Oxford Handbooks Online

Comparative Climate Change Policy Networks

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The Oxford Handbook of Political Networks
Edited by Jennifer Nicoll Victor, Alexander H. Montgomery, and Mark Lubell

Subject: Political Science, Comparative Politics, Political Methodology Online Publication Date: Aug 2016
DOI: 10.1093/oxfordhb/9780190228217.013.38

Abstract and Keywords

This chapter explains the method of policy network (PN) analysis and its benefits (and limits) for cross-national comparative analysis. The purpose of the PN approach is to understand how the structure of relationships among organizations engaged in a policy domain affects the content of policy and outcomes. The chapter illustrates the use of the PN method with reference to the ongoing cross-national project Comparing Climate Change Policy Networks (Compon). Global climate change constitutes an (un)naturally occurring quasi-experiment; in the face of a common threat, the various societies have exhibited divergent responses to reducing the cause, carbon emissions. This research project and network method can provide knowledge helpful to global negotiations as well as open up new vistas on thorny theoretical questions about the behavior and outputs of political systems.

Keywords: climate change, global warming, policy networks, political networks, comparative politics, comparative sociology

Introduction

In the study of comparative politics, the policy network (PN) method offers unique strengths for investigating complex processes. The PN method studies a *policy domain,* which consists of the interactions among the organizations engaged in trying to shape the formation of a number of national policies around a common theme, such as energy, healthcare, labor, or climate change (Laumann and Knoke, 1987). A national labor policy domain, for example, consists of the organizational actors and their interactions as they contend and cooperate to shape the outcomes of labor-related policy measures such as the minimum wage, aid to distressed sectors, and occupational safety. In the same way, a national climate change policy domain consists of the actors and their interactions over policy measures such as carbon tax, cap-and-trade, and alternative energy and conservation subsidies. The PN approach asks questions both about actors' typical relational partners in the domain and about their specific partners, tactics, and goal attainment for discrete policy formation processes within the domain. This allows us to study both the general pattern and the discrete variations on that pattern that exist within a single national policy domain. We can then compare these domain findings either to other domains within the same country or to the same domain in different countries. This facilitates our understanding of the structures of policy formation and their degrees of generality on an empirical

basis.

In this approach, the key word is *network*, indicating a pattern of relationships among members (as discussed throughout this handbook). In the study of politics, the key type of relationship boils down to power, *Macht*, the ability to get one's way despite opposition (Weber, 1978). So the PN approach is mainly concerned with power networks. We measure the relative power of actors by several types of outcome measures, as detailed in this chapter. However, when we study power closely, we realize it can be created through many different kinds of exchanges. For example, in one policy domain, the transfer of information might be the key to power, while in another, the provision of public political support or the formation of political coalitions might be key. There are many other such incentives that can constitute power, from cowrie shells to charismatic oratory. The advantage of the PN method is that it can measure these different ways of creating power as discretely composed networks. That is, the PN approach measures more than a single network, tapping into several that the researcher thinks could be relevant. Having measured these, one can re-create the social fabric of power, woven of several threads. The degree to which different societies have different social fabrics of power, once we are able to distinguish and measure it, becomes a matter of profound theoretical import.

Since the PN survey asks about a number of types of interactions, each forming a discrete network, the domain can be seen as several layers of interaction. In any domain, these multiple networks can be relatively contiguous, hanging with the same members and patterns, reinforcing each other, or relatively disparate, going off with different members in different patterns, the networks existing in tension with each other. In this way, the PN method illuminates the multiple channels by which organizations join into coalitions under the same banner, to struggle against other coalitions carrying different banners (Sabatier and Weible, 2007). The detailed tracing of many interactions among many organizations enables the researcher to view abstract causal factors as they work in the very mechanisms of the actual political process. In other words, the network represents the interactive process among many organizations, which enacts contextual factors and also through human reflexive creativity shapes and changes the contextual factors. The PN approach allows the empirical observations to somewhat more closely approach the "wicked" complexity of social and political causality, so very much evident in climate change problems (Levin et al., 2012).

Development of the Policy Network Approach

The social anthropology of Radcliffe-Brown pioneered the view of social structure as a set of networks among persons in social roles. This pattern he likened to the morphology of society, and he said the idea could just as readily be considered the basis of comparative sociology. He purposely ignored the role of culture (Radcliffe-Brown, 1940). This general social structural orientation went in different directions: micro, meso, and macro. On the one hand, this idea became the basis of structural social network studies. It permitted mathematical treatments due to the assumed equivalence of relationships as the components of structures. It also supported the growth of community power structure studies (Hunter, 1953; Knoke, 1981; Warner, 1963). Building on this general orientation, but also influenced by macro views such as Parsons's systems model and Karl Deutsch's view of communication flow as the "nerves of government" (Deutsch, 1966), as well as Homan's micro-exchange analysis (Homans, 1961), Laumann began to develop his PN approach (Freeman, 2004, 131).[1] Homans's exchange theory gave it a rational choice orientation, with networks assumed to result from the calculated choices of actors.

Laumann and Pappi's (1976) pioneering work compared "networks of collective action" in US and German community politics using quantitative network methods. This work led Laumann and his students to examine "community structure as inter-organizational linkages" (Laumann, Galaskiewicz, and Marsden, 1978) and further developments in a similar vein (Laumann

and Marsden, 1979; Knoke and Laumann, 1982). Laumann and his students developed the PN method with organizations as actors in his study comparing US energy and healthcare domains (Laumann and Knoke, 1987), leading to his discovery of a "hollow core" in US politics (Heinz et al., 1993). Following Parsons's influence, Laumann and his collaborators theorized this lack of center to be caused by political modernization. In Parsons's terms, modernization leads to a differentiation or "balkanization" of the US political system into clusters of governmental units and their regulated clients. The PN concept spread to a wide range of studies (Anheier, 1987; Kenis and Schneider, 1991; Knoke, 1990; Marsh, 1998; Raab and Kenis, 2007) (see chapter by Knoke and Kostiuchenko, this volume).

Following the US study, Knoke and Pappi initiated the first cross-national PN study, with the United States and Germany as their respective cases. In 1986, when I arrived at Knoke's institution, the University of Minnesota, as a junior professor, I joined the study and brought the Japanese case into the comparison. My specialization was Japanese environmental politics (Broadbent , 1989a, 1998, 1982), not Japanese national labor politics. I recruited an expert in Japanese interest group politics, Yutaka Tsujinaka of Tsukuba University, to help in the project.

Together, our four-author comparison of the US, German, and Japanese labor policy networks accomplished the first cross-national comparison of the mature PN approach. The assumptions underlying this study were that actors created networks in the pursuit of their interests, which were given "exogenously" by their positions in social structure. The starting theoretical assumption was that all three polities would show a hollow core and a balkanization of the polity into distinct interest clusters, such as Laumann and Knoke had found in their prior US studies. However, our findings did not support this hypothesis. Instead, while the United States had many competitive actors and a hollow core, Japan had a filled core with central all-purpose ministries coordinating the whole economy. And in Germany two giant corporatist hierarchies of business and labor collaborated to run the economy, with state backup (Knoke et al., 1996).

The Comparing Climate Change Policy Networks Project

Upon the conclusion of data collection for the labor study in 1991, I began to pursue my longer term goal, using the PN method to study comparative environmental policy formation. As the first version of what would become the Compon survey, I initiated the comparative environmental PN survey project. I asked my partner in the labor study, Yutaka Tsujinaka of Tsukuba University, to lead it while I cowrote the labor book with Knoke and Pappi. Tsujinaka dubbed it the Global Environmental Policy Network (Gepon) survey. With funds from the Japan Society for the Promotion of Science, he fielded the Gepon study in 1997 in Japan, the United States, and Germany. The data collection occurred at the fortuitous time just prior to the Kyoto Conference (COP3) that led to the Kyoto Protocol for emissions reductions. I collected some of the Japan survey responses for Gepon through direct interviews. Building on this experience, I started the project Comparing Climate Change Policy Networks (Compon) in 2006, recruited initial team leaders from relevant countries, and hosted the project's first international conference in January 2007 at the University of Minnesota. As principle investigator, I led the National Science Foundation application (co-principle investigators were Dana Fisher and Katsumi Matsumoto) that kick-started the project with a $589,000 grant (BCS-0827006). Since then, the Compon project has grown to include more than twenty-five direct and affiliated cases and over $2 million in funding from various governmental science research agencies. We define a *case* as the response of a political society to the challenge of climate change mitigation. The context of analysis is the nation-state, except for the region of Taiwan. As of December 2015, our website lists fifty publications from the project.[2] In the process, we have simplified the PN survey down from the original one-hour, face-to-face version to one that can be done by a respondent online in fifteen minutes with guidance from the researcher by telephone. This simplification enables a continuing expansion of the project to many more cases and to

panel studies of change over decades.

The Compon project extracts PN data from the climate change domains of a range of cases, including the biggest polluters and those with interesting responses. It collects four levels of data. Level 1 tracks keyword (climate change, global warming) news share in three major newspapers per case over time from 1997 to the present. Level 2 conducts a content analysis of a sample of the keyword articles for the focus years 2007 and 2008, just before the Copenhagen Conference (COP 15). Level 2 has extracted 167 ways of framing climate change from the newspapers and compared their relative prevalence across cases (seventeen cases). Level 3 is using the program Discourse Network Analyzer to study and compare climate change actor/discourse coalitions appearing in the newspapers.

The fourth level, the PN survey per se (currently sixteen cases), includes South Korea, Japan, Taiwan, Australia, New Zealand, Canada, the United States, Brazil, Sweden, Finland, Ireland, the United Kingdom, Germany, Switzerland, the Czech Republic, and India. Using the PN data, project teams develop models of how each polity works to produce its carbon emissions trajectories. Then cross-case comparisons begin the search for more general principles.[3] The important basic shift in theoretical perspective in the Compon project from the earlier PN studies is its explicit recognition of the role of culture and discourse as a collective factor in the formation of the organizational interests and preferences that drive action. This perspective is explicitly recognized in discourse network analysis (see chapter by Leifeld, this volume). In the Compon survey instrument, it is recognized by the affinity of organizations toward different interpretive frames about climate change.[4]

As of 2016, PN surveys for the Compon climate change project are still under way, with some collected and others in process. Comparative analysis is only just beginning. Accordingly, to illustrate points, this chapter draws on data from the earlier labor PN study (1986–1990 data), an initial cross-national comparative environmental PN (Gepon) study (1997 data), and the climate change PN (Compon) study (2010 to current data).

Global Climate Change as a Quasi-Experimental Research Project

Any study and its data collection methods or instruments must, of course, be designed with the larger theoretical questions and objectives in mind. The Compon project's approaches and instruments have been designed to study the global climate change problem from a cross-national, comparative perspective. The purpose of the Compon project is to show how differences among cases in the national policy-formation process are related to differences in their mitigation policies and to their actual carbon emissions. This in turn interacts with the international and global level of climate change politics and also the grim realities of disasters ensuing from climate change. The tools provided by the PN method greatly facilitate the Compon task.

The issue of global climate change represents the most consequential dilemma of collective action (DCA) ever to threaten the whole of humanity (Olson, 1965). In the DCA situation, participants opt for short-run personal benefit maximization, even though this reduces long-run collective and personal benefits. The dilemma can only be overcome by cooperative collective action to minimize the collective costs, but participants lack the mutual trust needed to join in collective action. Climate change presents the countries and peoples of the world with just this sort of dilemma. It represents a historically unprecedented possibility of collective disaster, but also an unrelenting and intensifying prompt for cooperative collective action (Beck, 1999). Only unstinting global cooperation will avert this risk (Hironaka, 2014). Yet most societies have not accepted this responsibility. Societies exhibit a wide range of responses, a few exhibiting wholehearted acceptance and effort, but most having a lukewarm or indifferent reaction. Some societies have managed to reduce their carbon emissions, while others have increased them massively.

Societies around the world are increasingly engaged in setting up measures to combat climate change, especially since the all-

inclusive Paris Accord reached in December 2015 (the 21st Conference of the Parties to the United Nations Framework Convention on Climate change, UNFCCC). A crucial factor noted in this accord is enhanced "transparency of action and support" to build the mutual confidence needed for effective reductions in carbon emissions (UNFCCC, 2015). This is necessary because each society will go about responding to this call for action in its own particular way. It will follow its own particular political processes, resulting in its own outcomes, more or less effectively reducing carbon emissions, or perhaps only pretending to do so. In its applied aspect, the Compon project is designed to provide this enhanced transparency of process and outcome. In its theoretical aspect, by the more detailed mapping of policy networks, the project must discover new political formations out of the seemingly familiar national polities, like dragging up strange creatures from the deep ocean.

Since the fit between the project methods and the real-world problem is crucial, some more detailed description is appropriate. With direct support from many member nations, in 1988 the United Nations started the Intergovernmental Panel on Climate Change (IPCC). The purpose of the IPCC is to collect, vet, synthesize, and publish reports, providing the highest quality scientific *knowledge* about climate change in all aspects. The IPCC published its first report in 1990 and its fifth in 2014. These reports have made clear to all that humans have caused the current rapid climate change, and that all countries, albeit at different paces, would eventually suffer intensifying and devastating weather disasters from climate change. Based on this science, in 1992 the UNFCCC, ratified by 191 countries (parties), initiated a new global moral injunction: all countries should reduce their carbon dioxide and other greenhouse gas emissions. The 1997 Kyoto Protocol (third Conference of Parties to the UNFCCC, or COP 3) took the next step and designated individualized specific reduction targets (averaging around 6 percent from 1990 levels) for the industrialized countries, to be met by the 2008–2012 compliance period. By 2005 most of the industrialized countries (except the United States) had officially accepted and ratified these targets. Moreover, given the rapidly falling prices of renewable sources of energy, humanity does have the technological ability to rapidly reduce our collective emissions of carbon dioxide. Yet despite these many factors supporting emissions reduction—scientific, moral, and specific normative targets—national emissions took diverse trajectories, increasing, leveling off, or decreasing. The sum total of the countries' actions led to a continuing rapid rise in total global emissions (until 2015, when it leveled off for the first time).

Some of the industrialized countries began efforts to reduce their own emissions, or in place of that, to pay for equivalent reductions in the forests and industries of developing countries (the "Clean Development Mechanism"). Overall, the Organisation for Economic Co-operation and Development (OECD) countries slowed their rate of emissions increase, but only a few attained their Kyoto targets by domestic reduction. On the other hand, the developing countries were not assigned targets under Kyoto and increased their emissions rapidly. Today, China has become the largest annual emitter of carbon dioxide, although the United States still remains by far the largest in total emissions since the 1800s. In total, global emissions have continued to rise at the "worst case scenario" rate of the early IPCC reports. This continuous increase has dimmed hopes of constraining the global temperature rise to below 2°C (IEA, 2011), a level some scientists consider a tipping point in the worsening of climate change.

Accordingly, at this point the crucial study of humanity's global climate change predicament has changed from a geophysical to a social scientific one. Why are humans doing this? Can anything change their behavior? The global dilemma of climate change provides the conditions to carry out a global social scientific experiment. In response to the same stimulus, the long-term threat and risk posed by climate change, nations have been responding in very different ways. This (un)natural experiment can be used by social scientific research to search for the causes of different response patterns through comparative cross-national research. This possibility is provided by the variation in mitigation response across nations, countries, societies, and regions (our cases). As the ultimate outcome variable, since 1990 the cases have differed greatly in their emissions trajectories, stabilizing, going up, or going down.

This global situation contains some of the elements prescribed by the scientific method: cross-case variation in response to

similar stimuli. This cross-case variation sets up the conditions for an (un)naturally occurring global social scientific quasi-experiment (Campbell, Stanley, and Gage, 1966). The Compon project seizes upon this situation and uses it as the basis for a global comparative research project. The global experimental question is this: *In the face of similar scientific knowledge, moral injunctions, normative targets, and technological potentials, why do the 1990–2013 carbon emission trajectories of different cases different so greatly, going up, leveling off, or decreasing?* What factors explain this range of variation? Why do not *all* cases make reducing emissions and increasing sinks (CO_2 absorptive forests) their top priority? Answers may come readily to mind and even seem obvious, but to better ascertain their validity, a scientific approach must convert such ideas into hypotheses, testable using standardized cross-case data. The comparative method in social science refers to the comparison of huge units (countries, regions, societies, polities) with many factors considered in their full interactive complexity (Ragin, 1987). The PN method greatly enhances our capacity to trace and grasp this interactive complexity.

Once having developed this kind of detailed network data and analysis for a number of cases, the possibility of cross-case comparison arises. Researchers of anthropogenic global climate change (AGCC) have concluded that it is a "super wicked" problem because of four factors: "Time is running out; those who cause the problem also seek to provide a solution; the central authority needed to address it is weak or non-existent; and, partly as a result, policy responses discount the future irrationally" (Levin et al., 2012). From the standpoint of social scientific causal analysis, AGCC is a super wicked problem because it entails multiple levels and types of input, feedback loops, and distributed impacts.

This kind of complexity requires a new way of thinking about social causality. In order to better understand the intertwining of factors, social scientists have been calling for new inter- or transdisciplinary approaches to the problem (Broadbent and Vaughter, 2014, Manfredo et al., 2014). As the following sections illustrate, the PN method helps greatly in the empirical study of this complexity, of how diverse causal factors intertwine in a field of political contention. As an ideal type, the PN approach can carry out such a program. It can operationalize different theoretical axioms as distinct network questions in the PN survey. The resulting relational data, coupled with other data from the survey, can distinguish the relative political efficacy of different relational media (Broadbent , 1989b). The network approach can accomplish this seemingly paradoxical feat because it puts the hypothesized media from different theoretical schools, as much as possible, into a common metric: *network terms testable by network data*. In reality, the difficulties of fielding a multinational study put pragmatic limits on how fully the ideal can be realized.

Given this range of causal possibilities, we designed the Compon project to collect not only networks between the actors, but also data on the influence, ideologies, beliefs, preferences, tactics, and political participation of the actors. Starting in 2007, over the course of six international meetings the growing number of case teams collaborated to design standardized data collection methods to produce comparable data. In addition to the PN approach, we incorporated newspaper discourse using in-depth content analysis and Discourse Network Analyzer, which revealed the clustering of actors and positions in the papers. We also built a database containing relevant data for each case, such as emissions, population, economy, and institutions. We envision that when sufficient data accumulate, after a number of intermediary analyses, we will employ Ragin's method of QCA to find (perhaps multiple) causal pathways to classes of outcomes in the dependent variable: emissions trajectories (increase, level off, decrease) between 1990 and 2012 (end of the first Kyoto commitment period) (Ragin, 1987). Moreover, if we can continue the project as a panel study with repeated surveys of the same cases over time, we can address a question of the experimental dynamics: *What level of carbon dioxide atmospheric concentrations and accompanying ecological disaster, if any, will prompt the global community to take effective action to radically reduce annual carbon emissions?*

Modeling the Climate Change Domain from a Policy Network Approach

In order to run the quasi-experimental design, we have to understand the basic factors that influence the outcome in cases of climate change response. Figure 1 models the basic processes that make up a *case* (the response of a political society to the challenge of climate change mitigation). This model, the basic Compon ecopolitical case model, brings together different factors that bear upon a case and influence its emissions trajectories over time in a dynamic and reciprocating process. The model links a case to its internal and external dynamic influencing factors. It shows how the different cases contribution to the formation of global regimes.

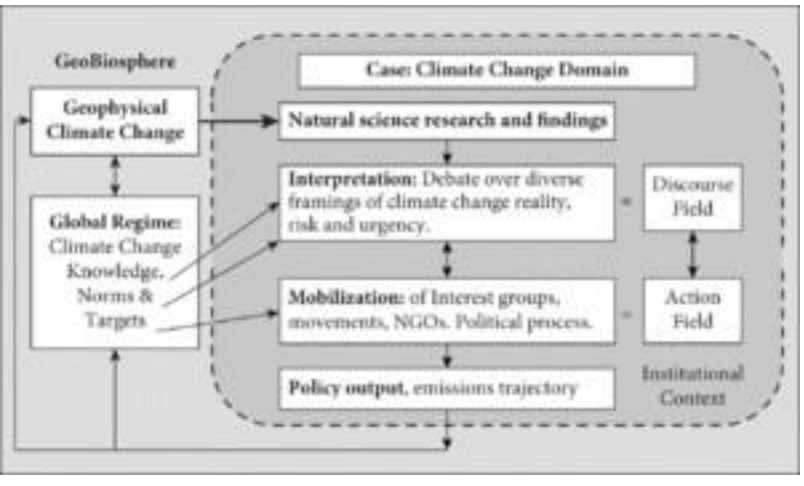

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Figure 1: Climate change ecopolitical model

The initiating factor in this model is the big arrow from geophysical climate change to scientific knowledge about it. Swedish scientists initiated climate change research and also in 1988 started the IPCC. Thus began the global learning cycle described in the figure, which has by now penetrated all countries. The meteorological science of atmospheric chemistry provides the only way to understand the causes of climate change, since they are not visibly obvious. Usually social contention occurs over more obvious harms like poverty, oppression, discrimination, or religious sectarianism. Even there, it may take earlier developments in moral codes and philosophy to eventually justify the "cognitive liberation" that spurs resistance (McAdam, 1982). The findings of natural science sometimes arouse mobilizing passions, as evidenced by the Copernican revolution and the reaction to Darwin's theory of evolution. Contentious passions can be intensified if the scientific information entails a change in the modes of production and consumption, as do the solutions to climate change. In this case, the climate change scientific findings set off a social process of interpreting and acting on the problem. This is the process of socially constructing the problem, framing it with degrees of reality, belief, risk, and priority for action (Hannigan, 1995). In our model, we simplify this social construction process down to the interaction of *discourse field* and *action field*.

In some cases (societies, polities of climate change process) these processes have been largely consensual, whereas in others, such as the United States, they have aroused tremendous contention. At any given point in the cycle, a case will produce some amount of carbon emissions, and perhaps some policies that will modify those emissions. The policies range from rapid growth using coal-fired energy, which greatly increases emissions, to support for solar and wind energy, which can rapidly reduce emissions. These policies and emissions in turn affect the case's stance within international negotiations. The international negotiations establish a global regime, which can be weak or strong in its effects on total global emissions and atmospheric levels of carbon dioxide. These global effects then feed back to each case in a repetitive cycle. Increasingly, especially boosted by the Conference of the Parties (COP 21) in Paris in December 2015, all cases (societies, nations) have become participants in this feedback loop.

This climate change ecopolitical model indicates (1) the interaction between case and global context, (2) the interaction within the case between active processes and shaping contexts, and (3) the interaction between the discourse field and the action field during the social construction of the problem. Figure 2 simplifies this process even further to show just the discourse and action

fields and their interactions as networks between actors and frames (interpretive ideas, or in Latour's terms, *actants*; Latour

[2005]). These actors and frames are what can be directly measured by the PN survey. *In other words, discourse meanings and actor intentions interact to form advocacy coalitions that contend, negotiate, or cooperate to determine policy output and outcomes*.

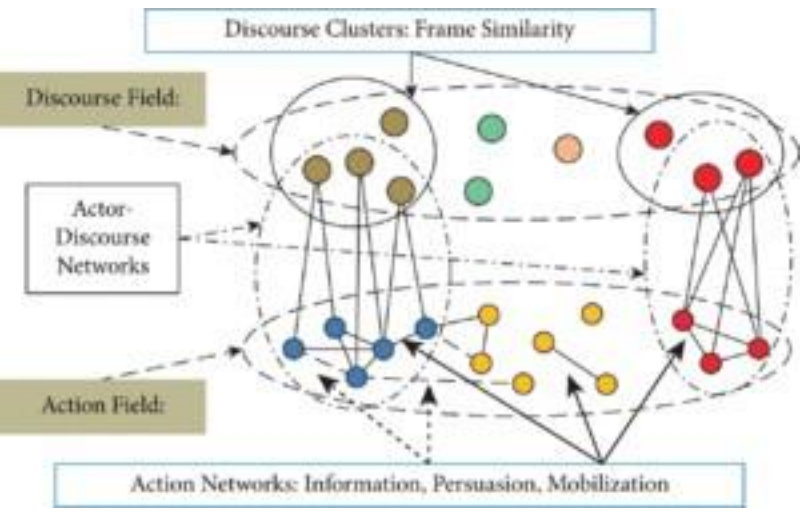

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Figure 2 Discourse and action fields as networks

These levels must be taken into account as context when interpreting the patterns of policy networks. In the climate change domain, the active political process in a case proceeds through perception, interpretation, discourse, and sociopolitical interaction, which arise in tension with preexisting institutionalized formations. These interactions shape the actual networks that emerge to influence case policy outputs and outcomes.

Any research project and its data collection instruments must be designed to address the critical questions at stake, insofar as they can be assessed during the planning phase. The climate change policy domain is uniquely mediated by elite and public acceptance of abstract scientific knowledge. However, the translation of this scientific conclusion into a political force powerful enough to rapidly reduce emissions remains a major stumbling block. The PN method allows the researcher to trace the golden thread of scientific knowledge. It goes into and through the social meat-grinder of conflicting interpretations and contentious politics, either to disappear altogether or to come out connected to some real outcomes.

To many people in the United States, scientific findings remain wispy theory, nothing concrete and scary enough to stimulate the required changes in habits, profits, and institutions. Unlike the black smoke or toxic smell of local industrial pollution, climate change does not present any irrefutable causal evidence to the human senses. On the contrary, the resulting excess fires, floods, droughts, storms, heat waves, sea level rises, and many other changes can easily be written off by the nonspecialist as natural weather variation. Adding inertia to its acceptance, the idea of human-caused climate change, along with that of evolution, poses a fundamental challenge to many traditional religious beliefs. As a result, in the United States, rather than ready acceptance, the idea of AGCC often elicits rejection, denial, or numb indifference, leading to inaction (Norgaard, 2006). If people and societies do not accept the scientific findings as a palpable basis for action, they will not reduce emissions. However, the same cannot be said for many other countries, as the Compon study shows.

In empowering beliefs about climate change, including scientific knowledge as one kind of "belief," their political potency depends on their being taken up by an advocacy coalition. A previous study of national compliance with international environmental treaties concluded that advocacy coalitions are key actors (Clark et al., 2001). That study followed the theoretical lead about advocacy coalitions by Sabatier (Sabatier and Jenkins-Smith, 1993). The study also noted the importance of "multinational, multi-actor advocacy communities" in global environmental governance and the inadequacy of traditional approaches to explain these. But, it added, "*Our study was not designed as an exercise in developing or testing propositions about the growth and impacts of such actor coalitions or interest networks*" (Clark et al., 2001, 187). (It should be noted here that the advocacy coalition concept would appear to assume a pluralistic democratic political system with an active civil society. However, in this comparative study, not all societies, such as China, have such a polity. Nonetheless, even within its party-dominated power structure, different advocacy coalitions do develop and contend over proper policy directions.)

Hypotheses about Causes of National Climate Change Responses

The Compon project took the baton of propositions about actor coalitions and ran with it. Starting in 2007, the project members developed a number of hypotheses about the growth and impacts of such actor coalitions (Broadbent , 2010). The hypotheses developed from the broader literature relevant to climate change politics, including empirical studies and also fields such as the sociology of science and communication studies. It was important to couch these hypotheses in terms testable by the network data that would emerge from the project. Fundamentally, given the problem, all the hypotheses concern the social conditions under which the IPCC-type scientific information could be turned into actual policy outcomes curtailing carbon emissions. Following are a few exemplary bivariate (ceteris paribus) hypotheses:

> **H1:** *The more the culture gives legitimacy to the IPCC-type science, the more a case will mitigate its carbon emissions.*
> Network indicator: The proportion of organizations in the climate change domain that receive vital scientific information directly from the IPCC.
> **H2:** *The more credible and engaged the domestic climate change science community, the more a case will mitigate its carbon emissions.*
> Network indicator: Degree of engagement of domestic research establishments as knowledge brokers in scientific information networks.
> **H3:** *The more powerful the interest groups dependent upon fossil fuel use are, the less a case will mitigate its carbon emissions.*
> Network indicator: Relative political influence scores of fossil fuel companies and related business sectoral associations in networks of political cooperation and advocacy coalitions.
> **H4:** *The stronger the advocacy coalitions in support of the dominant (IPCC type) climate change scientific findings are, the more a case will mitigate its carbon emissions*.
> Network indicator: Relative political influence scores of networked clusters of organizations advocating for climate change mitigation.

The Survey Instrument and Data

In a cross-national comparative project, the common survey instrument has to be designed to capture the minimal information necessary for the comparison to answer the most pressing questions. That is because of the many limitations, including respondent patience, on even the best-funded survey. The PN survey has been a living, growing, transforming instrument. In the early versions, it took an hour or more to administer in a personal interview. Recently, the Compon project, aiming to make it easier for new case teams, reduced it to a fifteen-minute survey with fewer questions and networks that can be done online. The survey both enables the research and also strictly delimits it. As such, the instrument must be subjected to continual reflexive, critical, but constructive scrutiny.

A single PN survey gathers data on one policy domain (labor, climate change, etc.) at the national level in one country. A single national domain is one case of a domain that may exist in many countries. The PN survey tries to capture a set of networks among all the consequential organizations in a policy domain. The selection of organizations, or boundary-setting operation, is a crucial first step. This act establishes the list of organizations that will be included in the survey as respondents, and a longer list (mostly international) that will be included as passive partners without interviewing. This problem of boundary specification can

be difficult for a large and complex polity. The list must include the most central actors, then should go down the hierarchy of organizational power until it reaches the maximal number that the average respondent can handle. In practice, this usually means a list of between 50 and 130 organizations. However, the research team starts in relative ignorance of the actual influence of different organizations within the domain. The team has to pick them out from existing studies, newspaper reports, organizational charts, a panel of experts, and other secondary sources. Once the survey goes to the field, the list is set in stone.

The PN survey instrument asks about the kinds of relational media, such as information or collaboration, that organizations transfer among themselves in the domain. Each organizational respondent checks off from the full organizational list all those specific organizations with which it transfers a specific kind of relational medium. The name of network designates the kind of relational medium, such as information, that it contains. On the survey, each type of network has its own full list of organizations in the domain. The respondent checks off all the other organizations on the list with which it has that kind of relationship. Each bit of data is a dyadic relationship of a particular content.

A wide variety of transferred media could, in principle, generate influence in a domain. The media could consist, for instance, of cowrie shells, common kin-group membership, habitual or coerced obedience, vital information, formal authority, pay-off money, trust or confidence in long-term reciprocity, belief in a common symbol, adherence to a common ideology, and many more. Given the limits of survey length and respondent fatigue, a multinational research project can actually only include questions about a few types of networks in its common survey instrument. So the project must select them judiciously based on problem, theory, or experience.

All the N organizational survey responses for a given type of network are combined into an N by N data matrix. This matrix contains all the dyadic transfers between organizations of a single medium or network type within the domain. Using this matrix data, a network analysis program like UCINet creates a graphical representation of the total pattern of social distance among all the organizations as well as statistics.

The PN survey also asks the organizational respondent about the relative perceived influence of other organizations, as well as about the respondent organization’s issue-related knowledge and beliefs, solution preferences, resources, participation in specific bills, and degree of goals attained. If we want to know how a domain produces policies, a crucial piece of information is the relative power of the domain members and of the ideologies and policy preferences they carry. Political studies heretofore have often considered power in its gross, undifferentiated quantity. The main question was, who had it and who did not? But contemporary theories increasingly contend that power is relational and can be produced by different types of incentive networks, depending on the case.

The active policy-formation process is constituted by mixtures of many dyadic interactions and whole networks. The survey reveals the mixture (of measured networks) particular to a given national domain at a given time. This slice-in-time network is like a slice across a river; while the single slice cannot represent the whole river, it does represent the particular qualities of that river that would be found nowhere else. Hence it implies both the upstream and the downstream formations of the same river. The same is true for the domain network, which implies the generative past leading up to it and its future behavior as well. The latter can be captured by repeated panel surveys. Comparison of domain networks across cases reveals different mixtures in network types, patterns, interactions, and other qualities. Restricting our cases to contemporary nation-states reduces but does not eliminate this variation.

Measuring Power

The empirical study of relational power started with the community power structure research of the 1950s and 1960s. Out of

such studies grew many debates about the nature and composition of power, the measurement of which is necessary to the PN approach. By asking knowledgeable respondents who was most influential, Hunter discovered a highly centralized, informal, elite power structure in Atlanta, mostly composed of business leaders who called the political shots (Hunter, 1953). He created the *reputational* measure of power, which remains a central measure in the PN survey instrument. Dahl countered those centralized findings in his study of power in New Haven (Dahl, 1961). He found that officials in the formal decision-making positions were besieged by many demands from diverse interest groups, but found a fair balance among them and made the final decisions. From these observations, Dahl created a *positional* theory of power within a pluralist polity—that the formal positions of authority such as the mayor really do exercise power. These two studies established a continuing debate about the distribution of power within a polity (political field). We can also refer to a *behavioral* measure of power, based on the self-reported political goal attainment success rates of organizations. The discussion of power and its network measurement goes much deeper and is very relevant to comparative political studies, but space limitations prevent its pursuit here (Knoke, 1990; Lukes, 2005; Scott, 2001).

The PN survey provides data on all three of these approaches to the measurement of power. One network question asks respondents to check off all the organizations especially influential within the policy domain. The sum of these checks from all respondents produces a *reputational* power score for each organization in the domain. Reputational power sounds like a weak measure built on rumor, but in the PN survey it is a very strong measure because it comes from the assessments of engaged political experts. *Positional* power is represented by the official, legitimate decision-making authorities on the organizational list (such as ruling political party or parties, president or prime minister's office or cabinet, governmental ministries and their departments). And finally, the survey asks for each organization's evaluation of its own political success by its participation in and attempt to influence the outcome of each of a number of policymaking events (such as, in the climate change mitigation domain, a decision about a carbon tax or emissions trading scheme), producing a *behavioral* measure of power.

The PN approach assumes that real power need not be confined to the formal authorities. This is, on the contrary, an empirical question. The organizations consequential to the outputs and outcomes of a national policymaking process can potentially come from any sector of state and society, domestic or even international. With independent measures of power in hand, the researcher can test the relative influence of different organizations and different networks within the policy domain network. In any domain, certain actors and types of network will show up as generating more or less power than others. These power and influence data help assess the relative validity of different causal hypotheses. Different hypothesized factors can be integrated into a hybrid explanatory model, weighted by their respective production of power in the domain.

The Network Image: Measurement, Interpretation, and Analysis

The basic notion of social distance is crucial to the measurement and graphical representation of social and political networks. Social distance is defined as the number of other actors A has to pass through in order to get to D. Arranging actors by social distance on a two-dimensional plane is simple enough for four actors in a string (A□B□C□D) or in a star pattern with one central hub. But when you have 50 to 130 actors with multiple connections and pathways stretching among them, the most accurate representation requires three or more dimensions, determined by computer algorithms. To inspect this visually, humans have to look at the two- or at most three-dimensional shadow cast in what the computer algorithm determines to be the least distorting projection of its optimal N-dimensional solution. Practically, this means that any flat projection of a complex network might place distant nodes near each other, creating an illusion of closeness—a caveat for visual inspection to be kept in mind.

A PN image is constructed from a whole network, or at least as close to one as the research team can approach. Within the

network perspective, the network pattern is a kind of graphical statistical indicator. The network pattern is arrived at by relational statistical methods of calculating social space. Once it has been created and the types of actors have been indicated by distinguishing icons, the researcher can often visually discern qualities of the large-scale pattern: clusters in dynamic tension with others, patterns that brim with political significance. This is refreshing for the artists among social scientists, who tend to think in patterns rather than in linear correlations (Abbott, 1988). Just as the pattern itself may arise from chaotic dynamism, so too may it be irreducible to network statistical indicators such as centrality and clique analysis. Many forms of network statistics, such as betweenness measures, may be extremely helpful. But at the same time, interpretation of the pattern requires intuitive linking to larger political dynamics and to the subtleties of complex interactions through detailed case knowledge. Quantitative statistical measures cannot by themselves adequately capture this entire holistic pattern or its implications. Hence, PN research requires a creative interplay of fuzzy interpretation and precise quantification.

Quantitative Descriptive Indicators

Statistical measures provide crucial and precise information about aspects of the network that can sharply reveal differences in comparative research. For instance, one can adjust the size of the icons to reflect the amount of information they exchange with other actors or some other property. The more they exchange, the more central they are, at least within a given cluster. The distribution of sizes and patterns will differ across cases, and probably across domains within a given society. These statistical measures have been elaborated on in many books and need not be reviewed in detail here (Prell, 2012; Wasserman and Faust, 1994).[5] But a brief summary may be useful.

Network statistics produce quantitative scores for individual members, member types, subgroups, and whole networks. Individual actor scores derived from network measures include indegrees, outdegrees, centrality, and brokerage. A simple count of different types of actors in the different cases can be very revealing. Respondents may also assign scores indicating the actor's reputation for influence (as mentioned above). Subgroup indicators include cliques of different sizes and composition (k-cliques) produced by clustering (a set of actors from three to n sharing many ties within the set).[6] Whole network scores include density (percent of all possible ties actually made), connectivity (percent of all actors actually connected into the network), and path lengths (percent of actors that can be reached by one tie, by two ties, and so forth).

Once some distinct clusters in a network have been determined, one may investigate the relationships between them. Some clusters may be totally isolated from others, forming what Burt (2005) calls structural holes. Or they have one or more actors that bridge between them, crossing the structural hole, in theory giving such uniquely situated actors relatively strong social capital and power (Gould and Fernandez, 1989; Putnam, 2000).

From a different approach, block models allow the researcher to compare the joint role structures of multiple network matrices (Wasserman and Faust, 1994, 425–460). This method divides the members into groups with central actors (leaders) and groups with peripheral actors (followers). One study used this technique to compare leadership in the United States and German urban power structures (Breiger and Pattison, 1978).

In dealing with multiple networks in the same domain, the method of matrix correlation (QAP) is very useful. It shows the degree of congruence or overlap between two or more networks. It can help answer questions such as: Do the political support and information networks coincide with each other or involve different actors and/or different patterns? This can be an important theoretical question. The degree to which the same actors transfer both kinds of resources will indicate a certain type of power concentration in the system. For instance, in the climate change mitigation domain, one important subset of actors will be those who receive vital scientific information from the IPCC. If these actors are also joined by a mutual political coalition, their impact will probably be magnified.

The use of two-mode network analysis permits studying the relationships of actors to ideas or events (Breiger, 1974). This has become useful in studying the relation of actors to discourse, as pioneered in discourse network analyzer (see chapter by Leifeld, this volume). In the case of climate change politics, the organizational actors have different preferred ways of framing the issue. The earlier part of the Compon study distilled a set of 131 different ways of framing climate change from the three major newspapers (2007–2008) of seventeen societies. For instance, some cases accepted the climate change science promulgated by the IPCC, while a few rejected it. The Compon PN survey includes questions about actor framing preferences as well. This allows us to distinguish the field of discourse from the field of action.

The discourse field shows the frames that are prominent within a domain and how they tend to cluster with each other. The meaning pattern of clusters and the holes between the clusters defines in itself a distinct "cultural" pattern of framing preferences for an issue domain (Pachucki and Breiger, 2010). The action field, in contrast, shows how actors actually establish ties with other actors by transferring or exchanging various kinds of resources and positive or negative sanctions. Each of these two fields can be analyzed separately, or they can be analyzed in tandem. In the latter approach, by analyzing how actors cluster around common framing profiles, one may distinguish potential advocacy coalitions within a domain. Then, if in their actual ties to each other, the same sets of actors also indicate that they actually do exchange vital information and join together in political advocacy coalitions, one has very strong evidence of the existence of advocacy coalitions. From this point, it is possible to measure the relative power of these advocacy coalitions in the ways mentioned above, to see which ones get their way in shaping policy. This then is the heart of how the PN approach can reveal the structure of political configurations, leading to the outcomes of emissions trajectories. These network statistics, applied to comparative PN analysis, offer powerful new tools for digging deeper into the "wicked" complexity of political systems, as exemplified by comparative climate change mitigation politics.

Challenges and New Directions

Including Meaning in the Relational Social and Political Approach

As noted above, the PN method has blossomed in many qualitative and quantitative studies. One significant change has been the expansion from the study of interests and interest-based preferences to include the study of discourse and culture. This adds the dimension of meaning to the dimension of the relational. That is, it includes cultural distance and clustering based on the similarity of actors' profiles of meanings or frames about an issue. In this vein, discourse network analysis (see chapter by Leifeld, this volume) develops meaning clusters according to the number of actors sharing frames. Breiger develops "cultural holes" in parallel to Burt's "structural holes"(Burt, 1992; Pachucki and Breiger, 2010). This cultural approach provides a network method of operationalizing Bourdieu's concept of field (improving on his method of assigning positions to actors based on their quantities of economic and cultural capital) (Bourdieu, 1984, 1985). Sonnett (2015) has combined these approaches into a "netfield," and Martin (2003) has expanded on the relational qualities of the field. As another aspect, the emergent quality of patterns in dynamic networks indicates the utility of chaos theory (Gregersen and Sailer, 1993).

Complexity and Chaos

Complexity refers to the "butterfly effect," whereby seemingly insignificant elements of a system can magnify to become determining causal factors. *Chaos* refers to activity that on one level seems random and unpredictable, but on a higher level can produce a pattern. This emergent pattern gives order and meaning to the seeming chaos below. The different types of networks

and their members interact with each other in "networks of networks," providing effects of complexity and chaos (D'Agostino and Scala, 2014, Lee et al., 2014). The PN survey gathers data on multiple networks among multiple organizational actors, thereby enabling the representation of multiple networks. These representations are of course limited to the *measured* networks among the *selected* organizations asked about in the survey instrument. Each discrete network type, such as information transfer or political collaboration, contains a unique subset of actors engaged in a unique relational pattern. The researcher can view each network singly, examine the tensions between the different networks, or integrate them all into a total unified network. Multiple networks conjointly bear upon an actor (node) to affect behavior. Likewise, whole networks interact as layers within complex topologies, their tensions and synergies affecting the operation of institutions and systems (Menichetti et al., 2014).

The networks, singly and as multiple synergies, manifests patterns, often displaying densely interlinked sets of actors forming clusters, as well as sparser areas between clusters. The data allow the researcher to discern the particular ideologies and policy preferences, relative amounts of power and influence, and tactics toward discrete policy struggles of the different actors, clusters, and networks. These distinct aspects have various relationships of complementarity or tension with each other, which affect the operation of the total domain network. The special analytical capacities here described allow a more exact and differentiated tracing of the political process through to its outputs. The exercise shows why a particular national policy domain ratifies some policies and not others. Ultimately, the PN approach is about better understanding the operation of power in political systems, that is, about why political systems produce various outputs and outcomes.

New Theoretical Forms

Integrating the several dimensions provides for a fuller accounting of the deep ontological formative differences among societies and polities. Ultimately, this trend will merge social actors and cultural memes as potentially potent coactants within multiplex, complex, and chaotic sociocultural networks (Latour, 2005). Such seemingly subtle differences profoundly affect the diversity of political system operation. While perhaps seemingly a digression, this discussion of complexity and chaos is quite indicated and required by the comparative PN study of political systems. The PN approach provides new ways to grasp these subtleties.

The key advantage of the PN approach, *as an ideal type,* then, is to let us see in one view all the relevant modes and patterns of interaction, ideology, and influence among all the relevant organizational actors and ideas in a given national policy domain. Many practical obstacles hinder the realization of this ideal, but it is the visionary goal. More exacting and precise data often, after overcoming paradigm inertia, force the creation of new models and theories. The PN method embodies this threat or promise. For example, in the network one can consider the position and operations of a single organization or a type or class of organizations. An economic ministry or a protest movement can be juxtaposed against the rest of the network. The same is true of a class or type of organization, such as business associations or labor associations. This spotlighting reveals the relative clustering, cohesion, ideologies, and political power of a class, and hence of its relevance as a collective political actor. Each of these discrete spotlight analyses invokes and enables the more refined testing of theories that have grown up around the given type of individual or collective actor, such as government bureaucracy or social movement or class. When the network is examined in total, though, the conjoint presence of the actors and their theoretical halos creates an awkward juxtaposition. This jumble, under the heat and pressure of systematic inquiry, melts and melds theoretical concepts into new hybrid explanatory models and theories. Rather than being inductive or deductive, this is best labeled an abductive process of theory building (Tavory and Timmermans, 2014).[7] To push a pun, it runs off with the best ideas.

The theoretical reformulation implied by the PN approach is profound and paradigm shaking. Political science is imbued with an orientation to "who gets what, when, how" and how rational actors attain those ends (Lasswell, 1936). To this focus on the

individual actor, political sociology added attention to the "social basis of politics": large-scale social groupings, institutions, formations, and changes (Lipset, 1963).[8] The study of political networks brings a fresh third interactive perspective to this quest. The network view argues that actors are creating or embedded in sets of local, relatively stable relationships with other actors. Even if relationships are rationally and instrumentally created by individual actors, the resulting larger pattern of relationships bends back to face them with a forceful context. But the relationships may be more than rational and instrumental. They may even shape their very motivation and goals; actors may be embedded in networks and may even be their puppets (Emirbayer, 1997). In addition, multiple networks interact in complex ways. To best understand these implications, one must don a new set of relational-relativity spectacles. Despite the noted limits and cautions, the PN approach opens to our view a new social-political landscape. As we explore this strange morphology, it puts existing theories to the test and forces the generation of new, more closely hewn questions and theories.

Limits to the Network Approach

When one delves into power empirically, as this approach allows, it becomes complicated. In my extended studies of the PN data from the labor PN project, I have reached my own conclusions and speculations about the implications for theory and measurement, noted as follows and in preceding sections of this chapter.

Western political theory, located at the middle range, carries paradigmatic assumptions about the composition of political systems—of isolated, rational actors driven by interests, using instrumental, calculated tactics, and possessing powers that exert force upon each other. Each actor encounters its limits coming from the aggregate forces it faces. In addition, these actors play upon a landscape of institutionalized rules that may sanction their actions. This view is akin to Newtonian theory in physics, wherein objects exert at a distance a force known as gravity. Certainly this process can produce a type of relationship and power network. Coming from mathematical graph theory, formal terms refer to networks as consisting of edges and nodes. This projects a rather crisp image that is transitive and of equal quality throughout, like a computer network. This kind of image forms an underlying assumption for a lot of theory and statistics for social and political networks, such as centrality and betweenness. However, this assumption places more paradigmatic stumbling blocks in the way of comparative PN studies.

All social network theories, images, and statistics, unfortunately, suffer from a common debilitating, if not fatal, flaw. They tend to assume that social networks are integral and transitive (that they transfer the same relational mode throughout). This misplaced concreteness arises because many network theorists and statisticians implicitly take electrical or computer networks, with their automatic and accurate shuttling of information, as their models. Social networks, however, may work more like the game of telephone. The message degrades and changes as it passes from node to node. The PN survey (and any whole network survey) produces a network by connecting the dyadic links indicated by the survey respondents. We assume that the network is integral and transitive. But perhaps members do not transfer exactly the same information or other medium when they receive from one partner and then give to another partner. Accordingly, the researcher must maintain a skeptical awareness of the breakdown potential of social networks and look for additional evidence to justify any conclusions drawn from images and statistics.

The social and political reality is much messier and becomes more so when viewed comparatively. Harrison White laid the groundwork for contemporary mathematical and statistical studies of networks (Freeman, 2004). In the first edition of his germinal work, *Identity and Control*, he states that his work deals only with social relations, not with culture. In his second edition, he equates culture with identity which in turn reduces to control strategies (White, 2008; Emirbayer, 2004, 8). He treats actors and networks as objectively real entities as measured and hence can accept the crisp, crystalline view. And yet even he ends up saying: "*Social organization is like some impacted, mineralized goo, some amazing swirl of local nuclei and long*

strands of order among disorder (White, 1992, 127). Now, if networks were the sole reality, White might say that they resemble disconnected pick-up-sticks. But the word *goo* implies that his intuition signals some inarticulate, less tangible substance surrounding the networks.

As we go into it and use it for comparative studies, the PN approach forces us to recognize more and more goo, like dark matter in physics. Actors and networks can be composed of different stuff than calculated *Macht*, than lines of power per se. In a given society, the sum total of forces at work can create valleys into which actors and relationships fall, congealing and taking shape along predetermined lines. This viewpoint of network formation parallels the Einsteinian view of gravity, which contrary to Newton, sees it as a curvature in space-time into which objects fall (Hawking, 1996). A whole national society is shaped over time by culture, social training, and a wide range of informal and formal institutions to generate certain types of actors and relationships in its political processes. Rather than rational actor theory, this reality is better approached by relational network theory (Emirbayer and Goodwin, 1994; Emirbayer, 1997), but even this fails to grasp the encompassing ontology of the social.

Conclusions

Over the past centuries (starting with the ancient Greeks), founded in cross-national comparison, the field of political studies has developed various broad (macro) theories about the drivers of policy formation, including class, culture, rational actor competition, and institutions. Evidence has consisted largely of narrative case studies highlighting certain factors or broad statistical tendencies. Both have a vagueness consistent with their lack of specific mechanisms and systematically traceable relational patterns of power. The new approach of PN research, in contrast, pushes research into unexpected, variegated, and complex dynamics, at best only partially and tangentially explained by any of these theories. Even when investigating just a single domain in a single case, the PN meso-relational perspective is eye opening. But the comparative method has always been the mother of social scientific theory building. When used to compare the same policy domain across different national political systems, the PN approach reveals distinct and nuanced configurations that offer great stimulation to the exploratory mind. The variegated configurations show how subtly and deeply the actual processes may differ. They can produce power and outcomes through very different mixtures of actors, motivations, discourse, and relational network modalities. Thus, peering deeply into these and comparing these complex meso-level dynamics pushes one to rethink the validity of old theories and to create new hybrid models and theories more descriptive and predictive of the newly observed realities. In this way, the PN approach has the potential to profoundly reshape the study of politics.

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Notes:

(1) In contrast, the larger school of social network analysis focuses on small-group or interindividual scale interactions (Freeman, 2004).

(2) Compon project website, www.compon.org.

(3) While comparing the policy networks, in the final stage the Compon project will feed them into an analytical machine known as qualitative comparative analysis (QCA). This machine facilitates the search for causal pathways leading cases to more or less compliance with emerging global mitigation regimes (Ragin and Becker, 1992).

(4) Perhaps the deepest theoretical program on this perspective comes from Latour (2005).

(5) The statistical algorithms that run these analyses on network matrices are available in network analysis software packages such as UCINet (Borgatti, Everett, and Freeman, 2002).

(6) What Robert Putnam calls bonding ties (Putnam, 2000).

(7) It runs directly contrary to the deductive theoretical hypothesis testing approach often taught in social scientific graduate methods courses. The latter results in the rather loose connection between reality and theory typical of macro-institutional, event-illustrative, and usually reductionist studies.

(8) During his career, Lipset was president of both the American Sociological Association (1993–1994) and the American Political Science Association (1981–1982).

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