Policy Analytical Capacity and Policy Activities

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Abstract. The study of policy process involves the study of policy actors - people involved in the development of public policy in a particular geographic area. This paper investigates policy actors in the context of Colorado climate and energy issues with a particular emphasis on the types and levels of their engagement in policy activities. The conceptual framework guiding this study centers on policy analytical capacity, the ability to acquire and use information in the policy process. High policy analytical capacity is expected to be associated with high levels, and more diverse kinds, of policy activities. The findings partly confirm the expectations. Actors from government and the non-profit sector report the highest policy analytical capacity and highest and most diverse range of policy activities. However, researchers, despite relatively high levels of policy analytical capacity, report involvement in just a few activities beyond conducting research. Actors with strong educational backgrounds in the physical sciences are more likely to be involved in conducting research whereas those with strong backgrounds in the social sciences are more likely to be involved in evaluating and appraising policies and working with the public. The conclusion contextualizes the findings by focusing on the relationship between technical and scientific complexity of climate and energy issues and the necessity for participating actors to possess high levels of policy analytical capacity.

Keywords. Information processing, expert-based information, climate change, policy processes

Résumé. L'étude du processus de politiques publiques implique l'étude des acteurs de politiques publiques – les personnes impliquées dans le développement de politiques publiques dans une aire géographique donnée. Cet article analyse les acteurs de politiques publiques dans le contexte des questions de climat et d'énergie du Colorado, en mettant l'accent sur les types et les niveaux de leur implication dans des activités de politiques publiques. Le cadre conceptuel qui oriente cette étude est centré sur la capacité d'élaboration des politiques publiques, l'aptitude acquérir et à utiliser des informations dans le processus de politiques publiques. Une capacité analytique élevée des politiques publiques devrait hypothétiquement être associée avec des niveaux élevés ainsi que des formes plus variées d'activités de politiques publiques. Les résultats confirment en partie cette hypothèse. Les acteurs du gouvernement et du secteur à but non-lucratif signalent la capacité analytique d'élaboration de politiques publiques la plus élevée, et le registre le plus pointu et varié d'activités de politiques publiques. Cependant, les chercheurs, en dépit d'une capacité analytique d'élaboration de politiques publiques relativement élevée, signalent une implication dans seulement quelques activités, au-delà de la conduite de leurs recherches. Les acteurs avec un bagage éducatif solide en sciences physiques ont plus de chances d'être impliqués dans de la recherche, tandis que ceux dont le bagage est en sciences sociales ont plus de chances d'être impliqués dans l'évaluation des politiques publiques et de travailler avec le public. La conclusion de cet article contextualise les résultats en se penchant sur la relation entre, d'une part, la complexité technique et scientifique des questions de climat et d'énergie et, d'autre part, la nécessité pour les acteurs engagés de posséder des niveaux élevés de capacité analytique de politiques publiques.

Mots clefs. Traitement d'information, information fondée sur l'expertise, changement climatique, processus de politiques publiques

Introduction

Policy process research is the study of public policy development over time and the actors, events, and context surrounding this development. The foundation of the field started, in part, by recognizing that public policy develops not within a single administrative agency or by a single government institution (courts, executives, legislatures) but rather by subunits of a political system in what have been called "whirlpools" (Griffith, 1939), "subgovernments" (Freeman, 1955), and "policy subsystems" (Redford, 1969). The arguments from these foundational pieces continue through today. Policy subsystems remain a primary unit of analysis (Howlett et al., 2010; Baumgartner and Jones, 1993;

Sabatier and Jenkins-Smith, 1993), in part from the lasting recognition that public policies operate across multiple, interlinked organizations and groups of people specialized and involved therein. These specialized and involved people, called "policy actors", have devoted nontrivial amounts of time and effort, sometimes for decades, to gain deep knowledge and to build and maintain their network in an effort to affect the development of public policy. Focusing on these policy actors, this paper seeks to answer a rarely explored question: How are policy actors engaged in the policy process and what factors explain their engagement?

The operation of policy subsystems encompasses multiple functional areas in the context of a problem and related politics. In some situations, the conduct of research and the evaluation and analysis of policies are central for understanding the severity of problems and to anticipate future impacts of proposed solutions. In other situations, the challenge may be one of coordination in the implementation of a government program. In most situations, policy subsystems necessitate political maneuvering from negotiating with opponents to developing stronger networks of allies as policy actors attempt to advocate for certain policy preferences.

Like the diversity of functions operating within a subsystem, policy actors vary in their role and involvement. Given resource, institutional, and cognitive constraints, policy actors are likely to specialize and undertake some activities more than others. Certain policy actors, like researchers, are expected to be more involved in information-related activities: conducting research, appraising policy, and evaluating policies and outcomes. Government officials are expected to participate in implementing or delivering policies and programs. Most policy actors are expected to engage in various forms of politically oriented activities: building coalitions and negotiating in multi-stakeholder processes. This paper seeks to understand who is participating in each type of activity and whether their level of policy analytical capacity matters in their involvement.

Policy analytical capacity generally refers to "information acquisition and utilization in the policy process" (Howlett 2009; pg 162). We use the concept "policy analytical capacity" as a guiding conceptual framework for data collection and analysis. As a framework, policy analytical capacity operates at the individual, organizational, and subsystem levels. While this paper deals with a single policy subsystem – energy and climate issues in the state of Colorado – the analysis is on individuals embedded in their organizational context. For individuals, their policy analytical capacity might relate to their formal level of training and education. Their organizations might provide additional incentives and resources to permit them to engage in some activities over others. Thus, the argument is that policy activity engagement is shaped by factors operating at the actor level and at the organization level.

The policy actors examined in this paper are those people involved in climate and energy issues in Colorado, United States. Colorado possesses a balance of traditional energy resources and a recent rise in its renewable energy sector. The threats to the State from climate change include shorter and warmer winters, a thinner snowpack, earlier melting of the snowpack with increased spring runoff, increased periods of drought, increases in the number of wildfires, and substantial losses of alpine forests due to pine beetle infestations. Like many areas of the world and the United States, Colorado launched an initiative to address climate change, which resulted in the creation of the Colorado Climate Action Plan in November 2007 (Ritter, 2007). This plan called for a 20% reduction of state greenhouse gases emissions by 2020. This Colorado Climate Action Plan is similar to the approximately thirty other state plans in the U.S. (Ramseur, 2007).

This paper proceeds in the usual manner starting with a theoretical description of policy analytical capacity as it relates to policy activities. We then describe the case study of Colorado climate and energy issues and the methods of data collection. The results indicate that, contrary to our expectations, researchers are most involved in conducting research and less involved in other activities. Actors from government, businesses, and non-profits show more diverse and higher levels of activities. Whereas researchers possess the most consistently high levels of policy analytical capacity, other policy actor categories are nearly equal on other measures. Finally, different educational backgrounds in the social versus physical sciences are associated with different forms of engagement.

Policy Analytical Capacity and Policy Activities

The policy actors involved in policy processes are not typical members of the general public (Herron and Jenkins-Smith, 2006; Zaller, 1993). Policy actors are people involved, one way or another, in the affairs of a particular topic in a policy subsystem. They may represent government agencies and elective officials from local, sub-national, and national levels. Some are members of interest groups representing purposive and material goals. Others work for the mass media, think tanks, consulting firms, and academic universities.

Scholars dealing with policy actors have focused narrowly on iron triangles (Freeman, 1955) or more broadly on issue networks (Heclo, 1978) or advocacy coalitions (Sabatier and Jenkins-Smith, 1993). One of the main scholarly foci, to date, has been on the manner in which policy actors mobilize and overcome collective action problems to affect the stages of the policy cycle, partly inspired by Olson's (1965) seminal work on interest groups. Indeed, much of the research on common pool resource theory has dealt with the institutional arrangements mitigating threats to collective action (Ostrom, 1990; Ostrom, 2011). Other case studies have described how actors use information to shape public opinion and the government agendas or how actors attempt to steer the implementation of a government program. Heyman's (2008) thick description of activities and influences by policy actors actually *Living the Policy Process* is but one example of such efforts. In the field of public administration, research often examines administrative and political activities by government officials as found in Svara

(1999; 2006). The focus of this paper is less on the influence of policy actors in a subsystem and more on the activities that policy actors actually undertake. We categorize policy activities into three overlapping categories:

1. Information: Much of policy processes involve the role of information and activities, such as conducting research, appraising policies, and evaluating policies.
2. Administrative: Policy processes deal with policies and government programs. Some policy activities, therefore, involve administrative activities from implementing or delivering policies to informing elected and appointed officials.
3. Political: Policy processes involve politics and the involvement of policy actors in negotiations and coalition building.

One of the more recent efforts to understand policy subsystems has been the literature on policy analytical capacity (Fellegi, 1996; Howlett, 2009; Riddell, 2007). Policy analytical capacity refers to the skills in acquiring and utilizing information in the policy processes to deal effectively with political behavior at all stages of the policy cycle. Policy actors with high levels of policy analytical capacity are argued to have a higher chance of shaping agendas, designing the content of policies, gaining an understanding of the context in which policies are implemented, and steering the evaluation of policy outputs and outcomes (Howlett, 2009).

The ontology of policy analytical capacity constitutes several dimensions that refer to various skills and knowledge forms. These forms of skills might involve areas of formal training: the abilities to do applied research, modeling policy analysis/evaluation, statistical methods, and trends and analysis and/or forecasting as in relation to the future state of the economy or of public opinion (Howlett, 2009; pg 164). High policy analytical capacity might relate specifically to the type of formal education, for example, did individuals take many college courses in climate and/or energy sciences and engineering? Or, did individuals take courses in policy analysis and law? Are individuals with cross-disciplinary training more active in complex public policy issues, like climate change, than those with narrower training within the physical or social sciences? At the individual level, this paper expects that, all else being equal, *policy actors with high levels of individual policy analytical capacity will report high levels and a diverse range of policy activities than policy actors with low levels of policy analytical capacity*.

Policy analytical capacity refers not just to individual attributes but also to the organizational affiliation of the policy actor. The vast majority of policy actors do not have the personal resources to sustain their engagement in policy subsystems over extended periods of time. Many policy actors represent government agencies, private organizations, or non-profits with extensive memberships and resources. Researchers, for instance, may be supported by universities or private consulting firms. As a result, the priority of some organizations, based on their core missions and purposes, will more likely align with the core affairs of a policy subsystem than others. Some organizations may also provide staff and information to their members to equip them to influence policy processes. This paper expects that, all else being equal, *policy actors with high levels of organizational capacity will more likely report high levels and a diverse range of policy activities than policy actors with low levels of organizational capacity*.

The theoretical effort of this paper is directed toward understanding the association between individual and organizational analytical capacity on levels of, and diversity across, policy activities. This paper also examines several rival explanations for understanding involvement in policy activities. The first rival explanation is organizational affiliation. Some organizational affiliations are likely to operate in certain niches within a policy subsystem and, therefore, affect the policy activism of their affiliates. For example, researchers are expected to be more involved with information-related activities. Government officials are more likely to be involved in implementation and delivery of public services. Non-profits and businesses are expected to be involved in informing government officials and attempting to shape public opinion. The second is extreme beliefs either in climate and/or energy issues. Assuming boundedly rational individuals, policy actors rely upon their belief systems to filter and interpret the world; people with more extreme beliefs are more likely to perceive severe problems to act upon and, therefore, are more likely to be involved in a diverse range of activities. Third, we expect that, the longer people are involved in subsystem affairs, the greater their level and diversity of policy activities. The argument being that cognitively constrained individuals take time to learn about the affairs and people in complex systems and their activities will increase alongside their increases in knowledge and network contacts (Simon, 1996). Finally, we expect that females will report lower levels of policy activities than males (Verba et al., 1997; Dalton, 2008).

Case Study Description

The case study is Colorado climate and energy policies. Colorado provides a good case study due to its vast traditional energy resources, the rise of its renewable energy sector, and its vulnerability to climate change. Colorado has long been a major producer of traditional energy with several major fossil fuel-rich basins, major production of coalbed methane, and vast reserves and high levels of natural gas production (US Energy Information Administration, 2009). In recent years, Colorado's renewable energy sector has seen considerable growth due in part to the creation of the state's renewable energy portfolio standard via ballot initiative in 2004 and a subsequent strengthening of the standard by the legislature in 2010 (Database of State Incentives for Renewables & Efficiency, 2010). The Colorado case is also good to study because of its vulnerability to both current and predicted impacts of climate change, including shorter and warmer winters and increased periods of drought (Ritter, 2007). Scientists project that in the ensuing decades, climate change in Colorado will produce temperature increases of 3

to 4 degrees Fahrenheit, longer and more intense wildfires during the summer seasons, and an increase in water shortages.

In the context of the United States, there are at least thirty states as well as hundreds of cities that have created a climate action plan of some sort (EPA, 2011; ICLEI, 2011). A climate action plan typically outlines policy goals and recommendations that a state or city will employ to address climate change by making specific policy actions towards reducing the GHG emissions of that entity. Early climate and energy policy innovations at the state level were categorized and examined by Rabe (2004) and while many of these policies were symbolic at first, later and especially recent developments, have become much more aggressive in goal and policy detail (Krause, 2010, Ramseur, 2007).

Former Colorado Governor Bill Ritter launched an initiative to address climate change statewide, which resulted in the creation of the Colorado Climate Action Plan in November 2007. This plan called for a reduction of the state emission of greenhouse gases by 20% by 2020. This plan for the state was created in a collaborative manner from a diverse set of stakeholders "...including business and community leaders, conservationists, scientists and concerned citizens" (State of Colorado 2007, pg 2). The Colorado Climate Action Plan is similar to the approximately thirty other state plans in the U.S (Ramseur, 2007).

The Colorado Climate Action Plan was preceded by a series of roundtable discussions and public input sessions that provided both the formal and informal discussions between advocates and opponents of citywide climate policies. Such ambitious climate goals will require these individuals and organizations to work together and make substantive policy changes from the status quo (Krause 2010; Ramaswami, 2008; Lutsey and Sperling, 2008; Byrne et al., 2007; Fogel, 2007; Selin and VanDerveer, 2007; Rabe 2004; Bulkeley and Betsill, 2003; Betsill, 2001).

Given that the Colorado plan is typical in comparison to other state climate action plans in existence, and given that policy analytical capacity has never been examined in United States statewide policy arenas, a typical-case approach to case selection is, according to Gerring (2007, pg 91-93), useful for an exploratory study such as this.

Methods of Data Collection

A web-questionnaire was administered to people actively involved in climate and energy issues in the city of Denver and at the state-level in Colorado, United States. Both the city and state-levels were used because Denver is the largest city in Colorado, the state's capital, and influential in state-level policy developments in climate and energy issues. It is also worth noting that the Mayor who spearheaded the Denver level climate action plan is now the Governor of Colorado leading the charge on the state level climate action plan.

The sample was collected through a modified snowball sample targeting those individuals involved in Denver and Colorado climate and energy issues. The sample was created first by searching the internet for government and nongovernment organizations and the people therein who are involved in Denver and Colorado climate and energy issues. Additionally, newspapers and online publications were also searched. The online search was complemented by preliminary interviews of five people involved with Denver and Colorado climate and energy issues. The total sample was 793.

The web-questionnaire was administered from February till April of 2011. Of the total, 272 people returned fully completed surveys for a response rate of 34% and 87 returned partially completed surveys (the inclusion of which equals 359 respondents and a 45% response rate). An assessment of respondents shows that, from the full sample, private sector, government, non-government, and researchers/academia categories responded in ranges from 26 to 86% of their respective populations in the sample. The exception is the media where only eight started to complete the survey out of 53 and only two fully completed it.

Results

The results are presented in two parts. The first is a descriptive portrayal of the policy actor categories and their individual and organizational policy analytical capacity. The first part also summarizes the control variables: climate change beliefs, number of years involved, organizational affiliation, and sex. The second is more explanatory where binary logit and ordered logit analyses are conducted to explain policy activity involvement by individual and organizational policy analytical capacity levels and the rival explanations.

Descriptive Analysis of Policy Actors, Policy Analytical Capacity, and Policy Activities

Table 1 shows descriptive characteristics of the sample respondents and some of their individual-level variables and organizational affiliations. Respondents were asked to identify their organization with the following question: "Which of the following best describes your organization?" The possible responses were four: academic/research (n=38), business/private sector (n=87), government (n=84), non-profits (n=55). These categories were confirmed through manual coding based on the respondents' email addresses and affiliations. Government officials come from city, state, and federal-level agencies. Researchers represent both those from academia, private consulting firms, and government research organizations (e.g., National Renewable Energy Laboratory). Non-profits consist largely of environmental organizations devoted to energy and climate-related issues in Colorado.

The sample has a fairly balanced representation of males and females with non-profits showing the lowest ratio (40% female) and the business/private sector the highest ratio (65% female) with a statistically significant difference between the actor categories ($p<0.10$, based on an independent sample, Kruskal-Wallis Test).

Knowledge and skills for successfully working within a policy subsystem will increase with time. The respondents from this study indicate that more than half have participated for less than 10 years with the modal category between 1 and 5 years with little difference between actor categories ($p<0.10$). Across the actor categories, less than 40% of business/private sector and non-profits report participating for less than five years.

The formal education level of the respondents is high with more than 60% of all categories earning at least a Master's / Professional Degree or higher. Researchers are the most likely policy actor category to have earned a Ph.D., M.D., or J.D. at 51% with a statistically significant difference across the actor categories ($p<0.001$).

The level of formal education might not coincide with actual classes in areas related to climate and energy issues. Respondents were asked for the Physical Science Courses question: "How many college courses on climate or energy sciences or engineering have you taken?" Similarly, for the Social Sciences Courses question: "How many college courses in economics, public policy, political science, or law have you taken?" Respondents were given four response categories: none, less than five, between five and ten, and greater than ten.

From Table 1, there is a significant difference among actor categories with regards to the number of social and physical science courses ($p<0.10$). Researchers are more likely to take a high number of physical science courses compared to the remaining actor categories. However, the actor categories show less divergence in the social sciences with 53% (researchers) to 77% (business/private sector) taking five or more courses.

The formal training of the actor categories was measured by six dichotomous variables: "In which of the following areas have you received formal training?" The categories including applied research, modeling, policy analysis, policy evaluation, statistical methods, and trends analysis and/or forecasting. The categories are ranked from the highest reported area of training (statistical methods at 47%) to the lowest area of training (modeling at 25%). The respondents are nearly identical in their training in policy analysis and evaluation as well as trends analysis and forecasting and modeling. They differ most in statistical methods and applied research. To be used in the multivariate analysis, the sum of formal training is the sum of techniques with the sum of nearly three areas for researchers to less than two for non-profits.

Table 2 shows the climate-related beliefs by the actor categories. Respondents were asked to rate their views on the severity of climate change, the causes, and possible approaches for mitigating carbon. The questions were asked on a -2 = Strongly Agree to +2 = Strongly Disagree scale. These items were then aggregated into single-scaled item called "climate beliefs" and, for the multivariate modeling of policy activities, the absolute value was calculated to assess extremity of climate beliefs (see factor loadings on Table 2). Those with more extreme climate beliefs (regardless of their stance on climate change) are expected to report higher levels and range of policy activities. The argument being that policy actors with more extreme beliefs should care more about, and thus try harder, to affect policy subsystem affairs. While actors from the businesses/private and non-profit sectors have the lowest level of beliefs in the validity of climate change, the four actor categories are statistically indistinguishable in their extreme beliefs.

Table 3 presents the organizational capacity questions and the mean responses by organizations. The three questions were combined by their means into a scale and the unrotated factor loadings are presented in the first column as well as the Cronbach's alpha (.74) for the scaled item. The three questions aim to capture the priority of climate change to the actors' organization, the resources the organizations possess, and the actual effort the organization puts toward climate change. The results indicate that, for two of the questions, there is a statistically significant difference by organizational affiliation with government being reported as having the least level of resources for climate-related issues and as placing the least emphasis on climate-related issues and energy policies. The organization capacity scale repeats this pattern with governments' mean lower than the other three actor categories.

The dependent variable for this study is policy activities. Table 4 reports the mean percents by actor categories for their reported engagement in each type of activity. The activities are generally organized from those related most to information (conducted research), then to political activities (coalition building), and administrative activities (implemented policies). The general order is not meant to be strict and mutually exclusive in the boundaries between the activities.

Overall, the results show that research/academic actors are often least likely to be engaged in activities except for conducting research on climate-related issues and/or energy policy. The exception is business / private sector which reports lower levels (compared to researchers) of consulting with the public and implementing policies. The highest levels of engagement come with government officials and non-profits but even these two categories differed by more than 10 percentage points on "informed elected and appointed officials" and "implemented or delivered policies or programs on climate-related issues and/or energy issues."

Explanatory Analysis of Policy Actors, Policy Analytical Capacity, and Policy Activities

Table 5 presents the multivariate analysis explaining the variance in policy activity responses per activity and by the sum of all activities. A binary logit analysis was used per activity and an ordered logit analysis was conducted for the sum of activities. Table 5 lists the unstandardized coefficients. The expectation is that higher levels of policy analytical capacity at individual and organizational levels would be seen across all activity levels. The explanatory variables are categorized in order including individual capacity, organizational capacity, and the controls. Researchers are used as the baseline dichotomous variable for the policy actor categories so that any significant coefficient for government,

non-profit, or businesses indicates departures from researchers. The models show decent fit with Chi^2 probabilities being significant ($p<0.000$) with the exception of "negotiated with stakeholders" where ($p<0.007$). Pseudo R^2 ranged from 0.08 to 0.22.

Two variables are consistently associated with policy activities. The first is organizational capacity, which shows significant associations for all activity types. Individual analytical capacity shows significant coefficients but less consistently compared to organizational analytical capacity. The most consistent variable at the individual level is having more than five classes in the social sciences, which is consistent with four of the eight types of activities. Whereas a higher number of physical science courses are associated with conducting basic research, social science courses are associated more with policy analysis and evaluation and in working with the general public and stakeholders. The results support the expectation that individuals' capacity is derived most consistently from their organizational affiliation and less from themselves.

The second most consistent variable is government actors, which compared to the researcher baseline category, are more likely to be involved with all activities except for conducting research. Similar to Table 4, with the exception of conducting research, government actors are more likely to be engaged in nearly all policy activities at higher rates than researchers. Whereas researchers are expected to have higher levels of engagement in information-related activities, Table 5 shows that government actors are more likely to report appraising and evaluating policies than researchers.

Several expected relationships between the explanatory and dependent variables are shown to be insignificant, including advanced degree and formal training. While there may be several interpretations explaining the lack of relations, we see the most likely reason as related to the bluntness of these measures compared to types of classes. That is, having an advanced degree is less important in explaining involvement in policy activities in the context of climate and energy issues as actual number of classes in the area.

Females, years involved, and extreme climate change beliefs are largely ineffective in associating with the dependent variables. One rationale is that organizational affiliation and capacity is far more consistent as a significant explanatory variable than any individual level variable.

Conclusion

This paper contributes to our understanding of policy processes and policy subsystems by exploring the activities conducted by policy actors as explained by their policy analytical capacity.

Individual policy analytical capacity – especially courses in the social and physical sciences – was found to be an important explanatory variable in some activities but not in others. Individual policy analytical capacity was most important in information-related activities, such as conducting research, appraising policy, and evaluating policy. Actors with strong educational backgrounds in the physical sciences were more likely to be involved in conducting research whereas those with strong backgrounds in the social sciences were more likely to be involved in evaluating and appraising policies and working with the public.

Policy actors were likely to be more highly and diversely involved in policy activities if they were from organizations with the capacity and the dedication to deal with climate-related issues. The organizational capacity scale was shown to be the most consistent explanatory factor in the multivariant analyses. This finding reinforces the argument that policy analytical capacity operates at both the individual and organizational scales and that measuring both are critical for understanding policy processes. This finding also reinforces the need for organizational level measures in policy process research wherein most studies deal with individual attributes or, if aggregate, coalition or subsystem level attributes (Sabatier, 2007; Howlett et al., 2010). Integrating individual and organizational attributes as done in this study suggests that descriptive and explanatory leverage might be found in measuring both.

The findings provide nuances into the functional niches of policy actors based on their organizational affiliation. Researchers were found to have the highest level of policy analytical capacity for most measures but engaged in the subsystem affairs mostly as conductors of research. While not unexpected as a single result, it is unexpected in comparison to how researchers were comparatively less engaged in other activities, even those related to research and information. That is, researchers were least likely to report appraising policy options and just as likely to evaluate policy processes, results, and outcomes as other policy actors. Political and administrative activities were reported by researchers at a lower frequency, including building coalitions and implementing policies. In some ways, these depictions fit the "civics textbook" model of researchers and scientists: a view that describes this expert category to be the neutral providers of information separate from political and administrative affairs (Sabatier and Zafonte, 2001). Such a caricature would be inaccurately applied, however, for researchers were involved in policy activities that are more political in nature such as coalition building (74% of them) and policy activities that are more administrative in nature such as implementing and delivering policies (45% of them). Their frequency of involvement was simply lower than the other actor categories. Probably the best interpretation of these findings would mirror Svara's (1999; 2006) argument concerning overlapping spheres of responsibilities between staff and elected officials in relation to the administrative and political dichotomy. That is, researchers have institutional and professional incentives to conduct research, their primary role. However, they also engaged in other activities that fall outside of their core area of activity.

Similarly, policy actors from government, business / private sector, and non-profits were involved in conducting research but at a much lower frequency than researchers. These other policy actor categories, however, engaged in other activities also at a high frequency. A very high percent of non-profit and government actors were involved in coalition building and informing elected and appointed officials.

These findings are based on original data collected from the opinions of people involved in Colorado climate and energy issues. Climate and energy issues are complex issues that possibly select people with higher individual level policy analytical capacity than other less technical subsystems. While the findings show that researchers may have had higher policy analytical capacity than other policy actors, the findings also show that these other policy actors were just as skilled in modeling, trend analysis and forecasting, and policy analysis/evaluation. The results most likely match other climate and energy policy subsystems with a large enough population to support people with formal training and education and possibly other subsystems as technical as this one.

Yet any attempt to generalize these findings should be tempered by the measurements, data collection, and method of analysis. For example, policy analytical capacity relates to how individuals process and utilize information. We measured this by their formal training, level of education, and courses taken in the natural and social sciences. We did not measure disciplines directly because disciplines might not actually reflect formal training at the undergraduate and graduate levels. The measures used in this study of discipline are crude by grouping economics, for example, with political science. Clearly these disciplines are different but, more importantly, we aimed to capture individuals who have training that have crossed major disciplinary boundaries for economics and political science are more closely related than climate and energy modeling or engineering. Furthermore, one of the next steps should be to capture more nuanced organizational affiliations; e.g., partition the researcher category into academics, consultants, and government researchers. Or, partition government into federal, state, and local and non-profits into categories of environmental activists or others.

Caveats aside, this paper is one of the few that investigates the activities of policy actors in the context of climate and energy issues and in the policy process using systematic measures of data collection and analysis. The findings are important. Too often, the discussion of policy actors overlooks the different – yet overlapping – functional roles played within the policy subsystem. This paper finds that both organizational level and individual level policy analytical capacity shapes policy activities and that researchers are the most distinct of policy actor categories.

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Endnotes

1 Given the significant differences in the number of social and physical science courses across the 4 sectors (Table 1), we created an interdisciplinary variable to capture the individuals who had taken more than five classes in both the social and physical sciences. This variable was not statistically significant among any of the policy activities.

2 To assess any impacts from multicolinearity, we removed the Formal Training and Adv Degree to assess changes in the coefficients for the two course variables. The impacts were modest with significant coefficients for both course variables on the Implemented and Delivered Policies variable and greater than five social science courses was significantly ($p<0.05$) associated with coalition building, supporting the pattern in Table 5 that this variable shows association with policy analysis and various kinds of outreach. We also removed the two course variables and kept the Formal Training and Adv Degree variables in the models; the results attributed little explanatory power to the two variables (only a significant and positive association between Formal Training and Conducted Research)

Table 1. Descriptions of Policy Actor Categories

	Research / Academic	Government	Business / Private Sector	Non-Profit	Total
Number of Respondents	38	84	87	55	272
Percent Female*	55%	51%	65%	40%	54%
How Many years involved*					
Less than 1 year	3%	5%	4%	2%	4%
1-5 years	49%	48%	36%	36%	42%
6-9 years	19%	19%	19%	16%	19%
10-14 years	8%	15%	16%	13%	14%
15-20 years	3%	5%	8%	15%	8%
Greater than 20 years	19%	8%	17%	18%	15%
Formal Education***					
High School / Some College	0%	5%	1%	2%	2%
Bachelor's Degree	11%	27%	21%	36%	25%
Master's/ Professional Degree	38%	51%	40%	44%	44%
PhD, MD, JD	51%	17%	38%	18%	29%
Social Science Courses*					
None	5%	8%	4%	7%	6%
Less than 5	42%	33%	20%	31%	30%
Between 5 and 10	13%	27%	34%	26%	27%
Greater than 10	40%	33%	43%	36%	38%
Physical Science Courses*					
None	16%	33%	28%	36%	29%
Less than 5	32%	28%	33%	34%	32%
Between 5 and 10	8%	13%	14%	17%	14%
Greater than 10	43%	26%	26%	13%	25%
Formal Training					
Statistical Methods*	63%	51%	43%	36%	47%
Policy Analysis	42%	45%	49%	46%	45%
Policy Evaluation	37%	45%	49%	35%	43%
Applied Research***	66%	36%	30%	20%	35%
Trend Analysis, Forecasting	29%	27%	31%	15%	26%
Modeling	29%	25%	29%	16%	25%
Sum of Formal Training*	2.7	2.3	2.3	2.2	2.0

Note: Independent-Samples Kruskal-Wallis Test with significance levels at *p<0.10, **p<0.01, ***p<0.001.

Table 2. Climate-Related Beliefs of Policy Actor Categories

	Factor Loadings	Mean Climate-Related Beliefs				
		Research / Academic	Government	Business / Private Sector	Non-Profit	Total
Government policies to promote renewable energy generation are required to combat climate change.***	.795	-1.4	-1.4	-0.9	-1.4	-1.2
Decisions about energy and its effect on climate are best left to the economic market, and not to government. (reversed)*	.687	1.3	1.3	0.9	1.2	1.1
The severity of predicted impacts on society from climate change are vastly overstated. (reversed)	.876	1.3	1.2	0.7	1.4	1.1
Human behavior is the principal cause of climate change.**	.817	-1.1	-1.1	-0.7	-1.3	-1.0
An energy and/or carbon tax is required to combat climate change.	.800	-0.7	-0.6	-0.3	-0.7	-0.6
A cap and trade system of permits for the emission of greenhouse gases is required to combat climate change.	.698	-0.2	-0.2	-0.3	0.0	-0.05
	Cronbach's Alpha					
Pro-Climate Change Beliefs*	0.87	-1.0	-1.0	-0.6	-1.0	-0.8
Extreme Pro-Climate Scale (absolute value)		1.1	1.2	1.1	1.3	1.2

Note: Independent-Samples Kruskal-Wallis Test with significance levels at *p<0.10, **p<0.01, ***p<0.001. Scale: -2 = Strongly Agree, 0 = Neither Agree or Disagree, and 2 = Strongly Disagree.

Table 3. Organizational Capacity

	Factor Loadings	**Mean Climate-Related Beliefs**				
		Research / Academic	Government	Business / Private Sector	Non-Profit	Total
Does your organization's work help to improve knowledge, skills, and networks needed to respond to climate-related issues and energy policies at the city and/or state level?	0.776	4.2	4.0	4.0	4.3	4.1
Compared to similar organizations, does your organization have adequate knowledge, skills, and people to respond to climate-related issues and energy policies?**	0.816	4.1	3.3	3.9	3.7	3.7
Compared with other issues that your organization responds to, how much of a priority are climate-related issues and energy policies?**	0.842	3.9	3.3	3.8	4.0	3.7
	Cronbach's Alpha					
Organization Capacity Scale **	0.741	4.1	3.5	3.9	4.0	3.8

Note: Independent-Samples Kruskal-Wallis Test with significance levels at *p<0.10, **p<0.01, ***p<0.001. Question 1 scale: 1 = "definitely not", 2 = "Probably not", 3 = "Somewhat", 4 = "Probably yes", 5 = "Definitely yes"; Question 2 scale: 1 = "Very low capacity", 2 = "Low capacity", 3 = "Medium capacity", 4 = "High capacity", 5 = "Very high capacity"; Question 3 scale: 1 = "Much lower", 2 = "Lower", 3 = About the same", 4 = "Higher", 5 = "Much Higher".

Table 4. Policy Activities

In the past year, have you participated in the following activities:	Research / Academic	Government	Business / Private Sector	Non-Profit	Total
Conducted Research on Climate-Related Issues and/or Energy Policy**	90%	51%	61%	66%	63%
Appraised Policy Options	50%	64%	56%	67%	60%
Evaluated Policy Processes, Results, and Outcomes	61%	71%	62%	64%	65%
Consulted with the Public	63%	70%	59%	75%	67%
Negotiated in a Multi-Stakeholder Consensus-Based process*	37%	52%	60%	62%	54%
Participated in Coalition Building (e.g., networking, information sharing)*	74%	82%	82%	95%	83%
Informed Elected and Appointed Officials**	58%	80%	66%	82%	72%
Implemented or Delivered Policies or Programs on Climate-Related Issues and/or Energy Issues***	45%	73%	44%	60%	56%
Sum Policy Activities (median)*	5	6	5	6	5.5

Note: Independent-Samples Kruskal-Wallis Test with significance levels at *p<0.10, **p<0.01, ***p<0.001.

Table 5. Explaining Policy Activities

	Conducted Research	Appraised Policy Options	Evaluated Policy	Consulted with the Public	Negotiated with Stakeholders	Participated in Coalition Building	Informed Officials	Implemented and Delivered Policies	Sum Policy Activities
Individual Capacity									
> 5 Soc Sci Courses	0.32	1.09**	1.08***	0.83*	0.69*	0.54	0.61	0.59	1.07***
> 5 Phys Sci Courses	1.18**	0.15	0.01	-0.17	0.14	0.14	.23	0.64	0.41
Adv Degree	0.02	0.02	0.23	-0.26	0.16	0.54	0.15	0.44	0.14
Formal Training	0.14	0.10	0.06	0.04	0.07	0.11	0.03	0.04	0.16
Org Capacity									
Org Capacity Scale	.48**	0.72***	0.65***	0.65***	0.49**	0.62**	0.90***	0.44*	0.86***
Controls									
Years Involved	-0.10	0.19	0.16	0.05	-0.05	-0.13	0.37**	0.06	0.09
Female	-0.46	-0.20	0.33	-0.07	0.24	0.91*	-0.53	0.42	0.01
Ext Climate Beliefs	0.02	0.25	-0.01	0.20	0.16	0.58**	0.08	0.33*	0.24
Government	-1.79**	1.46**	1.50**	1.02*	0.98*	1.65**	2.04***	1.89***	1.44***
Non-Profit	-1.15	0.93	0.50	0.71	1.20*	2.84***	1.33*	1.03*	1.18***
Bus / Private Sector	-1.49*	0.39	0.28	0.03	0.90*	1.08*	0.39	0.09	0.36
Constant	-0.31	-5.52***	-4.108*	-3.55**	-3.9***	-5.18***	-5.09***	-4.91***	
Pseudo R^2	0.15	0.16	0.14	0.10	0.08	0.18	0.22	0.14	0.09

***p<0.001, **p<0.01, *p<0.05. Robust standard errors. Coefficients are unstandardized coefficients from binary logit models except for Sum Policy Activities where unstandardized coefficients are calculated from an ordinal logit model.