CHP in the Netherlands. The main questions of this article are: Which types of perceived uncertainties are dominant for the innovation decisions related to micro-CHP in the Netherlands? How do actors react to the perceived uncertainties?

The case results demonstrate that different types of uncertainties influence the innovation decisions of the involved actors. The most dominant sources of uncertainty are technological and political uncertainty. Furthermore, the case shows that responses to uncertainty vary largely between various types of actors. Perceived

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uncertainties seem to block some actors, but induce other actors in fulfilling key activities that are essential for achieving a transition. We discuss how these insights can be used for improving policy for stimulating transitions.

Keywords: Perceived uncertainty; Transition; Innovation; Uncertainty management; Micro-CHP

1. Introduction

The concepts 'transition', 'socio-technological transformation' and 'system innovation' have been receiving much attention in literature [1–8]. Recently, a special issue of this journal was dedicated to these topics [9]. A transition, as we will call it in this article, is defined as a major, long-term technological change in the way societal functions (such as the supply of energy) are fulfilled [3,10]. Transitions that are initiated with a specific goal, such as the transition towards sustainability, are difficult to achieve [1,3,9,11–15]. Therefore, much research has been focusing on gaining insight into the characteristics of transitions and on applying these insights in the development of strategies and policies to steer such transitions (e.g. [5,9]). One of the outcomes of this research is that transitions have been characterized as consisting of several transition phases: pre-development, take-off, acceleration and stabilization [2,6]. This multi-phase conceptualization is helpful for analyzing transitions, but does not create insight in the underlying mechanisms that determine the dynamics of transition processes. In this article, we aim to contribute to a better understanding of these underlying mechanisms.

Starting point of this paper is that transitions are characterized by many uncertainties. These uncertainties play a key role, since they are considered to be one of the major blocking mechanisms of transitions [1,15,16]. Due to the long-time frame of transitions and the interrelatedness of technological and societal changes, uncertainty about the final outcome of a transition is large. Various types of involved actors each have their own vision of the future and these visions constantly change to adapt to new circumstances [6]. In order to reach each of the possible future outcomes, many separate innovation decisions (or 'transition steps') have to be taken [17]. It is the sum of these innovation decisions that leads to a transition. However, each of these innovation decisions is itself surrounded by uncertainties (e.g. [18–22]). The uncertainties that the involved actors perceive greatly influence their innovation decisions and thereby influence the transition as a whole. Thus, gaining insight in how perceived uncertainties influence innovation decisions and transition processes is important for better understanding the underlying mechanisms that determine transition processes.

Transitions involve a wide diversity of actors. While different actors each have their own perceptions of uncertainties, objectives and resources, they will also apply different strategies to cope with perceived uncertainties. One of the standard responses to perceived uncertainties is to delay or even to abandon (innovation) decisions [23]. In other words, perceived uncertainties might prevent actors from participating in transition steps. Participating in transition steps in this respect means that actors fulfill certain key activities that are essential for the success of a transition. For example, perceived uncertainties might prevent actors from investing in experiments. Since the final outcome of a transition is uncertain, it is essential for transitions that many of these experiments in various directions take place. Thus, perceived uncertainties can block the fulfillment of key activities and thereby hamper the overall transition [15]. However, perceived uncertainties do not necessarily have to hinder a transition. Some