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Expert-Based Information and Policy Subsystems: A Review and Synthesis

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This article reviews and synthesizes the uses of expert-based information in policy subsystems. The review begins by summarizing the different uses of information in the multiple streams theory, the punctuated equilibrium theory, the social construction theory, and the advocacy coalition framework. Three uses of expert-based information are identified as instrumental, learning, and political. The three uses of expert-based information are then compared across unitary, collaborative, and adversarial policy subsystems. This article synthesizes the findings in a set of propositions about the use of expert-based information in policy subsystems and about the factors that contribute to shifts from one policy subsystem to another.

KEY WORDS: science, collaborative management, the advocacy coalition framework, policy processes, policymaking, policy process theories

Introduction

The policy process is often conceptualized as a complex system of inputs and outputs (Easton, 1965). Among all the inputs and outputs, one of the most important is information. A deep literature exists about the role of information in various policymaking contexts (Adams, 2004; DeWitt, 1994; Fischer, 2000; Ingram, Schneider, & McDonald, 2004; Jenkins-Smith, 1990; Kingdon, 1995; Knorr, 1977; Lee, 1993; Ozawa, 1991; Pelz, 1978; Rich, 1991; Sabatier, 1987; Weiss, 1979; van Kerkhoff & Lebel, 2006). This literature shows that the use of information in policymaking ranges from the instrumental, where information directly impacts policy, to the political, where information is used to argue against an opponent (Knorr, 1977; Pelz, 1978; Rich, 1975). Over long periods of time, information can also foster learning, belief change, and policy change (Sabatier, 1987; Weiss, 1977). This article reviews the science and policy literature to generate propositions about (i) the different uses of expert-based information across three types of policy subsystems; and (ii) the expected role of expert-based information in contributing to shifts between policy subsystems.

Expert-based information is defined as content generated by professional, scientific, and technical methods of inquiry (Adams, 2004; van Kerkhoff & Lebel, 2006). It is often, but not always, based on accepted analytical approaches as defined by

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professional peers. The sources of expert-based information include the social and natural sciences, policy analyses, government reports, and research coming from universities, think tanks, and consulting firms. Likewise, the term "expert" includes policy analysts, scientists, and researchers in government and nongovernment organizations. Expert-based information is not restricted to the sciences, but it also includes information coming from engineering and the humanities. For simplicity, science and expert-based information will be used interchangeably.

Expert-based information is distinguished from local (or community) information, which is based on trial-and-error learning about a topic in relation to a specific place (Adams, 2004; Huntington et al., 2002; van Kerkhoff & Lebel, 2006). Distinguishing expert-based information from local information is important because the former takes on a greater force as a legitimizing agent in the policy process. The legitimizing force of expert-based information derives from popular perceptions that science is neutral and dispassionate (Ozawa, 1991). Making a distinction between expert-based information and local information is also useful because it often parallels divisions between public and private interests (Adams, 2004) and between cultures (Huntington et al., 2002).

Groups of experts in any policy process are not homogenous. Compared to scientists from academia, government scientists face different financial and professional incentives in conducting research, writing reports, making public statements, and relating to other actors. To complicate matters, many academics have "inner-outer" careers that teeter between academia and government (Kingdon, 1995, p. 56). Similar arguments can be made about scientists from think tanks, nonprofit and private organizations, and consulting firms. In addition, research has shown that the type of information (from a benefit–cost analysis to a financial model) affects its utilization (Rich, 1991). In this article, I temporarily put aside issues related to the role played by different types of expert-based information and of the experts' organizational affiliations.[1]

Every review bounds its phenomena. This article relies heavily on the theories of the policy process (Sabatier, 2007) to derive insights and propositions about the roles of expert-based information in policy. The referenced policy process theories include the multiple streams theory (Kingdon, 1995), the punctuated equilibrium theory (Baumgartner & Jones, 1993), the social construction theory (Ingram, Schneider, & deLeon, 2007; Schneider & Ingram, 1997), and the advocacy coalition framework (Sabatier & Jenkins-Smith, 1993). Among policy process theories, the advocacy coalition framework is used most because it already states hypotheses about the use of science in policymaking (Sabatier, 1987, 2005; Sabatier & Zafonte, 2001). Beyond the literature on policy process theories, this review draws heavily on the research utilization literature including Amara, Ouimet, and Landry (2004), Caplan, Morrison, and Stanbaugh (1975), Rich (1975, 1991), and Weiss (1977).

This article proceeds inductively in five parts. The first part summarizes the ways in which expert-based information is integrated in the different theories of the policy process. The second describes how the uses of expert-based information in policymaking can be simplified into learning, political, and instrumental uses. The third identifies unitary, adversarial, and collaborative policy subsystem types, and the

fourth describes the role of expert-based information in each. Building on the first four sections, the final part provides two sets of original propositions about (i) the use of expert-based information in policy subsystems; and (ii) shifts between subsystem types.

Part 1. The Use of Expert-Based Information in Four Policy Process Theories

There are many descriptions of expert-based information usage in the policy process. Dunn (1994), for example, takes the policy cycle and describes how science is used in each stage. He shows that science can be used to (i) identify problems in agenda setting; (ii) forecast impacts in policy formulation; (iii) compare alternatives in policy adoption; and (iv) monitor impacts in implementation and evaluation (Dunn, 1994, p. 17). Descriptions of expert-based information in the policy cycle tend to emphasize the instrumental use where science directly impacts policy without much reference to politics or learning. An instrumental interpretation of expert-based information in the policy process is not surprising considering the rational, apolitical, and sequential assumptions of the policy cycle. Fortunately, several theories have improved our depiction of the policy process beyond the faculties of the policy cycle (Sabatier, 2007). A summary of four of these theoretical frameworks provides a more complete depiction of expert-based information in policymaking.[2]

The Multiple Streams Theory[3]

The multiple streams theory describes how agenda setting and policy change result from policy entrepreneurs attempting to open windows of opportunity by merging previously independent problem, policy, and political streams (Kingdon, 1995; Zahariadis, 2007). The multiple streams theory places expert-based information in two of its streams. In the problem stream, actors use science to indicate the seriousness and causes of a problem and to help evaluate the effectiveness of current policies and programs. In the policy stream, science offers ideas, helps legitimize ideas, and provides a means for entrepreneurs to advocate for the technical feasibility of an idea. A principal strategy for policy entrepreneurs is to seek the right opportunity to utilize expert-based information to place an issue on an agenda, match an idea to a problem, and advocate for policy change. The implication from the multiple streams theory is threefold: (i) policy participants use science to identify problems and evaluate ideas as solutions; (ii) the effect of expert-based information is contingent on the presence of a skillful entrepreneur; and (iii) entrepreneurs use expert-based information to shape agendas and policies for political gain.

The Punctuated Equilibrium Theory

The punctuated equilibrium theory argues that policy change is not only mostly incremental but also marked by sporadic punctuations (Baumgartner & Jones, 1993;

Jones & Baumgartner, 2005). The causal driver in the punctuated equilibrium theory is the pace with which actors process information, shift their attention, and change the policy image. Policy images reflect both emotive and empirical social constructions of an issue (Baumgartner & Jones, pp. 25–7). Incremental policy change arises because actors resist changing their behavior or beliefs from challenging information, thereby maintaining a stable policy image. In contrast, punctuated policy change occurs when actors overcompensate for previous neglect of information and radically readjust a policy image. Policy images also play an important role in policy processes by affecting the scope of conflict and the mobilization of allies and opponents. Actors wanting to maintain the status quo will use science to fortify the legitimacy of current processes, limit any negative attention, and dampen the mobilization of potential opponents. Actors wanting punctuations will use science to challenge the legitimacy of current processes, publicize negative aspects of the policy issue, and mobilize allies for change (see Pralle, 2006). The seminal example is the nuclear power industry in the twentieth century (Baumgartner & Jones, pp. 59–82; Duffy, 1997). It was scientists who helped create the positive image of the industry immediately after World War II and fostered incremental policy change for nearly 20 years. It was also scientists who leaked safety concerns in the 1960s that eventually modified the policy image and led to major changes in the industry in the 1970s. The implication from the punctuated equilibrium is fourfold: (i) the causal driver within the punctuated equilibrium theory is the pace with which actors process expert-based information; (ii) disproportionate information processes result in creating, maintaining, or destroying a policy image; (iii) expert-based information affects the expansion of conflict expansion and mobilization of political interests; and (iv) expert-based information can be a contributing factor to both incremental and major policy change.

Social Construction Theory

The social construction theory, as presented by Ingram et al. (2007) and Schneider and Ingram (1997), focuses on the interdependence of power and social constructions of target populations to shape policy designs and to enhance or degrade democratic processes. The social construction theory depicts the perceived content and quality of expert-based information as socially constructed phenomena. The use of expert-based information is contingent on the composition of the scientific community, prevailing social constructions, and the distribution of power (Schneider & Ingram, pp. 150–88). Critical factors for understanding science in the social construction theory include the extent that (i) the scientific community is divided or united; (ii) the policy community is divided or unified; and (iii) the scientific and technical information presents risks or opportunities to powerful groups (Ingram et al., p. 109; Schneider & Ingram, pp. 150–88). The implication from the social construction theory is that expert-based information depends heavily on political context, and it can be used to reinforce or challenge prevailing social constructions of target populations and policy designs.

The Advocacy Coalition Framework

The advocacy coalition framework views policy as translations of beliefs from competing coalitions (Sabatier & Jenkins-Smith, 1993). Expert-based information affects policy indirectly by slowly altering the beliefs of policy actors in a process called "policy-oriented learning" (Sabatier, 1987; Sabatier & Zafonte, 2001; Weiss, 1977). During intense conflicts, the advocacy coalition framework predicts that (i) expert-based information becomes a valuable coalition resource to mobilize allies and to argue with opponents; and (ii) policy-oriented learning occurs within one coalition rather than between coalitions (Sabatier, 1987). Learning across coalitions will more likely occur when conflict is at intermediate levels, when there is a professional forum, when both coalitions have access to technical resources to engage in debate, and when discussions focus in part on secondary aspects of their belief systems (Sabatier, 2005; Sabatier & Weible, 2007, p. 220). Within the advocacy coalition framework, science indirectly influences policy through learning and belief change, and it is also dependent on both the level of conflict among coalitions and the availability of institutional forums enabling discourse among coalitions.

These four theories provide different insight into the use of expert-based information in policymaking, especially compared to the policy cycle. Expert-based information serves political uses from reinforcing social constructions of target populations to fortifying arguments of advocacy coalitions. Science often shapes policy indirectly by modifying policy images and by changing beliefs through learning. The multiple streams theory, the advocacy coalition framework, and the social construction theory emphasize that the role of science is dependent on the policymaking context.

Part 2. Three Uses of Expert-Based Information

One way to draw lessons from the policy process theories about expert-based information would be to make a list of all the ways that science is acquired, learned, and applied in policymaking. Such a list would showcase the nexus between science and policy but would not necessarily facilitate communication among scholars or guide research in the area. What is needed is a depiction of expert-based information in policy that simplifies the complexity. This section describes three uses of science in the policy process, drawing from the research utilization literature (Caplan et al., 1975; Dunn, 1994; Knorr, 1977; Pelz, 1978; Weiss, 1979).

Learning

The learning use of expert-based information focuses on the cognitive processes of policy participants. The learning use is derived from Weiss (1977) who argued that the accumulation of science slowly and indirectly affects policy by altering decision makers' beliefs about the causes of problems and preferred solutions. The argument is that a single research study or report rarely has a significant impact on the beliefs of political actors or on any single policy decision; research instead affects policy

indirectly by accumulating, like sedimentation, and gradually altering the belief systems of the actors involved in a policy process. The learning use is the basis for policy-oriented learning and one path for belief and policy change in the advocacy coalition framework (Sabatier, 1987), and it also parallels the long-term effects of science on government in the multiple streams theory (Kingdon, 1995). In the punctuated equilibrium theory, the learning use is found in its theory of information processing, where expert-based information shapes learning disproportionately through a slow reluctance to accept contradictory information and with dramatic shifts in attempts to overcompensate for past decisions. From a punctuated equilibrium perspective, the learning use contributes to the accumulation of information and the radical shifts in attention and punctuations in policy.

Political

When decision makers rely on expert-based information to legitimize previously made policy decisions, information is being politicized (Fischer, 2000; Jasonoff, 1990; Jenkins-Smith, 1990; Ozawa, 1991; Schneider & Ingram, 1997). The political use may include the distortion and/or the selective use of information. In the policy process theories, examples of the political use include various strategies: (i) creating, maintaining, and destroying policy images in the punctuated equilibrium theory and social constructions in the social construction theory; (ii) convincing coalition allies to mobilize around a given issue or to counter arguments by opponents in the advocacy coalition framework; and (iii) attempting to tie policy ideas to problems by policy entrepreneurs in the multiple streams theory.

Instrumental

The instrumental use occurs when expert-based information directly affects policymaking. The instrumental use is based on the rational, ideal approach to problem solving where a problem exists, research is conducted, and the decision follows the research findings (Amara et al., 2004; Caplan et al., 1975; Weiss, 1979). Science used in this way might include direct impacts from science on forecasting impacts, highlighting trade-offs, and evaluating impacts of current policies and programs. In contrast to the political use, the instrumental use of expert-based information often requires a willingness to entertain outcomes that conflict with beliefs. Furthermore, the instrumental use is more observable and possibly more attributable to one or more information sources, in contrast to learning. Depending on the decision-making context, the instrumental use of expert-based information can be found in the policy process theories. For example, the advocacy coalition framework would predict that the instrumental use of science will more likely occur in professional forums where coalitions work cooperatively often with scientists. The social construction theory would predict that the instrumental use of science will more likely occur when there is consensus among scientists and policy participants. The instrumental use of expert-based information is not inconsistent with, but is harder to find in, the punctuated equilibrium theory and multiple streams theory. One could

speculate from a multiple streams perspective, for instance, that policy participants are more likely to use expert-based information instrumentally when the problem and policy streams are flowing independently from the political stream and less when entrepreneurs attempt to merge streams.

Part 3. The Three Policy Subsystem Types

If the political context is not considered, the three uses of expert-based information can oversimplify and misrepresent the nexus between science and policy. The question is not whether a use exists or does not exist—all three uses occur in a policy process at any moment in time. Instead, the question is under what contexts will one usage reinforce or dominate the others (Amara et al., 2004). The next challenge is to develop an understanding of different types of political contexts to subsequently draw lessons about the role of expert-based information in each.

The first step in understanding policy processes is to decide on a level of analysis. This article focuses on policy subsystems, as depicted explicitly in the punctuated equilibrium theory and the advocacy coalition framework (Baumgartner & Jones, 1993; Sabatier & Jenkins-Smith, 1993). Definitions of policy subsystems vary across the literature with a number of variants including whirlpools, subgovernments, iron triangles, and issue networks (see McCool, 1995, pp. 251–411). Borrowing from the advocacy coalition framework, policy subsystems are semiautonomous decision-making networks of policy participants that focus on a particular policy issue usually within a geographic boundary (Sabatier, 1987).

Taking a policy subsystem approach to understand political context is not enough to understand the use of expert-based information in policymaking. Depending on a person's perspective, the context of a policy subsystem might include cultural factors, institutions and rules, socioeconomic or environmental conditions, relations among actors, social constructions, power, and authority.[4] To simplify, three ideal types of policy subsystems are defined and presented in Table 1. The first, a unitary policy subsystem, includes a single, dominant coalition that is similar to an iron triangle (Freeman, 1955) or a policy monopoly (Baumgartner & Jones, 1993). The second type, a collaborative policy subsystem, involves cooperative coalitions where conflict is at intermediate levels. The third is an adversarial policy subsystem, characterized by high conflict among competitive coalitions. Table 1 identifies five attributes of each policy subsystem type and the following paragraphs define each of these attributes.

1. *Coalitions* are defined mostly in accordance with the advocacy coalition framework. The advocacy coalition framework defines coalitions by compatible policy core beliefs and by similar coordination patterns (Sabatier & Jenkins-Smith, 1993). The advocacy coalition framework would predict high intra-coalition belief compatibility across all policy subsystem types. At the subsystem level, belief compatibility among actors refers to the degree of convergence or divergence in belief systems among all subsystem actors, including those from different coalitions (Jenkins-Smith, 1990, p. 95). The three subsystem types in

Table 1. A Summary of Three Ideal Types of Policy Subsystems

	Unitary Subsystems	Collaborative Subsystems	Adversarial Subsystems
1. Coalitions	Single coalition with high intra-coalition belief compatibility and high intra-coalition coordination	Cooperative coalitions with intermediate inter-coalition belief compatibility and high inter and intra-coalition coordination	Competitive coalitions with low inter-coalition belief compatibility and high intra-coalition and low inter-coalition coordination
2. Policy images	Single	Reconciled	Debated
3. Degree of centralization and interdependence	Authority is centralized and interdependence with other subsystems is ignored	Authority is decentralized, fragmented across policy subsystems, or both. Coalitions share access to authority.	Authority is centralized but fragmented within the policy subsystem, fragmented across policy subsystems, or both. Coalitions compete for access to authority
4. Venues	Coalition influences decisions in one or two amiable venues (legislature, agencies)	Coalitions use a variety of venues, including ones based on consensus-based institutions	Coalitions seek to influence decisions in any amiable venue (courts, legislatures, agencies)
5. Policy designs	Policies distribute benefits to single coalition	Policies are voluntary, win–win, and flexible in means	Policies are coercive, win–lose, and prescriptive in means

Table 1 vary from high compatibility in beliefs for unitary subsystems where opponents are largely nonexistent, to low compatibility in beliefs for adversarial subsystems where coalitions are very competitive, and to intermediate levels of compatibility where coalitions continue to disagree but agree enough to cooperate in collaborative subsystems.

Coalitions are also defined by their coordination patterns among allies and opponents. Coordination includes a range of activities from developing and executing joint plans to modifying behavior to achieve similar or noninterfering objectives (Sabatier & Jenkins-Smith, 1999, pp. 138–41). Whereas earlier versions of the advocacy coalition framework assumed that all coalition members interact, this assumption has been shown to be unrealistic (Nahrath, 1999; Schlager, 1995). It is more plausible and still consistent with the framework to assume that coordination among members will vary based on the centrality of a given issue to the members' beliefs and to the members' resources. Coalition members could then be classified as either auxiliary or principal members (Hula, 1999; Silva, 2007; Zafonte & Sabatier, 2004). Principal members are central to the coalition and coordinate the majority of coalition activities. The expectation is that principal coalition members are directly connected to nearly all coalition members or separated from other coalition members by one or two other coalition members. These principal members serve as entrepreneurs for a coalition in providing leadership and in bearing the transaction costs in coordinating activities. In

contrast, auxiliary members are peripheral to a coalition's network and coordinate with only a few other coalition members. This modified definition of coordination patterns within coalitions continues to assume that policy core beliefs are the glue that binds coalitions together but now assumes that some members will anchor the coalition as central participants whereas others will serve as auxiliary members on the periphery.

The three subsystems vary by the degree that coordination patterns are primarily within coalitions or between coalitions. In unitary and adversarial subsystems, coordination patterns will primarily occur within a coalition among allies. In collaborative subsystems, coordination patterns will include more cross-coalition interactions or a broker that connects opposing coalitions.[5]

2. *Policy images* are projected social constructions or public translations of a coalition's beliefs that frame events and serve as sound bites, campaign slogans, and causal stories (Baumgartner & Jones, 1993; Schneider & Ingram, 1997; Stone, 1997). To achieve their belief-driven objectives, coalitions project and defend policy images to contest an opponent or to attract positive or negative attention to the policy subsystem. Such a process is consistent with Jenkins-Smith's (1990) description of subsystem conflict as including the "struggle over the manipulation of the shape and content of the policy space" (p. 86). The principal audiences of a coalition's policy image include actors in other subsystems, the general public, and macropolitical actors. Following the logic of the punctuated equilibrium theory (Baumgartner & Jones, 1993; Pralle, 2006), a stable policy image serves to insulate policy subsystems from external interference whereas an unstable policy image can attract the attention of macropolitical actors with the potential to alter the distribution of resources and authority in the subsystem. The three policy subsystems vary with unitary policy subsystems showing a single policy image, collaborative policy subsystems showing a reconciled policy image, and adversarial policy subsystems showing contested policy images.

3. *Degree of centralization and interdependence*. Policies are made by actors with authority to make decisions and in most industrialized, democratic systems, authority is fragmented. The fragmentation of authority in a policy subsystem is a function of two factors: The first is the degree of centralization or devolution and the second is the degree of interdependence from other policy subsystems. In federalist systems, for example, as decentralization and devolution increases, authority shifts from federal government agencies toward state and local government agencies and from the exclusion to the inclusion of interested and affected nongovernment actors in decision making. As centralization increases, authority shifts toward federal government agencies and possibly state agencies. The implication is that some coalitions gain and others lose, as authority shifts between centralized and decentralized locales. The extent that centralization helps a coalition is contingent on the extent that the authority rests with government agencies sympathetic to the coalition's objectives or is divided with other government agencies counter to a coalition's objectives.

The authority in a policy subsystem is also affected by the degree of interdependence with other policy subsystems (Scholz & Stiftel, 2005). Policy subsystems are semiautonomous and always overlap so events in one policy subsystem will, to various degrees, affect other policy subsystems (Fenger & Klok, 2001; Zafonte & Sabatier, 1998). Given overlap with multiple policy subsystems, coalition members tend to pay attention to other policy subsystems when they can secure political gains or prevent political losses. Thus, the interdependence of policy subsystems should not be viewed as a politically neutral phenomenon but instead as a situation where coalitions can gain leverage over another coalition or where conflict emerges between coalitions from different policy subsystems.

A winning policy subsystem configuration from a coalition's perspective can be found in a unitary policy subsystem where authority is centrally located within one or just a few government agencies sympathetic to a coalition's objectives and where other policy subsystems are ignored. A more confrontational situation can be found in adversarial policy subsystems where authority is centrally located but also fragmented across multiple government agencies aligned with competing coalitions, where conflict between coalitions arises from the intersection with other policy subsystems, or both. In collaborative policy subsystems, authority tends to be more decentralized and devolved and the intersection with other policy subsystems can be a point of tension, but such tensions are also mitigated. In contrast to adversarial policy subsystems, coalitions in collaborative policy subsystems are more likely to use consensus-based institutions to help share access to authority and overcome the fragmentation within and between subsystems.

4. *Venues* are decision-making arenas where coalitions attempt to influence decisions made by each other and, particularly, by government agency officials (Baumgartner & Jones, 1993; Pralle, 2006; Sabatier & Jenkins-Smith, 1993). Traditional venues include legislative committees and subcommittees, courts, executives, and administrative agencies. These traditional venues dominate adversarial and unitary subsystems and are limited in resolving conflicts because (i) legislatures tend to sidestep conflicts by writing vague policies; (ii) administrative agencies respond to vague legislation by making coercive top-down decisions; and (iii) courts resolve procedural issues, not substantive disputes (Emerson, Nabatchi, O'Leary, & Stephens, 2003, pp. 5–9). These traditional venues also limit participation among interested and affected actors and limit discourse by relying mostly on hearings and testimonies. In contrast, collaborative subsystems not only include these traditional venues but also venues featuring a configuration of consensus-based institutions. These consensus-based institutions usually involve deliberative norms of engagement, inclusive participation, transparent decision rules, and face-to-face negotiation. The argument is not that coalitions solely engage in consensus-based institutions. Sometimes, for example, two cooperative coalitions will work together to pressure officials in a legislative venue. The argument, instead, is that collaborative policy subsystems

will feature a consensus-based institutional venue that fosters communication and cooperation between coalitions.

5. *Policy designs* are the content of a policy that "cause agents or targets to do something they would not do otherwise or with the intention of modifying behavior to solve public problems or attain policy goals" (Schneider & Ingram, 1997, p. 93). Policy subsystems vary in the extent that designs are coercive or voluntary and flexible as well as in their distribution of costs and benefits (Wilson, 1995).

Summarizing the patterns from Table 1, a unitary policy subsystem is one dominated by a single coalition. This dominant coalition will be supported by a single policy image that reflects a high degree of belief compatibility among members and facilitates coordination among members. If opposition exists, they will be unorganized and lack sufficient resources to pose any threat to the coalition's position. Authority in a unitary policy subsystem will be centralized within a few agencies that serve as principal members of the dominant coalition. The preferred instruments will distribute benefits to coalition members and costs across society or will be flexible and voluntary in compliance. The dominant coalition will maintain the status quo by continuing to assert influence in just a few venues, by making incremental policy choices, and by dampening internal and external events that might attract the attention of the general public or macropolitical actors.

Collaborative policy subsystems include cooperative coalitions who continue to disagree but who are able to find enough common ground to negotiate and work together. Access to authority is shared among coalitions, and negotiations occur in venues featuring open participation rules, transparent decision making, and consensus-based decision rules (Sabatier et al., 2005). Opponents regularly engage each other face-to-face; and cooperation between opponents is often aided by effective brokers. The coalitions continue to coordinate with allies but cross-coalition coordination occurs. Cooperative coalitions prefer policy instruments that are flexible in means or voluntary in compliance.

Adversarial policy subsystems will include competitive advocacy coalitions with incompatible beliefs and different patterns of coordination. Authority will be fragmented between coalitions. Competitive coalitions will usually be anchored by government agencies or a powerful interest group and have access to sufficient resources to challenge each other in framing the policy image and in accessing venues. Inter-coalition conflicts are compounded because coalitions prefer coercive and prescriptive policies. A competitive coalition trying to change the status quo will try to expand the scope of conflict outside of the policy subsystem by attracting attention of supportive macropolitical actors or other subsystem actors (Pralle, 2006). A competitive coalition wanting to maintain the status quo will try to keep decisions within a subsystem and dampen conflict escalation (Pralle, 2006).

Part 4. Expert-Based Information and Policy Subsystems

This section describes four attributes of expert-based information across the three types of policy subsystems.

1. *Analytic compatibility*. Analytic compatibility is the extent that experts active in a policy subsystem share similar theories and methods in understanding and explaining phenomena in a policy subsystem. Jenkins-Smith (1990) described a similar category called "analytic tractability" in reference to problem attributes. This article shifts his definition from problem attributes to expert attributes. The rationale is that complexity or tractability of a phenomenon is based on the state of existing theory and methods and less on the problem itself (King, Keohane, & Verba, 1994, p. 10). Analytic compatibility assumes that experts with similar analytical approaches or with similar "scientific paradigms" will elevate similar components of a system to study, use similar methods for measuring the chosen components, and make similar arguments of cause and effect within a system (Kuhn, 1970; Sabatier & Zafonte, 2001).

   In studying experts in the policy process, analytic compatibility can be defined operationally by matching similar academic disciplines, subdisciplines, and other fields of study (Barke & Jenkins-Smith, 1993). The fundamental assumption underlying analytic compatibility is that disciplines represent a mobilization of bias in comprehending complex phenomena (Kuhn, 1970).[6] The explanatory power of disciplines as an operational measure of analytic compatibility should not be overemphasized. Individuals are too complex to assume that the behavior of experts can be boiled down to their disciplinary training. Instead, the argument is that public policy researchers will be able to explain a portion of the variance in expert behavior in a policy process by measuring their discipline and matching the analytical assumptions of a given discipline to the coalitions' beliefs. Outside of policy core beliefs, the expectation is that analytic compatibility will provide a secondary basis for bonding experts to coalitions. The idea is that a coalition will more likely listen to experts if the experts' analytical approach reinforces a coalition's belief system.

2. *Treatment of uncertainty and risk*. Probably the most important attribute in studying expert-based information in the policy process is the treatment of uncertainty and risk. Scientific and technical uncertainty in a policy subsystem includes three dimensions: (i) inability of actors to know the components that define and affect a subsystem, including problem seriousness, various causes, or plausible actions and consequences; (ii) inability to measure and understand components of a subsystem; and (iii) inability to know the links or probabilities between actions and consequences (Jones, 2001, p. 48; Rowe, 1977). Uncertainties translate into risk when the probabilities linking actions to consequences are known (Knight, 1921). Both uncertainties and risks are used in subsystem politics. Uncertainty, for example, provides actors with an opportunity to use their beliefs to interpret unknowns in a decision situation. By emphasizing unknowns, subsystem actors can raise anxiety and fear among the general public and macropolitical actors or counter an opponent with a rival causal story (Stone, 1997). Emphasizing uncertainty can increase perceptions of formidable transaction costs, thereby threatening collective action within and between coalitions. Risks are also useful in

politics but for different reasons. The political power of risks is the ability to link a cause with an effect—no matter how probable or improbable.

3. *Experts and coalitions*. Experts will become members of a coalition based on shared beliefs and because their information will likely buttress a coalition's arguments. Experts join coalitions, especially in unitary and adversarial subsystems, because their information will be largely ignored otherwise (Sabatier, 1987). Coalitions seek experts as allies because of the legitimacy of expert-based information in helping to make and implement decisions. Extant research has shown that scientists can be coalition members by matching the beliefs of scientists with the coalition's beliefs and by asking all subsystem actors to identify information sources, allies, and coordination partners (Weible & Sabatier, 2005).

4. *Policy-oriented learning*. Policy-oriented learning is defined as "relatively enduring alternations of thought or behavioral intentions that result from experience and/or new information and that are concerned with the attainment or revision of policy objectives" (Sabatier & Jenkins-Smith, 1999, p. 123). Policy-oriented learning is adaptive learning and involves interpreting mistakes, making strategic adjustments, and trying new strategies for goal attainment (Sabatier, 1987). Learning, however, is limited by the actors' cognitive abilities. Responding to complex external stimuli, actors must simplify based on previously learned strategies, by belief heuristics as filters, and by focusing their attention (Jones, 2001). Actors with similar simplification strategies will probably find it easier to learn among each other. Thus, policy-oriented learning is easier within a coalition where members share similar belief systems than between coalition where opponents likely disagree (Sabatier & Jenkins-Smith, 1999, pp. 145–7). Among experts, another factor affecting policy-oriented learning is analytic compatibility. The argument is that the higher the analytical compatibility of scientists, the more likely they will learn from each other. Whether it is learning between coalitions or between experts, policy-oriented learning is not a politically neutral process but instead contributes to a policy subsystem's social constructions (Schneider & Ingram, 1997), policy images (Baumgartner & Jones, 1993), and policy spaces (Jenkins-Smith, 1990).

   From Tables 1 and 2, the following arguments emerge about the use of expert-based information in the three subsystem types. In unitary subsystems, the analytical compatibility will be high because scientific and technical experts are aligned with the dominant coalition. In such a situation, experts will agree on which components of the subsystem to recognize, on methodological approaches, and on perceptions of uncertainties and risks. The political role of experts will be to report positive news to macropolitical actors and the general public. Scientists will be fairly central as a source of information but will be on the periphery as important allies and coordination partners. In unitary subsystems, learning will be constrained within the dominant coalition, largely reinforcing preexisting beliefs or the analytical approaches of active scientists.

   In collaborative subsystems, subsystem actors will seek to integrate local information and expert-based information in consensus-based institutional

Table 2. The Use of Expert-Based Information in Three Types of Policy Subsystem

	Unitary Subsystems	Collaborative Subsystems	Adversarial Subsystems
1. Analytic compatibility	Experts agree on theory, data, and methods	Experts reconcile differences in theory, data, and methods	Experts disagree on theory, data, and methods
2. Treatment of uncertainty and risk	Uncertainty used for political gains	Uncertainty acknowledged and decisions proceed adaptively	Uncertainty used for political gains
3. Experts and coalitions	Experts serve as auxiliary allies	Experts serve as auxiliary allies or opponents	Experts serve as principal allies or opponents
4. Policy-oriented learning	High intra-coalition learning and no inter-coalition learning	High intra-coalition learning and high inter-coalition learning	High intra-coalition learning and low inter-coalition learning

venues. Actors will recognize the limits of information and proceed adaptively through joint fact-finding strategies (Dewitt, 1994; Lee, 1993; Norton, 2005; National Research Council [NRC], 1996). Cooperation across coalitions will coincide with cooperation across different analytical methods of inquiry. The result will be interdisciplinary approaches to problem solving. Scientists will continue to be coalition members but their centrality, especially in ally and opponent networks, will decrease.[7] Policy-oriented learning occurs across coalitions and disciplines.

In adversarial subsystems, coalitions will diverge in their analytical approaches to problems solving and in their perceptions of uncertainties and risks. Coalitions will use uncertainty and risk to boost their preferred policy image or to challenge a policy image of a rival coalition. Because of the political value of expert-based information, experts will become central allies in their coalition. Consequently, experts will also become central opponents to a rival coalition. Learning will reinforce beliefs within coalitions and among experts with similar analytical approaches.[8]

Part 5: Stating Propositions

Given Tables 1 and 2, a number of propositions can be derived about the role of expert-based information in the policy process. Two sets of propositions are presented. The first set includes three propositions about the use of expert-based information in policy subsystems.

1. *The political use of expert-based information will be highest in adversarial subsystems.* The rationale for the first proposition derives from the high-value conflicts in adversarial subsystems, making expert-based information appealing as a political weapon to argue against opponents.

2. *The instrumental use of expert-based information will vary from the highest in collaborative, to an intermediate level in unitary, and to the lowest in adversarial policy subsystems.* Science will least likely be used instrumentally in adversarial policy subsystems because actors will primarily be set on defeating opponents and

reinforcing their policy positions and not on following the suggestions from expert-based information. The instrumental use will most likely be found in collaborative policy subsystems because of the potential for iterative, joint fact-finding to get the right science and to get the science right for decision-making actors (Ehrmann & Stinson, 1999; NRC, 1996). The instrumental use will be found in unitary, as long as the science reinforces the status quo of the subsystem, but will be ignored otherwise because of the homogeneity of beliefs among members of the dominant coalition.

3. *Learning will occur within coalitions or among experts with similar analytical approaches in all subsystems and will most likely occur across coalitions or across experts with dissimilar analytical approaches in collaborative subsystems.* In adversarial and unitary subsystems, learning will mostly reinforce existing beliefs or analytical methods. The intermediate level of conflict and presence of consensus-based venues in collaborative subsystems makes it the best type of policy subsystem for learning across coalitions or across different analytical approaches.[9]

The second set of propositions summarizes the rationales for shifts from one subsystem to another and the role of expert-based information in each.

1. *A shift from a collaborative subsystem to a unitary subsystem will occur under two conditions: (i) when there is a decrease over time in the diversity of participants relative to the diversity of the actors affected by subsystem decisions; and (ii) when there is a decrease over time in attention given to the subsystem by macropolitical actors and the general public.* The participation within a collaborative policy subsystem can be reduced by human time constraints, lack of media attention by the media, loss of subsystem salience, and the alienation of new actors by the emergent vocabularies and social constructions (Leach, 2004; Norton, 2005; Schneider & Ingram, 1997).

2. *A shift from a unitary subsystem to an adversarial subsystem will occur when there is an increase in participation by macropolitical actors and/or by new actors from the same or from a competitive policy subsystem.* This proposition is a simplified restatement of the collapse of a policy monopoly (Baumgartner & Jones, 1993; Redford, 1969; Schattschneider, 1960).

3. *A shift from a collaborative subsystem to an adversarial subsystem will occur when new actors begin to participate from a competing policy subsystem and/or after an internal or external event alters the balance of power between existing coalitions*. This proposition focuses on the increasing interdependence of competing policy subsystems (Redford, 1969) or from the reemergence of conflict from an event that radically shifts subsystem policies (Sabatier & Jenkins-Smith, 1993).

4. *A shift from an adversarial subsystem to a collaborative subsystem will occur after a hurting stalemate when the existing coalitions exhaust the available venues and view the status quo as unacceptable*. This proposition is a restatement from the advocacy coalition framework (Sabatier & Jenkins-Smith, 1999, p. 150).

Conclusions

This article seeks to understand the use of expert-based information in policy from the perspective of four major theories of the policy process, adding to the related literature (e.g., Ingram et al., 2004; Jenkins-Smith, 1990; Kingdon, 1995; Lee, 1993; Ozawa, 1991; Sabatier, 1987; Schneider & Ingram, 1997). Building on previous works, the emphasis here is on the comparison of different uses of expert-based information across three types of policy subsystems and by summarizing and deriving testable propositions.

The findings in Tables 1 and 2 rely mostly on the advocacy coalition framework, the punctuated equilibrium theory, and the social construction theory. These three analytical approaches are complementary because they share similar assumptions, share similar causal logic about the policy process, and can be easily applied to subsystem politics. The multiple streams theory was of less utility, probably because its logic applies more to macropolitics than subsystem politics. For instance, the multiple streams theory assumes fluid participation among participants, which better characterizes macropolitical behavior than subsystem behavior. However, the logic in the multiple streams theory about coupling ideas and problems is consistent with the relationships presented in Tables 1 and 2.

This review augments the advocacy coalition framework in at least four ways.

1. The advocacy coalition framework predicts that conflicts will generally occur between coalitions within policy subsystems. This article argues that conflicts can also occur between coalitions from different policy subsystems. While similar arguments are made by Fenger and Klok (2001) and Zafonte and Sabatier (1998), conflict between coalitions from different subsystems is better conceptualized through the expansion of conflict and venue shopping as found in the punctuated equilibrium theory.

2. The advocacy coalition framework defines coalitions as actors with similar policy core beliefs and coordination patterns. This article adds to this definition by formalizing two types of coalition members: principal and auxiliary (Hula, 1999; Silva, 2007; Zafonte & Sabatier, 2004).

3. Policy images (or social constructions) are among the most important concepts in the punctuated equilibrium and social construction theories. However, both of these theories have been unclear with respect to the source of policy images. In the advocacy coalition framework, policy images become public projections of belief systems.

4. The advocacy coalition framework connects scientists to coalitions based on similar beliefs. This article adds analytical compatibility as a secondary bond between scientists and coalitions.

In outlining the elements and relationships in Tables 1 and 2 and in deriving the propositions, an effort was made to meet the criteria for generating theories in King et al. (1994, pp. 99–114) and in Sabatier (1999, pp. 262–6). First, an attempt was made to

define clearly the concepts and to make them logically coherent. Second, relationships in Tables 1 and 2 have two causal drivers: either beliefs from the advocacy coalition framework or attention from the punctuated equilibrium theory. Third, the propositions are falsifiable. Fourth, the intended scope is one or more policy subsystems. Fifth, it offers nonobvious propositions. Sixth, it is based on a review of, and an attempt to improve, existing theories and frameworks.

To a great extent, this review and synthesis simplifies the use of expert-based information, the role experts, and policy subsystems. In the face of complexity, however, the best strategy is to proceed with explicit and clear simplifying strategies that can aid communication, guide behavior, and—most importantly—be tested and applied empirically. There is probably no better way of learning from mistakes and proceeding adaptively as researchers.

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Notes

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1. Researchers can look to the work by Barke and Jenkins-Smith (1993), who show that different organizational affiliations of scientists shape perceptions of risks.
2. Another major policy process theory is the institutional analysis and development framework (Ostrom, 1990, 2005). The IAD framework seeks to explain individual behavior and collective action within action arenas that are shaped by physical, community, and institutional factors (Ostrom, 1990). In the IAD framework, information is used by actors mostly to reduce transaction costs, identify important strategies, and facilitate collective action (Schlager, 2007, p. 301). While the IAD framework mostly expects direct, instrumental uses of information, it does not preclude the opportunistic use of information for personal gain (Schlager, 2007). The implication from the institutional analysis and development framework is twofold: (i) information is typically used instrumentally and affects the extent that actors can act collectively; and (ii) the opportunistic use of information is possible. The institutional analysis and development framework is not discussed in this review because it downplays science, learning, and the role of coalitions and because it is not a subsystem framework.
3. The multiple streams theory has been labeled a framework (Zahariadis, 2007). In this article, I follow Ostrom's (2007) definitions of frameworks, theories, and models, and adopt Schlager's (1995) classification that multiple streams is better categorized as a theory than a framework. I use similar arguments for labeling the social construction theory. For simplicity, I often refer to the frameworks and theories of the policy process as just "theories."
4. Other researchers have categorized different kinds of policy subsystems (see Howlett & Ramesh, 2003; McCool, 1995).
5. Two types of coalitions are presented: competitive and cooperative. Competitive coalitions exist in adversarial policy subsystems and are defined by high levels of distrust, polarized beliefs, and mostly internal coordination patterns. In contrast, cooperative coalitions exist in collaborative policy subsystems and have intermediate levels of trust and belief differences and more cross-coalition interactions.
6. Empirical support for the analytical bias of academic disciplines can be found in Barke and Jenkins-Smith (1993). Recognizing that disciplines create analytical bias is not an original argument (e.g., Snow, 1964). It is, however, a salient topic today. The movement across academia for interdisciplinary edu-

cation is an institutional response to the limits of uni-disciplinary education in solving complex problems. Similarly, a number of recent publications discuss biases in academic disciplines and the effects on public policy (e.g., Cohen, 2006; Norton, 2005). Cohen (2006), for example, offers a multi-disciplinary framework to help policy actors counter the "deep analytic bias" in their disciplinary approaches to understanding environmental policy (p. 12).

7. Weible (2007) found that the citations to university scientists and consultant decreased for ally and opponent networks in two collaborative compared to two adversarial policy subsystems.
8. In collaborative and adversarial policy subsystems, the coalitions might vary in the extent that they rely on science. Some adversarial and collaborative policy subsystems will involve coalitions with active scientists as members. Other collaborative and adversarial subsystems will involve a coalition with members from the scientific community and another without. When a coalition with experts faces a coalition without experts, issues of technocracy and democratic accountability of expert-based decisions will likely emerge (see Fischer, 2000; Lach, List, Steele, & Shindler, 2003; Schneider & Ingram, 1997).
9. This proposition builds heavily from the advocacy coalition framework (Sabatier & Jenkins-Smith, 1993). A glance at the relationships in Tables 1 and 2 suggests additional propositions and hypotheses. For example, Table 2 suggests the following: In collaborative compared to adversarial policy subsystems, the centrality of experts in coalitions will decrease. One of the advocacy coalition framework's hypotheses is in Table 2: "Policy-oriented learning across belief systems is more likely when there is an intermediate level of informed conflict between the two coalitions" (Sabatier & Jenkins-Smith, 1999, p. 124).

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