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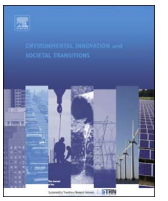

A social network analysis of Germany's wood-based bioeconomy: Social capital and shared beliefs

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ABSTRACT

The present study undertakes a social network analysis (SNA) to identify some of the main organisations involved in Germany's wood-based bioeconomy (WBE) innovation system, their relationship to each other and their shared beliefs. The resulting network map shows a rather densely connected "strategic" WBE network where actors exchange mainly information and knowledge. Some 30 organisations are central to the network and act as "brokers" connecting different segments of the network. Despite weak connections, organisations report high levels of trust regarding their cooperation. Most actors share similar visions about the WBE. However, the different meanings and policy preferences associated with these beliefs vary. Given this low frequency of contact and the absence of a shared, common policy vision the WBE networks is less likely to initiate collective action.

1. Introduction

The bioeconomy can be understood as a cross-sectoral concept, where different sectors (e.g. food, feed, chemistry, energy, fuel, and pharmaceutical sectors) are expected to cooperate in order to derive products from renewable biological resources stemming from agricultural-, forest- and fishery- sectors (McCormick and Kautto, 2013; van Lancker et al., 2016). Under a so called "wood-based bioeconomy" (henceforth WBE) (Hagemann et al., 2016), forest biomass would be valorised beyond classical applications (e.g., woodwork, pulp and paper, and wood for bioenergy), into high value products (e.g. pharmaceutical materials or chemicals), biofuels, and other lower value applications (Näyhä et al., 2014; van Lancker et al., 2016).

Both scholars and policy makers assert that innovation plays a central role in ensuring a sustainable bioeconomy transition, both on the supply side (e.g., new technologies and products) and on the user side (e.g. consumption and waste patterns) (BMBF, 2014; Hellsmark et al., 2016; Purkus et al., 2017; van Lancker et al., 2016). Regarded from a Technology Innovation Systems (TIS) perspective (Bergek et al., 2008; Hekkert et al., 2007), a multitude of different renewable resource-based technologies and innovation structures would have to come into play under the broad concept of "bioeconomy"(Purkus et al., 2017). Such innovation structures are created and shaped by different actors and institutions with a stake in the new innovation system (Musiolik et al., 2012). In the case of the WBE, this would require close cooperation and knowledge transfer among various different actors from multiple sectors and fields. Particularly, "formal networks" are likely to play a key role in such processes of system building because they enable actors to coordinate their strategies and organize collective action (Musiolik et al., 2012). However, lack of trust (Newell and Swan, 2000), disunity and divergent interests among different organisations may undermine the cooperation needed for successful collective action (Heaney and Rojas, 2008). Additionally, information and knowledge gaps are not always easy to overcome and arise mainly due to

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various institutional and conceptual barriers between researchers, innovators, producers, end-users, policy makers and the civil society (BMBF, 2011; European Commission, 2012; van Lancker et al., 2016). The German government has supported a number of bioeconomy networks, clusters and councils aimed at bridging some of these information and knowledge gaps. Whether these newly established networks are indeed able to collaborate and align their mutual goals towards the establishment of a successful bioeconomy is still uncertain.

The importance of collaboration and social capital has been widely acknowledged both in technology innovation (see e.g., Hellsmark et al., 2016; Vico Perez, 2013) and natural resource governance studies alike (Borg et al., 2014; Paletto et al., 2015). Cross-sectoral networks have become a common form of collaboration in the area of innovation systems (Musiolik et al., 2012) and broader sustainability transitions (Fadeeva, 2005; Krott and Hasanagas, 2006). Thus, a wide range of forms of collaboration across public and private sectors were considered to generate new potentials for learning, adaptation, and social capital (Borg et al., 2014; Cashore and Vertinsky, 2000). Particularly the level of social capital, as well as the shared trust and beliefs among different organizations, was found to influence the structure of such cross-sectorial actor networks (Henry et al., 2011). Within these cooperation networks, so called “learning networks” or “policy networks” can be indicative of coalitions made up of actors sharing the same beliefs (Bergek et al., 2008; Sabatier, 1988). Thus, while social capital does indeed often enable cooperation and helps solve collective problems, it can sometimes also facilitate the formation of interest groups (henceforth IGs) with specific political agendas (Chamlee-Wright and Storr, 2011). For example, Kleinschmit et al. (2014) postulate that the shift towards bioeconomy offers potential for the formation of such new policy networks and IGs between players from different sectors and industries. Thus, traditional network boundaries of “classical” sectors (i.e., forestry and agriculture) are expected to shift, allowing new cross-sectoral actor networks to form and in turn reveal emerging IGs and power struggles in the bioeconomy arena (Kleinschmit et al., 2014).

Social Network Analysis (SNA) has been increasingly recognised as a valuable method to empirically assess social capital and the formation of IGs and their potential impacts in a given policy arena (see e.g., Heaney and Rojas, 2008; Henry et al., 2011; Ingold, 2011; Varone et al., 2016). However, tracing the complex and lengthy formation process of such networks in practice remains an empirical challenge (Markard et al., 2015; Varone et al., 2016). With the fairly recent emergence of the bioeconomy agenda in Germany (BMBF, 2014), studies assessing bioeconomy networks have been scant. To date, several studies have approached the bioeconomy from the TIS perspective. However, most of these studies have focused on single innovation systems (see e.g., Giurca and Späth, 2017; Hellsmark et al., 2016). Some studies have even discussed the applicability of the innovation systems approach to the bioeconomy concept as a whole (Purkus et al., 2017). Yet, the different ways of finding the actors involved in an innovation remains subject to scholarly debate (Carlsson et al., 2002). To date, descriptions of actor networks and social capital under the WBE in Germany have been mainly cursory (see e.g., Giurca and Späth, 2017). Previous studies have attempted to identify actor networks involved in a particular innovation system through SNA (see e.g., van Alphen et al., 2010). However, these actor networks have mainly resulted from qualitative studies, and provided little information about the quality of different network “resources” such as the type of contact, the level of trust and shared goals or policy preferences within an innovation system. In this paper we take an actor-centred approach and aim to fill this empirical gap by analysing the nature and structure of actor networks involved in the emerging bioeconomy innovation system.

The main aim of this empirical study is to understand how initial actor networks and subsequent social capital and shared beliefs facilitate or hinder the formation of an innovation system. More specifically, through SNA we analyze the social capital within existing government-supported bioeconomy networks as well as identify common policy interests that these different organizations share. Given the wide scope of the bioeconomy concept, we focus here on one subsystem of the overall bioeconomy, namely the case of the German WBE which has attracted interest recently due to its prospects of building on a wide resource base (Bioökonomierat-BÖRMEMO, 2016) and on production pathways that do not directly compete with food production (Hagemann et al., 2016). To this end, a discussion on the implications of these network structures, social capital and IGs for Germany’s WBE innovation system will be provided. Following research questions are addressed:

- What type of organizations are involved in the WBE network?
- How is the network structured in regards to connections, information/knowledge exchange and trust?
- Can this network structure and social capital be indicative of certain IGs in the WBE network?

This paper proceeds as follows: Section 2 provides the theoretical underpinnings of the study; Section 3 presents the data sources and methodology; Section 4 presents the main results, and Section 5 the discussion and lessons learned.

2. Theoretical underpinnings

2.1. The bioeconomy innovation system

Innovation systems can be defined in a variety of ways: they can be national, regional, sectoral, or technological. One major commonality is that they all involve the creation, diffusion, and use of knowledge (Carlsson et al., 2002). This approach provides a heuristic for integrating insights from various theories (i.e., institutional theory and institutional economics) that seek to understand processes of innovation and technological change (Hekkert et al., 2007). Although different approaches to innovation systems exist (see e.g., Bergek et al., 2008a; Carlsson et al., 2002; Lundvall, 2008) these different studies point to the structure of the innovation system as the explanatory basis (van Alphen et al., 2010). Thus, besides institutions, the structure of an innovation system consists of actors (e.g. industry representatives, universities, governmental and non-governmental organisations etc.) and their networks