Theoretical considerations on the geopolitics of energy transitions

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Energy transitions can have large geopolitical consequences and, vice versa, geopolitics influence transitions. In the current literature on the transition to a hydrogen economy, it has only little attention. This chapter will describe an analytical framework that can be used to describe the evolution of energy systems in the context of geopolitics. Our analytical framework uses economic geography, political geography and political economy as building blocks linked by the institutional economic approach. The purpose is to find patterns in habits and institutions that explain the geopolitical process accompanied by energy transitions. This will help understanding future energy transitions and in their geopolitical context.

It is claimed that an energy transition is needed due to three world scale problems concerning energy demand, energy supply and the environment. The spatial characteristics of the energy supply chain will change dramatically with the possibility of major geopolitical consequences. The goal of this chapter is to create an analytical framework that explains energy transitions in a geopolitical context. The chapter will also assess institutional economic theory on its relevance for studying geopolitics. Transitions are often described in scenarios, roadmaps, etc. Although geopolitics is often mentioned, especially to underscore geopolitical benefits, it is never studied in greater detail. The framework described in this chapter will tested with the case of the emergence of the oil industry. It will ultimately serve to analyze the case of the hydrogen industry.

On the supply side of the energy supply chain, it is claimed that the world is running out of fossil energy sources (Dorian et al. 2006; IEA 2007). The fast growing world population and the soaring economies of China, India, and Brazil result in an accelerating energy demand. Consequently, energy consuming countries are competing for the scarcely accessible resources, colliding and cooperating with other international entities. There are different approaches for coping with these problems. A transition to an alternative energy system can be one of them.
At the same time air quality in especially cities is worsening and global warming has become a major issue (Dorian et al. 2006). The Kyoto deadline is enforcing governments to reduce greenhouse gas emissions. New international initiatives are taken and the pressure on countries to commit to environmental goals is increasing. There is a call for more efficiency and alternative energy solutions that support further economic growth and reduce pollution.

Alternative energy carriers like hydrogen might be able to solve parts of these problems. It implies that an energy transition is needed. There is extensive literature available that describe transitions from a policy perspective and governments use transition theories for management purposes. Transition management focuses on national policies, lacking attention to the international component. However, many scenarios often refer to the geopolitical advantages of hydrogen; they never seem to support this with arguments based on research.

The spatial factor plays a major role, as the activities in the energy system are located in different nation states and regions. In general, resources are not located where they are consumed. Therefore, nations have always tried to influence the spatial structure of the supply chain according to their particular goals relating to security of supply and demand, allocation of economic rents and the environment. The geopolitical influence on the spatial structure of the energy system in development is seldom addressed, so approaches are not readily available. I will remedy the situation in this chapter.

To be able to study the geopolitical influence, an analytical framework is needed. The meaning of geopolitics will become clearer and a better understanding is created on energy transitions from a geopolitical point of view. An energy transition will have geographic as well as geopolitical consequences. These consequences will partly reveal themselves in the institutional arrangements, introducing different actors and types of arrangements. By finding patterns and factors in past energy transitions, we can assess the possible geopolitical impact of a future transition towards hydrogen.

First, the framework will be built up by introducing and explaining key concepts such as transition. Then the term geopolitics, after being unpacked, will be reconstructed in a framework. Geopolitics combines different approaches namely economic geography, political geography and political economy. In addition, we will elaborate on institutional economics, which will provide the link between these approaches. New institutional economics and original institutional economics are assessed on their usefulness to create an analytical framework.
Transitions

‘[T]ransitions are processes of sociotechnical evolution in which economic, institutional and technical structures develop interactively and change drastically in the long run’ (Bruggink 2005). There are two approaches to transition. First, according to transition theory these three aspects interact in three levels of transitions; namely the landscape, sociotechnical regime and technological niches (Geels and Verbong 2000; Geels 2005; Rotmans et al. 2000; Rotmans 2003; Verbong and Geels 2007). Transition theory has its roots in evolutionary economics; but it takes a policy perspective on evolutions to new (large) sociotechnical systems. Concepts as path dependence and lock-in play a large role, and need to be dealt with by the policy makers to breach the current system. Second, transition management, a more normative version stemming from transition theory, guides the policy maker through the transition. It suggests certain policy actions for the different phases of transitions. The phases, four in total, are based on the product life cycle, using the characteristic s-curve.

The multi-level perspective described by Frank van Geels (2002) is widely accepted as transition theory. The level of the sociotechnical regime is dynamically stable, changing incrementally through small innovations. Many forces, as vested interests of organizations, keep the collection of sociotechnical regimes stable. At the level of technological niches different technologies are developed which call for a radical change in the regime but is not able to change it (yet) and therefore coexist. These niches are too small to have a decisive influence; but slowly many different appliances are found diffusing into the regime. Finally, the sociotechnical landscape level ‘refers to aspects of the wider exogenous environment that affect sociotechnical developments . . . They are beyond the direct influence of the actor and cannot be changed at will’ (Geels 2005). These levels interact and might create a transition.

In transition management, as described by Jan Rotmans et al. (2000) the four phases, identified by transition theory, need different policy approaches. In the first phase, the transition is predeveloped; government needs to broaden the field of possibilities, spur the participative discussions, and perform strategic niche management. In the second phase, the transition takes off and the actors need to be mobilized. In the third phase, the innovation and therewith the transition is speeding up; government should choose, adjust and support continuation of the developments. In the fourth and final phase, the system stabilizes, and the government should consolidate the new regime.

The main purpose of transition theory is to describe past transitions. In transition management, however, the theory is used for policy recommendations on a
national level and scenario building for future transitions. In the case of energy, the international component is very important and constrains the influence on transitions.

Many scenarios for the transition to a hydrogen economy follow more or less the patterns described in transition management. As a consequence, they use their concepts for recommendations for national governments. In many of these scenarios, geopolitics is addressed without further elaboration, as if geopolitics is given, and the goals and their meaning for society are clear. The geopolitical situation is difficult to influence by a single actor and cannot be changed at will. The framework used does not help to solve geopolitical issues, because it is partly situated at the difficult to influence landscape level. Moreover, management of a transition is not the goal of this research. Hence, transition theory and management does not help to solve the geopolitical questions related to energy transitions.

Unpacking geopolitics

‘Geopolitics . . . observes and speculates upon the influence of geographical necessities upon political events and changes in the political forms of states’ (Hagan 1942). While economic and political geography describe the economic and political status of different geographic regions and its development and interaction, political economy addresses governance structures, geopolitics deals with the possible strategies to gain access to limited geographical necessities or to improve the actors’ geographic conditions.

The economics of the geographic location of activities in the supply chain is influenced by political geography and political economy. Different states have different institutional, economic and political regimes that influence the routes and physical aspect as capacity of the infrastructure, including transit rights and costs. Why activities take place at specific locations can thus not be answered by using economic reasoning alone. It involves political processes and institutions (Odell 1963; Manners 1964).

Geopolitics is seen as an applied study. The geographic configuration is its starting point. Economic geography, political geography and political economy can provide the basis on which geopolitics is researched, but need to be linked. We believe institutional economic theory can provide this link. In the next sections, the four perspectives are described with the purpose to find commonalities and patterns that can be combined in an all embracing approach.

Economic geography

In addition to the usual costs of production and consumption, the specific spa-
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tial patterns in energy systems give rise to variations of costs related to location, distance, transport and storage. The supply chain can be a useful tool to identify the different segments and position them economically and geographically. The supply chain separates the energy system in several segments. It enables the explanation of different elements of the energy system on their spatial aspects. The supply chain crosses borders and includes the geographic factors location, distance, transport and storage (Manners 1964; Odell 1963). It can historically be observed that shifts in the costs of transport and storage have been crucial drivers, alongside the basic costs of production and use, in the evolution of energy use (Odell 1963; Manners 1964).

Gerald Manners has the following practical approach to economic geography: ‘In the study of the geography of energy three sets of questions merit particular attention. The first concerns the energy industries themselves. . . . The second set of questions relates to the transport of energy. . . . The third set of questions concerns the consumption of energy’ (Manners 1964). Where and why do activities take place? What are there patterns? Do they change over time? Is this seasonable? What are there implications? These questions can be approached in three ways. We can examine each resource in turn; study a variety of different energy economies; or find factors which influence the geography of energy and examine them in greater depth, ‘avoiding repetition, including different energy sources, and giving the study depth’ (Manners 1964). Peter Odell (1963) uses a similar approach.

Political geography

Whereas geopolitics studies the significance of geographic territory, its resources and the strategies which follow from it, political geography ‘constitutes the spatial analysis of political phenomena’ (Ferrari 2005). Political geography describes both the spatial outcomes of political processes and the ways in which political processes themselves are affected by spatial structures.

Four levels of political geography can be distinguished: the local, state, regional, and international level. The political regimes in countries determine in part the perception on energy issues and the way, when and with whom to resolve them. Political change can change preferences, interdependencies and relative position of countries or regions. Thus the way to resolve energy issues as shown in several publications (Odell 1963, 1970 and 1998; Correljé 1994). Moreover, changing borders can change the resource base and boundaries of the energy system. It follows that changes in political geography can have a major impact on the functioning of the energy infrastructure as a whole. Although political geographic changes can be very revolutionary, the institutional arrangements do not change radically (Odell 1998).
Political economy

Political economy studies political and economic aspects without the spatial implications. It focuses on the interaction of nation states on institutional, political and economic aspects. Nations compete and bargain in different forms from conflict to cooperation shaping the political economy of energy. Political economic problems are dealt with through institutional arrangements which are historically embedded (Rutherford 1996; Hodgson 1998; Williamson 2000). The type of arrangements used differs per country or region depending on the political economic regime and its history. Although the nation state is starting point of this approach, the process of globalization and the rise of non-governmental organizations (ngo) demise their role, which can be dealt with by using a multi-level governance approach (Finger et al. 2006).

ngo become increasingly powerful. Nations are increasingly interdependent and depend on the ngo for their supplies of energy. Issues cannot be resolved by individual nations. This process of globalization therefore needs a shift in thinking from nation states to more general spatial aspects. From this perspective, political economic issues occur at different spatial levels; local, national, regional and international. This results in the multi-level governance approach with institutions as unit of analysis for the study political economic processes.

The geography is an important element in the way the political economy takes form. The perception and the power of specific geographic areas on geopolitical issues differ with the position in the supply chain, which is to a large extend determined by its geography. The sort of power and arrangements nations might use depend on their resource base, territory, the activities in the supply chain they are involved in and the way they deal with (inter)national issues traditionally. But due to globalization, ties with ngo become increasingly important.

Although many theories have been developed and used to describe the (international) political economy, no one has a satisfying explanation for the processes involved in energy systems, which are context specific. For example, John Clark (1990) and Ethan Kapstein (1990) describe the history and economics of oil. They explain the evolution of energy demand and supply patterns by using different theories and approaches. These approaches are, however, dominated by business economics, cartel theory, vertical and horizontal integration theories, etc. They pay little attention to the government point of view and the evolution of institutions. Why and how institutions come to being? They do not address this question. However, the institutional aspects are dominantly present, it is from a static rational institutionalist view lacking explanations on the political background of the processes.
A distinction can be made between original institutional economics (oie) and new institutional economics (nie) (Rutherford 1996). On the one hand, oie has a biology based evolutionary background. It implies that history matters and habits influence the development of institutions. On the other hand, nie has an efficiency approach, closely related to neoclassical economics. Both approaches attempt to describe and explain the governance structures of firms and governments. This section will describe nie and oie approaches and assess them on their probable value to the research of geopolitical issues.

Transaction costs economics (tce), the most well known and accepted approaches of institutional economics, argues that the existence of the firm can be explained for reasons of reducing transaction costs. Transaction costs are ‘the costs involved in coordinating economic transactions’ (Groenewegen 1996). The key is to use a governance structure that reduces transaction costs to the optimum, so that the production function is as efficient as possible. When ‘firms coordinate transactions at a lower costs than contracts; firms supersede the price mechanism’ (Groenewegen 1996). It follows, that tce makes a fundamental distinction between governance structure like firms on the one hand and contracts on the other (Groenewegen 1996). Central to the argument are the property rights, and some, like Ronald Coase and Douglas North, place large emphasis on this issue. Getting the property rights right will lead to economic prosperity. There are several problems related to this perspective.

The first problem concerns equilibrium thinking. In tce actors are rational, and the focus is on the efficiency of the production function through efficient coordination (Groenewegen 1996; Rutherford 1996; Hodgson 1998). Equilibrium thinking, taking that ex-ante the most efficient governance structure can be determined, suggests that one optimal cost minimizing structure exists. However many different governance structures exist for the same kind of activities which seem to work efficient (Aoki 2007). This issue is not recognized nor explained by tce.

A second problem with tce is that it doesn’t provide a satisfactory explanation for government policy and structure, since no standard government structure exists and since the efficiency question is often of lesser importance. On the one hand, lowering transaction costs can be a policy instrument for national governments, since companies might choose the country with the lowest transaction costs to settle their activities. On the other hand, the coordination of transactions in the international supply chain can be, and mostly is, very complex. They involve multiple
states, firms, either national or public, and international organizations of all kinds with different goals and methods of dealing with these transactions. Coordination is a sociopolitical process which differs with the actors involved. Political goals and preferences play a major role. Furthermore, many different problems related to very different issues are linked and solved within the same process (Odell 1963), increasing complexity of the transactions let alone minimizing the costs.

A third problem is with the property rights. Although property rights need to be arranged, doing this properly depends on many factors related to culture, or cognitive frameworks of the geographic area under study. Rationality of property rights can therefore be questioned, and, as Douglas North points out in his 1990 book, same arrangements do not have the same result at the end. No corruption, a similar idea about what property is as in the American culture in which nie is developed, and a well working judicial system are precondition for efficient property rights. These are already difficult to influence issues and which are not addressed by nie.

A fourth problem is that coherence between the technical system and the coordinating regime is needed for the system to work as it should (Finger et al. 2005). As mentioned above, the supply chain contains links and nodes and therefore can be described as infrastructure or a technical system. According to Mathias Finger, John Groenewegen and Rolf Künneke, ‘the technical functioning of infrastructures needs to be supported by suitable institutional regimes in order to perform satisfactory, be it economic, societal, and even in technical terms’ (Finger et al. 2005). Performance indicators they propose are: static efficiency, dynamic efficiency or innovation possibilities, and system efficiency. Technical system integrity is determined by its resilience or robustness especially of their critical elements or functions.

So, next to sociopolitical and an economic viewpoint, a technical viewpoint of governance of international supply chain exist and needs to be considered. The technical system and the transactions involved become increasingly complex at the higher political levels. Different countries govern different parts of the infrastructure and have different rules and norms on how it functions. Additional coordination is therefore needed for transactions which cross borders, and especially for transactions which are critical for the technical functioning of the system. This can become troublesome due to different opinions on criticality. In addition, many critical functions do not take place in the country it is critical for. The question which arises is what kind of regime or governance structure is related with what type of international technical system. So far, nie does not provide an answer.
Original institutional economics

Original institutional economics (oie) started with the writings of Thorstein Veblen and, later, John R. Commons. It follows an evolutionary approach borrowed from Darwinian biology. Darwinians explain the development of organisms with general and specific theories. Institutionals, who adopt this practice, argue that there are multiple levels and types of analysis which must be linked together. ‘A crucial point here is that the concepts of habits and of institution help to provide the link between the specific and the general’ (Hodgson 1998). As a result, oie enables the linking of micro processes to macro processes on a more general level using institutions and habits as unit of analysis.

The oie approach is dynamic as well as holistic instead of static and deterministic as in nie (Groenewegen 1996; Rutherford 1996; Hodgson 1998; Wilber and Harrison 1978). oie enables the use of different theories to explain the existence and the development of institutions and technology. According to Geoffrey Hodgson (1998), this theory ‘does not attempt to build an all-embracing, general theory. Instead, complex phenomena are approached with a limited number of common concepts and specific theoretical tools’ (Hodgson 1998).

Different institutional arrangements are made for similar situations due to different understanding of the problems and interests embedded in habits and institutions (Campbell 1997). The different understandings find their cause in cultural differences, or historically given interpretive frames and meaning systems without disregarding the constraints given by existing institutions, power balances and state actions limiting institutional solutions. The core concepts used are habits and institutions in which the (economic) phenomena are embedded and, more importantly, developed.

Habits and institutions are vague terms. How they change is difficult to determine. Change is driven by problems and interests constrained by institutions leading to lock in and path dependence. From a rational perspective the main interest is to create an efficient production function and reduce transaction costs by efficient coordination for profit maximization. It is recognized however that (rational) interests are not sufficiently able to explain why inefficient institutions and multiple equilibrium exist. Mechanisms of change need to be found.

To cope with the above problem the concept of ideas is introduced as an instrument to complete the models of nie and oie (Berman 2001; Blyth 1997; Campbell 2004). Historical institutionalists had similar problems explaining institutional change and also introduced ideas in their analysis. Both, however, do not explain how ideas work or what they mean; but they focus on what and how they influence institutional change (Blyth 1997). John Campbell (2004) attempts to operationalize the concept of ideas to explain institutional change from a oie perspective.
Ideas helps to understand habits, identify them and describe how they change.

Ideas, embedded in the cognitive frames of society, constrain institutional change on the background; but they can also be on the foreground as concepts and theories (Campbell 2004). A distinction can be made between two categories of ideas (see Table 6.1). First, ‘ideas underlining taking for granted assumptions residing in the background’; and as ‘concepts and theories located at the foreground.’ Second, ideas can be either cognitive or normative’ (Campbell 2004). By combining the two categories, four types of ideas can be identified which affect policy making for both government as well as non-governmental organizations: programs, paradigms, frames and public sentiments. ‘[P]aradigms and public sentiments are second-order concepts insofar as they constitute the underlying ideas upon which the first-order concepts, that is, programs and frames, rest, respectively. As such, paradigms and public sentiments are constraints that limit the range of options’ (Campbell 2004). The role of interests becomes a subgroup within the concept of ideas (Campbell 1998, 2004).

Table 6.1: Types of ideas according to Campbell

<table>
<thead>
<tr>
<th>Cognitive (Outcome oriented)</th>
<th>Programs (elite prescriptions that enable to chart a course of action)</th>
<th>Paradigms (elite assumptions that constrain the range of useful programs)</th>
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<tbody>
<tr>
<td>Normative (Non-outcome oriented)</td>
<td>Frames (symbols and concepts to legitimise programs)</td>
<td>Public sentiments (public assumptions that constrain the range of legitimate programs)</td>
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Source: Campbell 2004.

Ideas can be exogenous at first, might solve a problem, and will or will not be accepted within the present system and change beliefs, habits, technology, etc. If an idea is accepted, it might lead to paradigm shifts within a region, country or industrial sector. From this perspective, an idea becomes a roadmap (Berman 2001; M. M. Blyth 1997; Campbell 2004), which fits well with the concept of programs and frames.

Ideas can also be embedded within existing paradigms, belief systems, and pre-
scribe how some action should be or not be conducted. ‘In sum, to understand ideational change it is necessary to focus on the reasons why ideas are discredited, new ideas are advocated by important carriers, and some ideas and not others achieve public resonance’ (Berman 2001). In addition, the study of how ideas are endogenously created or externally brought in is also important to understand the underlying mechanisms.

The concept of idea, as Campbell describes it, fits in this framework for five reasons. First, historical institutionalists ‘focuses on how ideas become embedded in social norms, patterns of discourse, and collective identities, intangible institutions characterized by intersubjective understandings or shared belief systems’ (Berman 2001). Hence it recognizes path dependence and lock in effects and therefore enables an evolutionary approach as done in oie. Second, ideas are useful as causal factors in institutional change. It study seeks the underlying factors for which ideas are institutionalized or not and fits therefore with the study of energy transitions. Third, ‘[i]deational variables are institutionalized when they have become habitual, natural, or instinctive for a particular community’ (Berman 2001). The unit of analysis are habits and institutions, and the change of them. Understanding the concept idea is crucial to explain habitual and institutional change. Fourth, ideas are manifested in the governance structures which emerge or are chosen. Through mechanisms of diffusion and path dependence of institutions and their underlying ideas institutional outcomes can have isomorphic effects (DiMaggio and Powell 1983). These mechanisms are further explained by using ideational concepts. Moreover it helps finding pattern models. Finally, ideas enable the introduction of politics in this framework. Ideas are transported through entities that possibly make them influential within the policy arenas (Campbell 1998). Framing and roadmaps of policy instruments is an important activity in this respect.

As mentioned, oie takes that institutional change is a pattern of evolution, as opposed to punctuated equilibrium or revolution often seen in static approaches of rational choice institutionalists (Campbell 2004). These are extremes and different patterns can be identified in between. Punctuated evolution recognizes (revolutionary) events which cause institutional change; and, at the same time, it recognizes the influence of path dependence through interpretive frames embedded in the habits, routines and institutions. Institutions at different levels have different speeds of change, ‘[t]hus, while formal aspects of institutional change may occur abruptly, the informal aspects, notably the cultural-cognitive and normative ones, are more gradual and tend to come first’ (Campbell 2004). This gives more meaning to Oliver Williamson’s (2000) four layered model which describes the different speeds of institutional change at different levels of formal to informal institutions; but it does not give an order in which the different levels change. Hence patterns
of evolutionary, revolutionary and punctuated evolution can be recognized and a
careful assessment at all levels should be made to identify the pattern of change
which fits best (Campbell 2004).

To find patterns, the causal relations need to be identified as a group of factors
and instruments. In addition, the underlying mechanisms need to be identified.
Path dependence and diffusion are strong mechanisms often used in literature. Path
dependence from a pure economic sense deals with the lock in effects of large sunk
investments. On the one hand, institutions are often designed, negotiated or have
evolved in such a way that altering them is difficult. Moreover, institutions are often
in the background as cognitive interpretive frames, which accordingly change fairly
slow, and therewith impede change. On the other hand, institutions can also be of
the enabling kind, since it can describe how changes can be introduced in a path
dependent way.

Diffusion leads to isomorphic outcomes (Campbell 2004; DiMaggio and Pow-
ell 1983). Institutions which are proven successful are copied by other agents, both
public and private. Three logics are involved: material interests, appropriate and le-
gitimate way to operate, and to cope with uncertainty (Campbell 2004). Moreover,
firms become more isomorphic because interdependent companies deal with their
repetitive and complex relationship by adopting each others institutions (DiMag-
gio and Powell 1983). During a process of translation, however, institutions are
adapted, so that it fits their current cognitive frameworks (Campbell 2004).

Through the (underlying) mechanisms, of diffusion and path dependence, like
bricolage, translation, transposition, etc., new institutions are formed which re-
place or complement old institutions. Distinctions between these mechanisms are
made by the way they introduce new types of institutions and the creation of ideas.
Two basic sources are addressed, the copying of institutions from outside a sector or
geographic area or from rearranging already existing institutions and ideas within
the sector or geographic area.

The distinction between endogenous or exogenous old institutions is vague, es-
specially when studying a global industry as energy. This is even more so if we intro-
duce the time factor. A time frame for change is therefore important. As mentioned
a holistic approach is needed. Crucial to institutional change is the transport of
ideas and their translation into institutions within the interpretive frames of the
sector or geographic area.

oie is mostly criticized on not being an economic theory, because it lacks of
formal modelling and use vague concepts. Its shortcomings stem mostly from the
lack of universal concepts; and it can therefore not be used for predictions. Indeed,
oie follows more the sociological principles than predominantly economic models
with (bounded) rational actors. Where nie can be used for more specific analysis
of governance structures using formal models stemming from classical economic theory, oie can be used as overarching approach for allocating theories and use them to explain the broader context.

The analysis of geopolitics in a multidisciplinary way is possible with oie. Both nie as oie, economic geography, political geography and political economy can be combined under the umbrella of institutional economics. However, with the introduction of ideational factors, the analysis becomes predominantly and historical institutionalist approach.

The four dimensions of energy transitions

The energy industry has four dimensions which need to be considered to address geopolitical issues. First, the supply chain describes the activities which take place for delivery of energy products. The energy industry has the properties of an infrastructure industry, because it has strong asset specificity. The supply chain put emphasis on the transport function. Moreover, it addresses the question of who does what and where. Economic geography answers these questions; but it mainly focuses on the relation between, on the one hand, geography and, on the other, income differences and the forming of agglomeration.

Second, the firms active in the supply chain are shaping the governance thereof. The amount of activities an individual firm performs depends on many circumstances. These circumstances influence the scale, scope and governance structure. nie theory address this dimension. With the concept of transaction costs, it captures the governance structures of firms. It can possibly explain why a firm is active in a particular or into several activities in the supply chain. However, there are some problems with it, because it does not sufficiently take into account the institutional context, especially from an international point of view.

Third, several nation states provides the institutional context of the energy industry. Scattered over continents, they create various contexts depending of which segment of the supply chain we take into consideration. By having a static approach, nie insufficiently address the variety of institutions, habits and ideas involved in nation states. Political geography, on the contrary, could tackle this issue. Despite this advantage, it does explain the emergence of cross border institutional arrangements. Only oie, by not being bound by a nation state-based framework, satisfactorily explains not only the variety of institutional arrangements within nation sates, but also cross border arrangements all through the energy supply chain.

Fourth, arrangements between nation states matters to cover the international character of the energy supply chain. Wether bilateral or multilateral, they govern energy infrastructures globally. Examples of these arrangements are the European
Union, the Organization of the Petroleum Exporting Countries, the International Energy Organization, etc. They provide political platforms to deal with issues, search for cooperation or resolve conflict. They give orientation at the regional, multi-lateral and global levels. Furthermore, arrangements are made for the supply or demand of energy, on transit rights, building new infrastructure, etc. Political economy often studies these issues. It misses, however, the spatial aspects of the energy supply chain and a fine-grained understanding of institutions.

Conclusion

How we can study the geopolitics of energy in a situation of transition? To solve this problem, this chapter has described the theories that might be relevant. These theories were evaluated in light of four important dimensions of the energy supply chain in an international context. We think that original institutional economics provides the best analytical framework. The reason is that it combines easily the fourth dimensions altogether. Moreover it can integrate all the other theories under the same umbrella. What integrates them are the institutions, habits, ideas, and, finally, technology.

Institutions change, according to oie, in an evolutionary matter. Therefore, they need to be studied by using a variety of methods and theories that describe change. Hence, the activities are performed in a combination of nation states, with a variety of institutions, habits and ideas. Products, transported across borders, are subject to several governance regimes. This can cause misunderstanding, clash of values, and conflict, and possibly the creation of a governance of their own. The role of international firms becomes, thus, very important.

The activities in the supply chain can be studied through a predominantly economic analysis coupled to the technological and spatial characteristics. On the one hand, economic geography seems the perfect theory to use when we address the question of allocation of resources in space. The difference between absolute and relative geography is useful. On the other hand, economic geography focuses on the forming of agglomerations and income differences between regions and countries. It does not explain governance structures of firms explicitly. Moreover it does not address the aspect of security of supply. The focus on space and the institutional aspects thereof is interesting and useful, and brings us closer to political geographic aspects.

So, the supply chain can be described using concepts from economic geography with a focus on transport. The relative position of a country vis-à-vis another’s absolute geography shapes their relative geography through transport networks. Traditionally, the locations of energy resources are difficult to change, because it
is geographically fixed by nature. This can possibly change by an energy transition, although sustainable energy is also fixed, up to a certain extent, to what nature provides. From this point of view, technology partly conditions the spatial structure of the supply chain and its economics. Innovation alters the location choices through the set of available alternatives, constrained by their economics without disregarding the institutional factors. In the end, firms govern the supply chain and determine where they want the activities to take place considering all the constraints.

We need therefore to examine firms on how they structure their activities through arrangements which has a decisive influence on the geography of the supply chain. nie factors as asset specificity, frequency of exchanges, decentralized or centralized coordination, ownership and vertical integration can give insights. The arrangements made are the outcomes of these factors. Moreover, they are the result of institutions, habits and ideas formed in the evolution of the firm, but also by the nation states and international organizations.

In the third dimension, the behavior of the public actors are involved: mainly nation states. As mentioned, they cannot be addressed by using nie or economic geography. Political geography seems useful, however. Still, oie concepts can cover the political geographic issues and provides the opportunity to look at specific aspects which are important for this research. That is, the institutions, habits and ideas related to space, and the actors which are attached to it.

Finally, the fourth dimension is often studied by international political economy. For this research, however, the focus is on arrangements, which are well described by concepts from oie. Again the concepts of habits and ideas, the mechanisms of change and economic geographic issues related technical aspects of infrastructures can be used to explain why the arrangements are shaped as they are. It integrates the knowledge gathered from the lower dimensions, but also influences behavior in the dimensions that need to cope with the international arrangements.

Thus, when studying international infrastructures, we propose to use original institutional economic concepts. Due to the very diverse nature of the actors at the different dimensions a single theory does not suffice and a holistic and eclectic approach is needed. oie can provide the framework in which the approach can take form as demonstrated above.

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