



# Information exchange under uncertainty: The case of unconventional gas development in the United Kingdom



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## ARTICLE INFO

### Keywords:

Information exchange  
Unconventional gas extraction  
Hydraulic fracturing  
Network analysis  
United Kingdom

## ABSTRACT

New techniques of unconventional oil and gas extraction, such as hydraulic fracturing, challenge current political, institutional and administrative practices in how to regulate activities in the underground. Conflicts of interests between economic promotion, landscape and natural resource protection, and new trends on energy markets are further intensified by the fact that techniques of oil and gas extraction come with a considerable amount of uncertainties regarding ecological and health impacts. Information exchange is one important aspect of how political actors try to reduce uncertainties and conflicts. Based on exponential random graph models (ERGM) for network data, we analyze to what degree ideologies, public authority, existing collaboration and scientific expertise drive information exchange in hydraulic fracturing regulation in the United Kingdom. Results show that technical and political information exchange have to be disentangled, and that the former is driven by expertise and existing collaboration, the latter by ideology, public authority and existing collaboration.

## 1. Introduction

Public policymaking in the field of environmental politics and land use management is increasingly complex, and scientific expertise is often needed to tackle modern policy problems (Lubell, 2013). This is particularly true when new techniques such as hydraulic fracturing for unconventional gas exploitation are discussed and applied, as they challenge current land use practices, environmental protection, property rights distribution and policy regulation about activities in the underground (e.g., Centner and Kostandini, 2015). In such a context, political actors are uncertain about the concrete effects of the new technique (for instance on the environment or human health), about the appropriate policy solution to formulate, and about the reaction and the potentially updated preferences of their peers (Newig et al., 2005). In order to reduce these uncertainties, political actors are expected to choose specific strategies of information exchange, and scientific actors might play an especially important expert role (see also Baird et al., 2016; Papadopoulou et al., 2011).

Besides *technical* information, which involves expert advice about the technology and its potential implications, *political* information is important in helping actors to plan their influence strategies and build coalitions when involved in a policy process. Both technical information on a given problem and political information on strategies of

coalition building are important resources for actors seeking to influence a policy process (Hecl, 1978; Leifeld and Schneider, 2012). Furthermore, actors can exchange information for gaining influence over a policy process (Coleman, 1986; Knoke, 1996; Pappi and Henning, 1999; Henning, 2009; Heaney, 2014; Leifeld and Schneider, 2012). Gaining and sharing technical and political information is thus a crucial aspect of actors' strategic behavior in policy processes in general, and even more in the presence of important uncertainties related to potential environmental or health impacts.

Yet, the strategies of information exchange among political actors, and the related differences between scientific and political information, have not been studied extensively. Notable exceptions are Leifeld and Schneider's (2012) study on the domain of toxic chemicals regulations in Germany or the examination of rural development projects by Papadopoulou et al. (2011). More generally, the literature on policy networks suggests that ideological similarity (Sabatier, 1988), social trust (Carpenter et al., 2004), perceived power (Ingold and Fischer, 2014; Fischer and Sciarini, 2016), and functional interdependence (Pfeffer and Salancik, 2003; Leifeld and Schneider, 2012) are important drivers of different types of network relations between actors. In this paper, we rely on various established drivers of network relations and test how they matter for two types of information exchange in the specific setting of land use policy and natural resources management.

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We test our arguments on a policy process related to unconventional gas development. Unconventional gas is extracted using new and controversial technologies of hydraulic fracturing (later: fracking; see [Centner and Kostandini, 2015](#)). Fracking allows extracting sizable resources of natural gas from basins that were considered to be difficult or costly to exploit before (IEA, 2012). The successful extraction of unconventional gas can have important consequences for the global energy market and geopolitical world map. However, there are also many environmental risks related to the technology, such as the contamination of surface waters and aquifers, the causation of seismic activity, or the generation of fugitive methane emissions ([Stevens, 2010](#); [Jackson et al., 2014](#)). As of today, there is a lack of scientific evidence on the exact economic and environmental impacts of shale gas development ([Stevens, 2010](#); [Wagner, 2015](#)). This results in considerable challenges to the promotion or regulation of fracking. The fracking issue therefore represents an ideal case to study information exchange on an issue characterized by scientific uncertainty about its impacts on one side; and uncertainty about how political peers or opponents might react to it on the other ([Ingold et al., 2016](#)).

We rely on exponential random graph models (ERGM) for network data to explore which factors account for network relations between actors within the technical and the political information exchange network. New data about the policy process on the regulation of unconventional gas development in the UK between 2007 and 2014 was gathered in the summer of 2014 ([Ingold et al., 2016](#)). In the UK, both the energy industry and government identified the high economic potential of unconventional gas development; but environmental risks persist and environmental organizations and the local population oppose fracking sites. Still, the UK is about to develop shale gas in spite of strong public opposition and mobilization ([Stevens, 2013](#)).

The remainder of this paper is structured as follows: after discussing the importance of information exchange for political decision-making and for the particular case of policy domains driven by scientific uncertainty and the arrival of a new issue, we deduce several hypotheses from policy process and resource dependence theories. We then briefly present the case, the data and the method. In the next sections, we present and discuss the results from the exponential random graph models. Section six concludes and highlights shortcomings and major findings of this research.

## 2. Theory

Information exchange among political actors is particularly important in policy domains coming with a high degree of uncertainty about the political problem at stake ([Metz and Ingold, 2014](#)) or with conflicts and uncertainties about natural resource use and protection ([Berardo, 2014](#); [Coglianese, 1997](#)). For example, uncertainties created by energy shocks have been shown to affect the behavior of actors ([Ahrari, 1987](#); [Fischer, 2015](#); [Grossmann, 2012](#)). Uncertainty is defined as actors' limited knowledge about future, past or current events ([Walker et al., 2013](#)). In such a situation, actors lack substantive knowledge about a political issue ([Newig et al., 2005](#)). They therefore have a harder time defining the seriousness of the problem, recognizing clear policy domain boundaries, anticipating the behavior and beliefs of other actors ([Krishnan et al., 2006](#); [Lubell, 2013](#)), "knowing the links or probabilities between actions and consequences" ([Weible, 2008](#)), and thus selecting appropriate policy instruments to tackle a problem ([Aoki, 2007](#); [Newig et al., 2005](#); [Landry and Varone, 2005](#)). In sum, uncertainty affects political actors' willingness or need to strive for or provide information, as well as their choice regarding which actors they exchange information with.

Information exchange is crucial not only for individual political actors, but also for their joint capacity to successfully address complex policy problems, especially in the domain of environmental policy ([Papadopoulou et al., 2011](#)). [Schneider et al. \(2003\)](#) demonstrate the added value of participation in community- and-expertise-based

institutions for the resolution of complex problems, while [Berardo and Scholz \(Berardo, 2014; Berardo and Scholz, 2010\)](#) underline the importance of bridging and bonding relations between actors, depending on their risk perception. Further, information exchange is an important pre-condition for the establishment of stable network relations and social capital: two important drivers to enhance resilience towards environmental impacts ([Ingold et al., 2010](#)).

### 2.1. Two types of information exchange

Two types of information relations are important when studying a policy domain under uncertainty ([Leifeld and Schneider, 2012](#)): on the one hand, actors exchange technical information in order to enhance their scientific knowledge about the problem as such. For example, [Phillipson et al. \(2016\)](#) demonstrate the importance of professional network relations and the diffusion of expert knowledge under complex and changing land management conditions. On the other hand, political information concerns the strategic exchange of information about similar beliefs, venue shopping and resources. Both types of information can be used to influence a policy process and thereby the policy output, but in different ways. Technical information consists of knowledge about the given problem and enhances substantive knowledge about the issue under uncertainty. It is often generated by scientists in the first place ([Leifeld and Schneider, 2012](#)), but can also stem from consultants, policy analysts and government specialists ([Weible, 2008](#)). This type of information can be used by actors in order to inform themselves about the substantive issue (the drilling technique, the potential impact on ecosystems, the change in resources allocation or property rights, potential risk for humans or the environment, etc.), or to influence the policy process through knowledge provision to other actors. One specific example would be expert reports prepared for decision-makers.

In contrast, political information is related to the strategic behavior of political actors. It allows actors to coordinate their influence strategies and to organize their work in order to impact policy outputs. According to the Advocacy Coalition Framework, for instance, political actors exchange information within their coalition in order to coordinate their actions ([Sabatier and Weible, 2007](#); [Weible, 2008](#)). Political information is used to communicate with peers about strategic actions to influence decision-making. Examples for political influence strategies are the coordination of venue shopping or joint lobbying activities ([Leifeld and Schneider, 2012](#)).

### 2.2. The main drivers of information exchange

Below, we outline four major drivers that are expected to enhance information exchange and discuss their importance in a context of uncertainty. While the first three drivers should be most important for political information exchange, the fourth factor should influence technical information exchange in particular.

#### 2.2.1. Belief similarity

Two actors with similar beliefs on what a policy should look like are likely to exchange information ([Weible, 2006](#); [Sabatier and Weible, 2005](#)). Shared values and beliefs are the basis for coalition formation and coordination among actors involved in a policy domain ([Sabatier, 1987](#); [Sabatier and Weible, 2007](#)). Generally speaking, we expect actors to rely on belief similarity when choosing their information exchange partners. Applied to land use and natural resources' policies, actors who share similar ideologies regarding the degree of state intervention when regulating activities in the underground are thus expected to get in contact. As illustrated by [Pedersen \(2010\)](#), beliefs are defended in so-called communities and take the form of ecosystem and nature conservation, economic development and the use of resources for human wellbeing, or the development of local business and labor market.

We expect differences between both types of information exchange. First, similar beliefs lead actors to form coalitions with the goal of

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