



Sustainability transition dynamics: Towards overcoming policy resistance



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ABSTRACT

Sustainability transitions receive major scholarly attention, often explicitly with the intention to develop policy recommendations aimed towards progressing such transitions. Despite these efforts, many implemented transition policies have not been able to meet expectations. This tendency of systems to defeat the policies that have been designed to improve them is known as 'policy resistance'. This paper addresses the question how we can explain the persistence of policy resistance in the context of sustainability transitions, and aims to bring us a step further in the direction of identifying policies that support overcoming policy resistance. System dynamics is an approach that explicitly addresses policy resistance and we investigate how this approach complements existing transition approaches. As an illustration, we apply the approach to the case of the Dutch energy transition, with the participation of 96 experts. We conclude that system dynamics complements the dominant multi-level perspective and the transition management approach by providing a middle ground between emphasizing agency or structure. Moreover, the approach helps overcoming policy resistance by mapping out the structure of the system responsible for policy resistance, thereby enabling the identification of high leverage points that support sustainability transitions.

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1. Introduction

A considerable number of studies have been published on *sustainability transitions* (Markard et al., 2012). These studies argue that the challenges today's societies face are unprecedented, and that fundamental transformation processes, or transitions, are necessary in order to meet them (Van den Bergh et al., 2011). Examples of such challenges are water and food scarcity, environmental pollution, and climate change (Markard et al., 2012). Sustainability transition studies aim to understand how transitions evolve over time, and often generate explicit policy recommendations to support progressing transitions. The multi-level perspective and transition management are two dominant approaches that are being used to study sustainability transitions (Lachman, 2013).

The multi-level perspective understands sustainability transitions as a coevolution of niches, regimes, and landscapes (Lachman, 2013). Niches are conceptualized as small spaces where innovations in technologies and markets occur (Geels, 2007), while regimes are the broader context in which niches find themselves, consisting of (groups of) actors, their rules and norms, as well as material and technological

elements (Geels, 2004). Landscapes represent the even broader trends and global events that provide the context in which regimes are embedded (Lachman, 2013). Transition management is a governance concept specifically developed for the management of sustainability transitions (Loorbach, 2010). Transition management is characterized by a focus on long term thinking, with appreciation for multiple domains, actors, and levels (Rotmans et al., 2001, p.22). It has a focus on learning, on system innovation alongside system improvement, and on keeping a large number of options open.

Policies that have been developed with the use of the multi-level perspective and transition management are meeting considerable *policy resistance* in practice: "Given recent drawbacks in actual policy contexts (Kern and Smith, 2008; Kern and Howlett, 2009), the role of transition management [...] remains to be seen" (Markard et al., 2012). In the Netherlands for example, transition thinking has been the foundation for energy policies for nearly a decade, but results have not been able to meet expectations (Kern and Smith, 2008). Policy resistance is the phenomenon that systems tend to defeat the policies that have been designed to improve them (Sterman, 1994), that "some problems persist in spite of continuous efforts to solve them" (Meadows, 1982, p. 103). The observation that policies brought forward by the multi-level perspective and transition management encounter policy resistance motivates our research questions: how can the persistence of policy resistance in the context of sustainability transitions be explained, and how may

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policies that overcome policy resistance be identified? Answering these questions allows us to enhance the transition literature, by putting it in a better position to understand and overcome policy resistance.

Policy resistance results from feedback loops pushing systems back towards their initial condition. An approach that explicitly addresses policy resistance and the underlying feedback loops is system dynamics (Sterman, 2000). System dynamics claims to be an approach that supports understanding and overcoming policy resistance, therefore we look in this direction for the answers to our research questions. While applications of system dynamics on transitions are numerous (Fiddaman, 2002; Ford, 1997; Forrester, 1971b; Meadows et al., 1972; Moxnes, 1990; Naill, 1992; Sterman, 1982), surprisingly, a strong connection with the sustainability transition literature has yet to be established. All approaches have their blind spots (Coenen and Díaz López, 2010), so rather than proposing to use system dynamics instead of the multi-level perspective or transition management, the current study aims to identify how system dynamics complements the multi-level perspective and transition management. As a result, we set out to expand the 'toolbox' of sustainability transition scholars and policy makers with the system dynamics approach, putting us in a better position to cope with policy resistance.

Evidence is coming from a case study we conduct in the context of the Dutch energy transition because this is a typical example where policies developed with the multi-level perspective and transition management have been meeting policy resistance (Kern and Smith, 2008). Our case study consists of eight workshops, in which a total of 96 experts from the industry applied system dynamics to explain policy resistance in the Dutch energy system. Using the case study as an illustration, we find that system dynamics complements the dominant approaches by providing a middle ground between emphasizing agency or structure. Moreover, we will show that the approach helps overcoming policy resistance by mapping out the structure of the system responsible for policy resistance, thereby enabling policy makers to identify high leverage points that support sustainability transitions.

In our study stakeholders are directly involved in mapping the system. This facilitated approach to system dynamics modeling is known as group model building (Richardson and Andersen, 1995). Group model building not only helps to elicit and integrate stakeholders' knowledge on the system of interest, but also has been shown to create commitment to proposed policies (e.g. Rouwette et al., 2011). System dynamics, facilitated or not, can be used to develop stock and flow diagrams and simulation models, or it can be used to develop a qualitative model. Because developing a simulation model falls outside the scope of this study, the end result of our modeling efforts consists of a qualitative causal loop diagram.

The remainder of this paper starts with a background on the phenomenon of policy resistance. Subsequently, we present the case study where we apply the system dynamics approach on the Dutch energy transition. This illustration includes a section discussing the background of the Dutch energy transition, a section on the methods that have been applied, a section discussing the model that resulted from the case study, and a section providing an analysis of this case, including policy recommendations that aim to overcome policy resistance. After this illustration, we return to the more general level of sustainability transition approaches by comparing system dynamics to the multi-level perspective and the transition management approach, followed by concluding remarks.

2. Policy resistance

2.1. Defining policy resistance

Policy resistance is the failure of policies to achieve the desired outcome. It is "the tendency for interventions to be delayed, diluted, or defeated by the response of the system to the intervention itself" (Meadows, 1982, in Sterman, 1994, p. 303). Moreover, "many times

our best efforts to solve a problem actually make it worse" (Sterman, 2000, p. 3). Already in the 1970s, scholars were discussing the "unexpected, ineffective, or detrimental results often generated by government programs" (Forrester, 1971a, p. 109). Policy resistance occurs when "policy actions trigger feedback from the environment that undermines the policy and at times even exacerbates the original problem" (Ghaffarzadegan et al., 2011, p. 24). Society consists of all kinds of actors, each with their own goals. "Suppose a government intervenes in such a system with a strong policy that actually moves the state of the system towards the government's goal. That will open up greater discrepancies for other actors with different goals, which will cause them to redouble their efforts" (Meadows, 1982, p. 104).

2.2. Policy resistance in the sustainability transition literature

The sustainability transition literature is full of references to policy resistance, although not by that name. In its overview of different transition approaches, Lachman stresses that transitions, although necessary, may be very hard to bring about due to the fact that "society is often 'locked-in' by [...] unsustainable systems of consumption and production" (Unruh, 2000, 2002, in Lachman, 2013, p. 269). Yet another term, in the same overview, is that of "persistent problems": those problems that are "inherent in system structures" (Lachman, 2013, p. 270). In their description of what they call the sustainability transitions field, Markard et al. (2012) explain that sustainability challenges are "aggravated by the strong path-dependencies and lock-ins we observe in the existing sectors" (Åhman and Nilsson, 2008; IEA, 2011; Safarzyńska and van den Bergh, 2010; Unruh, 2000, in Markard et al., 2012, p. 955). Van den Bergh et al. mention the "fundamental barriers" (Van den Bergh et al., 2011, p. 2) that often plague sustainability transitions, yet another indication of the persistence of policy resistance in this field.

2.3. Focusing on policy resistance with system dynamics

Although policy resistance is widely acknowledged in the sustainability transition literature, studies often touch the subject tangentially when setting their stage and studies focusing primarily on this phenomenon are rare. Perhaps related is the observation that policies based on those approaches suffer from policy resistance themselves (Kern and Smith, 2008), which can be seen as a suggestion that dominant transition approaches are not adequately suited to deal with policy resistance. To be able to both understand policy resistance and identify remediating policies, we turn to an approach that explicitly claims to be suitable to this end: the system dynamics approach (Sterman, 2000). According to the founder of this field, Forrester (1971a, p. 109), "society becomes frustrated as repeated attacks on deficiencies in social systems lead only to worse symptoms", and "the field of system dynamics now can explain how such contrary results happen". Moreover, applying the system dynamics approach "will lead to a better understanding of social systems and thereby to more effective policies for guiding the future" (Forrester, 1971a, p. 109).

A core idea in system dynamics is that numerical data in itself are insufficient to foster an understanding that is rich enough to capture the structure responsible for policy resistance, and that mental models should also be accessed. Group model building is a tradition focusing on how to access and represent the mental models of groups of experts (Vennix, 1996). Earlier examples of studies capturing mental models of experts to explain policy resistance are Perlow et al. (2002), Repenning and Sterman (2002), and Van Oorschot et al. (2013). However, these studies collected data on the level of single organizations. Sustainability transitions are so complex, that for the current study, eight workshops with experts are held. To our best knowledge, group model building has yet not been applied to understand policy resistance on such a large scale. System dynamics and group model building are discussed in more depth below, but first we provide some more background on the Dutch energy transition.

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