Policy Learning Mechanisms & the Regulation of US Drinking Water

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Abstract

Can regulatory agencies become learning organizations? The purpose of this article is to assert that they can when the right learning mechanisms are in place. This article utilizes the literatures on US regulatory politics, organizational learning, and policy learning to elaborate the concept of learning mechanisms and examine the circumstances under which they are most likely to be utilized within regulatory agencies. The second half of the article examines the utilization of learning mechanisms within US drinking water regulation during the years when the drinking water policy community was working to formulate and implement the Safe Drinking Water Act Amendments of 1996 (1996-2015). The article concludes by summarizing the findings and offering some propositions for future research.

Keywords: policy learning; learning mechanisms; regulation; drinking water

Can regulatory agencies be designed to function as "learning organizations?" That is, can agencies be consciously designed to effectively gather, interpret, and disseminate the knowledge required to produce better policy results? Neither scholars of regulatory policy nor scholars of policy learning theory have adequately addressed this question.

Scholars of regulatory policy, for their part, pay a lot of attention to questions of institutional design, but largely ignore learning. Regulatory policy scholars writing in the rational choice tradition contend that political "principals" – legislators, chief executives, and interest groups – purposely design regulatory agencies to serve their long-term political interests. For instance, some scholars contend that fact-finding, due process, judicial review, and other agency decision-making procedures are purposely written to favor a particular set of political interests (McCubbins, Noll, and Weingast 1987; Shipan 1997). If this thesis were broadly true, learning would be unlikely since regulatory agencies would use knowledge selectively to serve particularized interests rather than to design effective solutions. Other scholars writing in the same theoretical tradition, however, doubt these conclusions. Moe (1989) contends that the need for political compromise prevents principals from writing statutes with enough specificity to control agency behavior. Instead, principals grant career bureaucrats the autonomy to exercise their professional judgment, while holding out hope that interest groups will influence agency actions over time. Moe's thesis suggests that agency design might encourage learning if bureaucrats can resist political pressure. Nevertheless, because rational choice scholars generally assume that legislators write laws to advance their political careers rather than to make good policies, contemporary conceptions of policy learning do not seem to fit within their lexicon.

Policy learning scholars, by contrast, devote a lot of attention to mapping the learning process, but less attention to understanding the institutional arrangements that best promote learning. Up until fairly recently, most policy learning scholarship either focused on elaborating the nature of the learning process (Sabatier and Jenkins-Smith 1993; Rose 1993; Dekker and Hansen 2004), or distinguishing between the different types of lessons that may be learned (Glasbergen 1990; May 1992; Hall 1993). Less well developed within the literature is an understanding of the factors that facilitate and inhibit learning (Heikkila and Gerlak 2013). In particular, only a few studies have focused on the ways in which institutional arrangements impact learning processes (Busenberg 2001; Zarkin 2010). This stands in stark contrast to the literature on organizational learning, where the institutional arrangements that facilitate learning –commonly referred to as "learning mechanisms" – are widely discussed (Popper and Lipshitz 1998; Armstrong and Foley 2003; Oliver 2009).

The purpose of this article is to partially fill this gap in the literature by examining some of the institutional mechanisms that facilitate learning in regulatory agencies. In doing so, this article draws insights from the literatures dealing with policy learning, organizational learning, and regulatory politics. The following two sections of the article begin this process by summarizing policy learning theory, and surveying the literature on US regulatory politics for insights into the circumstances under which institutional learning mechanisms are likely to develop. Following the theoretical presentation, a case study of US drinking water regulation is examined in an effort to develop a set of theoretical propositions concerning the circumstances under which institutional learning mechanisms are most likely to develop and successfully operate.

Policy Learning Defined

The use of learning theory to explain collective decision-making has a long tradition in both organizational studies (Levitt and March 1988; Huber 1991; Argyris and Schon 1996) and policy studies (Heclo 1974; Hall 1993; Sabatier and Jenkins-Smith 1993; Birkland 1997, 2006). In recent years, learning scholarship has benefitted from efforts to integrate these bodies of literature and move political science closer to developing a more complete theory of how learning operates within the policy process (Busenberg 2001; Brown, Kenney, and Zarkin 2006; Dekker and Hansen 2004; Gerlak and Heikkila 2011). Nevertheless, policy learning remains a somewhat elusive concept, as policy scholars continue to debate the best ways to characterize and measure learning (Heikkila and Gerlak 2013).

In spite of these limitations, policy learning theorists offer an array of concepts that are useful in characterizing the utilization of knowledge within the policy process. The definition of learning developed by Gerlak and Heikkila (2011: 5) offers a good starting point for understanding policy learning. They define learning as:

> 1) a collective process, which may include acquiring information through diverse actions (e.g. trial and error), assessing or translating information, and

> disseminating knowledge or opportunities across individuals in a collective, and 2) collective products that emerge from the process, such as new shared ideas, strategies, rules, or policies.

Building on the definition of learning presented above, it is possible to elucidate the key elements that serve as the foundations of policy learning theory.

First, the policy learning process unfolds in a collective context that may include a single organization or multiple organizations comprising a policy network (Busenberg 2001; Heikkila and Gerlak 2013). Collective learning is generally conceptualized as a three-step process that includes gathering, interpreting, and disseminating information (Dekker and Hansen 2004). Gathering information involves utilizing practical experience or "feedback" concerning past policies (Heclo 1974; Pierson 1993), seeking out knowledge through "searches" for data and ideas held by other individuals, organizations, or jurisdictions (Rose 1993), or conducting research or experiments (Zarkin 2010). Once gathered, information must then be interpreted and given meaning through a process of study, analysis, and discussion that helps members of the collectivity develop better cause-and-effect understandings of a policy problem (Daft and Weick 1984; Nilsson 2006). Interpretation is then followed by a process of dissemination, in which information is distributed among members of the collectivity through mechanisms such as an exchange of documents, organizational meetings, public hearings, conferences, or through entities such as policy brokers and boundary organizations that foster dialogue (Sabatier and Jenkins-Smith 1993). Throughout the learning process, dialogue serves as an important mechanism for locating new data and ideas, sharing interpretations and analytical techniques, and persuading others to accept a particular course of action.

Second, the goal of the learning process is to arrive at more effective learning products (May 1992; Hall 1993; Argyris and Schon 1978). Glasbergen (1990) developed a typology of learning products that was shown by Fiorino (2001) to be useful for analyzing US pollution control politics. Glasbergen characterizes the most basic type of learning product as "technical" learning; that is, learning that leads policymakers to alter policy instruments and implementation designs within an established system of goals. Glasbergen next identifies "conceptual" learning as a second type of learning product that tends to coincide with broader policy changes. Conceptual learning is essentially the process that unfolds when a collectivity undergoes a partial or total alteration of its "policy paradigm." According to Hall (1993), a policy paradigm consists of both the hierarchy of goals and the causal beliefs that guide thinking and decision-making within a particular policy domain. A certain amount of conceptual learning occurs over time as a result of technical learning. For instance, new circumstances or experience working with various implementation strategies may cause policymakers to adjust or elaborate policy goals without fundamentally rethinking their causal beliefs (Oliver 1997). A complete paradigm shift, however, involves a fundamental rethinking of both components (Greener 2001).

Effective learning is by no means assured, and a range of endogenous and exogenous factors may facilitate or hinder the learning process. Endogenous factors include such things as the nature of the issue, the structure of the policymaking collectivity (centralized vs. decentralized), time and resource constraints, and the willingness of leaders to consider new ideas and disseminate information (Heikkila and Gerlak 2013; Busenberg 2001; Oliver 1997). Exogenous factors include external political pressure, political turnover, and rapid changes in the external economic, social, or natural environment (Sabatier and Jenkins-Smith 1993; Birkland 1997).

Many of the aforementioned factors are highly variable, which means that consistent and effective learning within a policymaking collectivity only happens if policymakers take care to effectively design what Glasbergen (1990: 182) calls the "facilities" for learning. Although Glasbergen is somewhat vague on this point, he seems to be referring to what other learning scholars broadly characterize as "learning arrangements" (Busenberg 2001) or "learning mechanisms" (Popper and Lipshitz 1998), as they will be referred to from here on. Broadly speaking, learning mechanisms are institutional arrangements that help policymaking collectivities to more consistently and effectively search for, process, and disseminate new data and policy ideas.

While learning mechanisms are widely discussed within the organizational learning literature (Huber 1991; Popper and Lipshitz 1998), their treatment within the policy learning literature remains underdeveloped. This paper partially addresses this deficiency by exploring the operation of learning mechanisms within one type of policy context: policymaking collectivities centered on regulatory agencies. To begin this discussion, the next section reviews the scholarly literate on US regulatory policy in an effort to elucidate the ways in which learning mechanisms operate within regulatory agencies.

Learning Mechanisms & US Regulatory Policy

The mainstream literature on US regulatory policy seldom mentions learning, per se. Nevertheless, a careful review of the literature reveals three broad conclusions concerning the role of learning mechanisms within regulatory agencies:

Conclusion #1: US regulatory agencies have commonly used certain types of learning mechanisms since the 1970s.

Legislatures delegate substantial decision-making authority to regulatory agencies for three overarching reasons: 1) lack of political agreement on more specific statutory provisions, 2) policy complexity, and 3) social conditions that change more rapidly than legislatures are able to act (Kerwin 2010). The latter two reasons largely explain why learning mechanisms are so important to regulatory agencies. Regulatory agencies originated more than a century ago as storehouses of expertise that could use knowledge to create and periodically update regulatory policies for an increasingly complex capitalist marketplace (Eisner 2000). Consequently, early US regulatory statutes endowed regulatory agencies with particularly broad delegations of authority accompanied by a mandate to pursue the "public interest" or some equally broad phrase. In practice, however, these ambiguous statutory mandates, combined with external political pressures, made regulators more likely to pursue the private interests of the industries they were supposed to regulate (Lowi 1979).

As a result, US regulatory statutes written since the 1970s contain more substantive and procedural specifics (Eisner 2000). These substantive and procedural legal directives, when properly constructed, serve as one important type of learning mechanism for regulatory agencies. Substantive legal directives relate to the type of evidence an agency must consider. For instance, an environmental policy statute might require an agency to utilize cost-benefit analysis or the best available peer reviewed science when writing regulations (Rosenbaum 2014). Procedural legal directives include provisions requiring an agency to review its decisions every few years to make sure they accord with changing social conditions or the most recent scientific evidence.

In order to effectively execute these legal directives, however, agencies need good advice from a variety of stakeholders. Therefore, organizational arrangements aimed at helping the agency obtain quality advice are a second type of learning mechanism employed by regulatory agencies. One way to obtain quality advice is to set up research capabilities within the agency. For instance, in the 1970s many US regulatory agencies created special policy planning offices designed to provide independent economic analysis to agency officials (Derthick and Quirk 1985; Zarkin 2010).

Research offices of this kind, however, present disadvantages as learning mechanisms. First, it is possible that the research office might not consider all available analysis or policy options because adherents to a particular academic theory or research approach dominate it. In US antitrust enforcement agencies, for instance, Chicago School economists rose to prominence in the 1960s at the expense of other perspectives (Eisner 1991). Furthermore, structural separation of the research office from operating bureaus makes it easier for the actual rule writers to ignore any advice they receive (Cook 1988). Organizations could try to remedy this problem by creating rule writing teams that include staff from both units (Lavey

1993; Hazlett 2011), but over time this might also cause the advice of the policy planning office to appear less independent.

For these reasons, it becomes important for agencies to broaden their search for knowledge by seeking out external advisory groups. Some US regulatory agencies, for instance, are statutorily required to have their scientific analyses peer reviewed by a board of external experts (Jasanoff 1992). Furthermore, agencies regularly hold public meetings and set up ad hoc advisory bodies to seek public comment on matters other than science (Kerwin 2010). For example, an agency seeking to incorporate values of environmental justice into its decision-making might set up an advisory body aimed at fostering a dialogue between regulators, industry, and a range of local citizen groups affected by a particular policy proposal (Williams and Matheny 1995).

Conclusion #2: effective learning mechanisms are most likely to be enacted in policy domains where there is broad agreement on goals and overarching values.

Most of the learning mechanisms mentioned in preceding paragraphs came about through legislative ascendance, either statutory or budgetary. As some principal-agent scholars note, however, legislators do not always have incentives to design effective learning mechanisms. When there is principled disagreement among contending interest groups, the ensuing conflict and compromise within the legislative process yields a bureaucratic design that favors the interests of one set of groups over another. For instance McCubbins, Noll, and Weingast (1987) contend that the US Toxic Substances Control Act was designed to place a high burden of scientific proof on regulators to benefit the interests of chemical companies seeing to bring new industrial chemicals to market. Effective learning mechanisms, by contrast, cause regulators to examine a broad range of appropriate evidence and make sound expert judgements.

Such learning mechanisms are likely to be created when there is broad agreement on the ends, though not necessarily the means, of policy. Busenberg (2001: 178) contends that broad agreement on policy ends is particularly likely to develop in policy domains that manage "hazardous systems," which he defines as systems "capable of generating hazardous events … that virtually every member of the network managing the system seeks to avoid." Principal examples of hazardous systems include industries that produce and handle oil, hazardous waste, and other materials that are harmful to human health and the environment. Because citizen groups, industry, scientists, and regulators all have incentives to avoid accidents, they also have incentives to seek out and widely disseminate quality information and ideas that will lead to safety improvements over time. The result, according to Busenberg, is that these policy networks have political incentives to construct effective learning mechanisms. In the next section, it is argued that drinking water regulation functions under analogous political conditions to the hazardous systems described by Busenberg.

Conclusion #3: learning mechanisms mitigate endogenous and exogenous learning constraints.

External political pressure and changes in organizational leadership serve as learning constraints when individuals who are hostile to new knowledge or established policy goals enter the policy process. Learning mechanisms, however, help mitigate these constraints by keeping agency officials focused on the attainment of goals, the consideration of new knowledge, and the construction of superior policy instruments. This is particularly true when learning mechanisms take the form of legal directives that must be followed by governmental officials. A failure to do so invites political criticism and lawsuits aimed at achieving more desirable legal outcomes (Kagan 2001).

Drinking Water Regulation as an Instructive Case

The conclusions discussed in the preceding section provide a path to understanding the role played by learning mechanisms within regulatory agencies, and the circumstances under which they are likely to be enacted. Nevertheless, the studies from which these conclusions are drawn raise additional questions that must be answered in order to assemble a more complete picture. For instance, how should legislatures write substantive and procedural statutory requirements to ensure that they serve as the most effective learning mechanisms? Under what circumstances are external advisory groups likely to serve as effective learning mechanisms? To answer questions such as these, it is necessary to investigate additional cases in which learning mechanisms of the kinds previously discussed exist and function effectively.

To this end, the remainder of this paper is devoted to an examination of US drinking water regulation between 1996 and 2015. Drinking water regulation provides a suitable case analysis for several reasons. First and foremost, drinking water regulation appears to be the type of policy domain in which learning is likely to occur. National regulatory standards for drinking water quality were established to prevent hazardous conditions by protecting the public health against waterborne disease epidemics. Much as Busenberg (2001) predicts, this is a policy domain in which there is little or no disagreement on the basic values questions (Zarkin 2015). Furthermore, the creation of health-based drinking water standards is a technically complex business that requires extensive consideration of biological science and economics (Raucher 1996). Taken together, these are the conditions under which learning is generally necessary, and learning mechanisms are likely to develop.

The remainder of this paper is devoted to exploring the role of learning mechanisms in regulatory agencies by analyzing the formation and implementation of US drinking water regulation. Building on the propositions articulated in the preceding section, the following questions will be used to analyze the case study later in the paper:

Q1: Did learning occur in US drinking water policy?
Q2: Did learning mechanisms impact the learning process?
Q3: What factors contributed to the success or failure of learning mechanisms?

By answering these questions, the intention is not to simply confirm or disconfirm that learning occurred, but to use the case of US drinking water policy to generate additional research propositions that may be applied and evaluated in future studies of learning mechanisms.

Learning Mechanisms & the SDWA Amendments of 1996

The SDWA Amendments of 1996 are best viewed as an episode of conceptual learning in which the goals and policy techniques of drinking water regulation were reoriented around "risk management" principles (Zarkin 2015). The risk management paradigm for pollution control policy stresses three overarching elements: 1) pollution prevention rather than post-hoc abatement, 2) public involvement and education, and 3) priority-setting based in a careful balancing of costs against comparative assessments of the risks posed by various environmental threats (Habicht 1994).

The most significant change contained in the SDWA amendments was a requirement that the EPA engage in risk-based priority setting when selecting, evaluating, and considering new contaminants for regulation. To effectuate this requirement, the EPA needed to develop and refine a series of protocols for the evaluation of scientific data — tasks that required a significant amount of technical learning over time. As such, Congress enacted a series of learning mechanisms to help ensure that the EPA would faithfully execute these expectations.

More specifically, the SDWA Amendments of 1996 stated that 18 months after enactment, and in five-year intervals thereafter, the EPA was required to compile a list of unregulated drinking water contaminants "which are known or anticipated to occur in public water systems, and which may require regulation" (6). In constructing the Contaminant Candidate List (or CCL) as it came to be known, the EPA was required to create and utilize an Unregulated Contaminant Occurrence Database. Within five years after enactment, and in five-year intervals thereafter, the EPA was further required to select at least five contaminants from the CCL to be considered for regulation – a process more commonly referred to as "regulatory determination." In selecting contaminants for regulatory determination, the EPA administrator was required to select those that likely pose the greatest risk to human health, and may only impose regulations if a contaminant 1) is likely to have adverse effects on human health, 2) is known to or likely to occur in public water systems at levels likely to pose a risk to humans, and 3) presents a "meaningful opportunity for health risk reduction." Along the way, the EPA is also required to use the best available peer reviewed science in making all new regulatory determinations.

The aforementioned legal requirements may be thought of as learning mechanisms for several reasons. First, they contain substantive requirements that regulators make evidence-based decisions. Second, they require regulators to engage in continuous learning by requiring them to consider new evidence and reevaluate their decisions every few years. Finally, the two preceding sets of requirements are all aimed at helping agencies achieve fairly well defined goals associated with the risk management paradigm.

The EPA also has learning mechanisms at its disposal to help gather, process, and interpret the knowledge required to discharge the statutory directives mentioned above. For instance, Congress specifically required the EPA to seek advice from its Science Advisory Board (SAB) in the construction of the CCLs (SDWA Amendments of 1996). The SAB's long history of serving as an external reviewer of the EPA's scientific methods and findings made it ideally positioned to provide advice concerning the evaluation of CCL contaminant evaluation protocols. Additionally, the SDWA requires the EPA to create and regularly consult a National Drinking Water Advisory Council (NDWAC) consisting of external experts. Although the SDWA Amendments of 1996 did not give the NDWAC a specific statutory role with respect to the regulation of new contaminants, its broad mandate to "advise, consult with, and make recommendations" concerning drinking water policy matters virtually guaranteed that it would have a voice in the process (Safe Drinking Water Act of 1974). Finally, the EPA may request advice from the National Research Council (NRC), which has occasionally provided the EPA with external advice concerning drinking water policy matters, particularly when Congressional appropriations allow such studies to be commissioned (Pontius 2003).

The following two sections chronicle the development of the four CCLs and the three regulatory determinations that took place between 1996 and 2015. Admittedly, the examination provides a fairly detailed account of the events that unfolded during this 19-year period. This level of detail, however, is necessary to fully evaluate the research questions that were posed earlier in the paper.

Creation of the Contaminant Candidate Lists: 1996-2015

Development of the first CCL required the EPA to create a contaminant identification protocol. Quite early on, EPA staff recognized that chemical and microbiological drinking water contaminants each presented distinct scientific challenges that made them difficult to compare along a common scoring mechanism. As such, the EPA proposed to evaluate the two categories of contaminants separately for inclusion on the CCL. Following risk management principles, EPA proposed that each category be evaluated using a four-step process: 1) identification of contaminants, 2) scientific assessment of health risks, 3) numerical ranking of contaminants based on health risks, and 4) consideration of potential regulatory options that might be available should the contaminant ultimately be regulated (EPA 1996).

The efforts of EPA staff to develop an elaborate contaminant identification methodology, however, were put on hold as the agency moved to comply with the statutory deadline for the completion of the first CCL. With no permanent standardized criteria in place, the EPA worked with the NDWAC and other stakeholders to develop temporary protocols (Announcement of the Draft Drinking Water Contaminant Candidate List 1997). Due to time and information constraints, however, the EPA chose to focus on those contaminants for which there was the most available data rather than those that necessarily posed the greatest risk. Ultimately, the EPA identified fifty chemical and ten microbiological contaminants for inclusion on the first CCL. Among the sixty contaminants on the CCL, twenty were identified as regulatory determination "priorities" based on the availability of data concerning health effects and occurrence in drinking water (Announcement of the Draft Drinking Water Contaminant Candidate List 1998).

Upon issuing the first CCL in 1998, the EPA recognized the deficiencies in the process and committed itself to the development of a "more robust approach to data collection and evaluation" for future CCLs (Announcement of the Draft Drinking Water Contaminant Candidate List 1998: 10285). Over the next several years, the EPA attempted to fulfill this commitment by engaging the NRC and NDWAC in the development of a more systematic CCL creation process. In 2001, the NRC issued a report outlining a two-step process that first involved identifying a "broadly defined universe" of potential drinking water contaminants and narrowing it down to a

Preliminary CCL (PCCL) using standardized screening criteria. The second step involved winnowing the PCCL into a final CCL using a numerical algorithm. The NRC also encouraged the EPA to make the CCL development process more transparent by better explaining its decision-making processes and making more information available so that the public could actively participate (NRC 2001).

At the EPA's request, the NDWAC reviewed the NRC report and generally approved of the recommendations (National Drinking Water Advisory Council 2004). The EPA publicly committed to implementing the NRC recommendations when it released a draft of the second CCL in 2004. The draft CCL2, however, did not employ the new framework. Instead, the agency would simply carry forward the list of contaminants contained on the first CCL (Drinking Water Contaminant Candidate List 2 2004, 2005). The EPA justified its decision based on the fact that it had further researched many of the chemicals on the first CCL and was now positioned to determine whether any of those chemicals required regulation. In particular, the EPA set up the Unregulated Contaminant Occurrence Database required by the SDWA and was just beginning to receive reliable data on many of the contaminants contained on the first CCL. Furthermore, the NRC framework required new criteria and decision rules that would take some time to develop. Nevertheless, the EPA used the public announcement as an opportunity to outline the new scheme and request public comment (Drinking Water Contaminant Candidate List 2 2004).

For the creation of the third CCL in 2008-2009, the EPA developed an elaborate and fairly comprehensive process that incorporated most of the recommendations made by the NRC and NDWAC. The EPA started by working with stakeholder groups to identify a "broad universe" through a multi-step process that first involved systematically evaluating 284 data sources. Through the application of standardized criteria, EPA and stakeholders narrowed the list to 26,000 potential contaminants contained in the 39 most complete and reliable data sources. Further screening caused the EPA to settle on a broad universe of 7,500 contaminants. EPA then applied health effects and occurrence screening criteria to create a PCCL of roughly 560 contaminants. The final step involved narrowing the PCCL to a draft CCL of 104 contaminants by utilizing an algorithm that scored the chemicals based on four variables designed to isolate the highest public health risks (Drinking Water Contaminant Candidate List 3 2008).

Following the public release of the preliminary CCL 3, the EPA asked the SAB to review the new protocols. The SAB provided generally positive feedback, calling the new CCL creation process "a more data-driven, systematic approach" (EPA 2009: 3). The SAB, however, made some fairly minor suggestions intended to improve the process. In particular, the SAB report indicated that the number of contaminants on the draft final CCL was too large to adequately communicate which ones posed the greatest risks. The SAB further recommended that the EPA provide a better explanation of the process by which the agency narrowed the PCCL down to the draft final CCL. The final version of the CCL ended up being slightly larger than the draft version (116 contaminants) and the EPA provided a more elaborate discussion of its decision-making processes (Drinking Water Contaminant Candidate List 3 2009).

The EPA continued to use the CCL 3 process when it began work on the fourth CCL in 2012 (Request for Nominations 2012; Drinking Water Contaminant Candidate List 4 2015). The EPA decided to retain all CCL 3 contaminants, and identify a “universe” of additional contaminants by seeking nominations from the public. Public nominations yielded a list of 59 contaminants that was subsequently narrowed to a universe of 43 following the examination of health effects and occurrence data. Further screening led the EPA to place 20 contaminants on the PCCL. The draft CCL 4, released in early 2015, contained a total of 112 contaminants, most all of which were carried over from the CCL 3 (Drinking Water Contaminant Candidate List 4 2015).

Regulatory Determinations, 2002-2014

As was previously noted, the SDWA Amendments required the EPA in five-year intervals to complete regulatory determinations for at least five contaminants listed on the most recent CCL. Doing so, however, first required the EPA to create protocols for selecting the contaminants that posed the greatest health risks and determining whether or not they needed to be regulated. To this end, the EPA enlisted the help of the NRC and NDWAC in developing a scientifically sound regulatory determinations process. The NRC (1999) suggested a particularly elaborate three-step process for making the required regulatory determinations that involved 1) a preliminary examination of each CCL contaminant in which existing data on health effects, exposure, and treatment options is reviewed, 2) a more detailed risk assessment for each contaminant, and 3) a separate decision document for each contaminant detailing whether or not it should be considered for regulation.

The NDWAC protocol also called for a three-step process more closely related to the three enumerated statutory criteria discussed in the preceding section. To assess adverse health effects, NDWAC recommended that the EPA use scientific risk assessments to create a numerical characterization of overall health risk for each CCL contaminant known as the Health Reference Level (or HRL). During the second step of the protocol, the EPA would then use occurrence data to determine the percentage of US public water systems reporting detections of contaminants at levels above half of the HRL. In the final step, the EPA would determine whether regulating the contaminant presented a meaningful opportunity for health risk reduction by estimating the portion of the population exposed to the contaminant at levels above half of the HRL (Announcement of Preliminary Regulatory Determinations 2002).

The process ultimately chosen by the EPA incorporated elements of both protocols, but was applied to a fairly limited set of contaminants (Announcement of Preliminary Regulatory Determinations 2002). Rather than evaluating all 60 contaminants contained on the first CCL, EPA chose to only work with the list of 20 regulatory priority contaminants. The EPA then narrowed the list down to nine contaminants after determining that inadequate monitoring methods and health and occurrence data existed for the remaining contaminants. The EPA evaluated the nine contaminants using the three-step process recommended by the NDWAC, ultimately deciding not to regulate any of the contaminants (Announcement of

Regulatory Determinations 2003). Following the completion of the second CCL, the EPA used a process for selecting and evaluating contaminants for regulatory determinations that roughly mirrored the relatively limited process used after the first CCL (Regulatory Determinations 2007, 2008).

The limited scope of the first two regulatory determinations ultimately drew criticism from a range of external actors. In particular, a U.S. Government Accountability Office (2011) report criticized the EPA for choosing contaminants for regulatory determination based more on the availability of data than on a systematic assessment of the appropriate risk priorities. The report further criticized the agency for failing to fully explain its decision-making processes and disclose the limitations of some it its analytical techniques. When the U.S. Senate followed up on the report with a hearing later in the year, a high-ranking EPA official conceded the inadequacies of its current regulatory determinations process and reassured legislators that the agency was "continually learning from each iteration of this process and … currently applying lessons learned from previous determinations" (*Oversight Hearing* 2011: 2). The agency also indicated that it would consult with an independent panel of scientists to improve its regulatory determinations protocols.

For the third round of regulatory determinations, the EPA modified existing protocols to produce a more rigorous and comprehensive three-phase process. During the first phase, the EPA analyzed all 116 contaminants contained on the third CCL to identify a short list of contaminants for which there was sufficient health and occurrence data to make a sound regulatory determination (Announcement of

Preliminary Regulatory Determinations 2014: 62721). During phase two, the EPA then formulated draft HRLs for 35 of the original 116 contaminants, and compared them against occurrence data to identify only those contaminants that "occur at levels and frequencies of public health concern" (62722). Of the 35 contaminants considered during the second phase, 5 were passed on to the third phase, where EPA staff derived a final HRL. After further analysis, EPA staff recommended to the Administrator that one of the contaminants be regulated (62727).

Analysis

The foregoing case study evidence does not suggest that the EPA was transformed into a learning organization in any complete sense. In addition to the SDWA, the EPA implements multiple major pollution control statutes, each of which imposes a somewhat different institutional design on agency decision-making processes. The data does, however, provide substantial evidence that the EPA became a learning organization with respect to drinking water regulation. For this reason, it may at best be fair to conclude that the SDWA Amendments transformed the EPA into what Zarkin (2010: 174) describes as a limited learning organization; an organization that able to engage in effective learning with respect to some issues within its jurisdiction but not others.

At the same time, however, these findings provide some important clues as to the circumstances under which regulatory agencies are most likely to learn. To place these finding in context, it is now necessary to return to the three questions posed earlier in the paper:

Q1: Did learning occur in US drinking water policy?

The evidence indicates a substantial amount of learning. The SDWA Amendments of 1996 are best characterized as an episode of "conceptual learning" in which portions of the risk management paradigm were enacted into law. The next 19 years represented a period of technical learning during which the EPA sought to develop concrete strategies for carrying out the risk management principles contained in the SDWA Amendments of 1996. Successful completion of the CCLs and regulatory determinations required the EPA to develop complex new protocols for identification and evaluation of drinking water contaminants the posed the greatest health risks. Constructing these protocols required the EPA to search for new ideas and adapt them in light of, limited resources, data availability, and other practical realities.

Q2: Did learning mechanisms impact the learning process?

Two types of learning mechanisms positively impacted drinking water regulation: statutory requirements and outside advisory groups. Substantive statutory requirements succeeded as learning mechanisms because they were relatively specific. Rather than vaguely commanding the EPA to utilize "sound science" or something to that effect, Congress specified the variables the agency needed to consider in evaluating new drinking water contaminants. By specifically indicating that the EPA needed to consider both the occurrence of contaminants and their health effects, Congress created a framework that limited EPA discretion to the fairly technical task of designing analytical protocols to implement these commands. As a result of these directives, important learning occurred after the passage of the

SDWA Amendments of 1996. These findings suggest the validity of the following proposition:

P1: Legislatures may facilitate technical learning by specifying the variables to be considered in agency decision-making.

By contrast, procedural mechanisms such as timetables for regulatory decision-making were a mixed blessing. On the one hand, specific timetables ensured that the EPA would examine data and make statutorily specified decisions on a regular basis. Nevertheless, the requirement that the EPA undertake two discrete tasks (construction of CCLs and regulatory determinations) according to overlapping timetables actually complicated learning to some degree. It took the EPA over a decade to design and implement rigorous CCL and regulatory determinations processes because the agency was continuously required to shift staff resources between the two tasks. Based on these findings, it is possible to state the following proposition concerning procedural learning mechanisms:

P2: Procedural statutory requirements facilitate learning when they are accompanied by specific substantive statutory requirements, and the agency is able to devote sufficient time and resources to learning and implementing lessons.

Advisory groups also played an active role in promoting learning in drinking water regulation. The evidence presented in the case study indicates that the SAB, NRC, and NDWAC all contributed to the development of analytical protocols for the CCL and/or regulatory determinations processes. Indeed, during the years following the passage of the SDWA Amendments of 1996, The NRC and NDWAC were virtually transformed into an ancillary group of agency staff whose proposed analytical protocols were regularly incorporated into EPA decision-making processes. Furthermore the EPA did not do take the advice of these groups simply because it was legally required to do so. Although the EPA is legally required to consult with the NDWAC on matters related to drinking water policy, the agency is not required to give NDWAC advice undue weight. The legal mandate to regularly consult the SBA and NRC on matters relating to drinking water policy is tenuous at best. Therefore, to fully understand why external advisory groups serve as important learning mechanisms in the formulation of US drinking water policy, it is necessary to consider other factors.

Q3: What factors contributed to the success or failure of learning mechanisms?

Since the evidence presented in this paper largely affirms the success of learning mechanisms within the drinking water policy domain, it is most appropriate to consider the factors that contributed to this success. Unfortunately, the evidence presented herein does not present an unequivocal answer to Q3. It is possible, however, to posit two potential explanations that may serve to guide scholars interested in further exploring the role of learning mechanisms within regulatory agencies.

First, the findings provide additional confirmation that learning mechanisms are likely to develop in policy domains where core regulatory policy goals are widely endorsed. US drinking water regulation is certainly one such policy domain. Virtually all stakeholders within the drinking water policy community agree that the single overarching goal of policy is the prevention of public health crises through the regulation of drinking water quality. As such, drinking water regulation is analogous to the type of “hazardous systems” policy domain in which Busenberg (2001) predicts that learning mechanisms are most likely to develop. However, it is not immediately clear that hazardous systems policy domains are the only places in which regulatory policy goals are clear and widely agreed upon. Nor, for that matter, is it clear that unified, widely agreed-upon goals are the only condition under which effective learning conditions develop. Additional research is needed to fully determine the range of issue domains in which learning mechanisms effectively operate.

Furthermore, even if learning mechanisms are most likely to be constructed in certain regulatory policy domains, there is no guarantee that they will be used effectively in the long term. Therefore, it can be posited that a second factor in the long-term success of learning mechanisms is a culture conducive to learning. Popper and Lipshitz (1998: 172) argue that such a culture would consist of “shared values and beliefs that ensure that the mechanisms produce actual learning … and not mere rituals of learning.” They further note that a culture conducive to learning would consist of 5 components: continuous learning, valid information, transparency, accountability, and an issue orientation in which information is evaluated based on quality rather than on the reputation of the source (172-175).

The data strongly suggests that at least some of the five facets of a learning culture exist among EPA staff engaged in drinking water issues. Continuous learning is indicated by virtue of the fact that the EPA actively engaged in a fifteen-year quest to promulgate and effectively utilize sophisticated analytical protocols. An interest in valid information is indicated by EPA’s interest in considering a broad array of data sources and utilizing only the most complete and current ones available. Transparency is indicated by virtue of the fact that EPA readily responded to calls from the NRC and SAB to better explain their decision-making processes and make more documentation available to the public. Accountability is indicated by EPA's willingness to continuously have its work peer reviewed and to incorporate that feedback into its final decisions. The existence of a commitment to an issue orientation is less clear from the available data.

None of these preliminary findings are conclusive. Nevertheless, the findings suggest that the following proposition is worthy of investigation in future studies:

P3: Effective utilization of learning mechanisms by regulatory agencies requires an organizational culture conducive to learning.

Examination of organizational cultures will necessarily require interviews with agency officials and other data that goes beyond what was used in the present study.

Conclusion

In conclusion, the findings contained in this study have implications for both scholars and practitioners of public policy. First and foremost, this study demonstrated that learning mechanisms, when properly constructed, can positively impact regulatory agency decision-making. Furthermore, this study catalogued some of the most important political conditions under which learning mechanisms are both constructed and effectively utilized. Policy practitioners interested in creating more effective learning organizations should take note of these findings. Scholars should take note that there is more work to be done to fully understand the role that learning mechanisms play within regulatory agencies. Further investigation of the propositions outlined above will enhance our theoretical and empirical understanding of this important but understudied research area.

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