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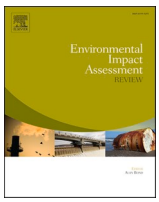

Toward NEPA performance: A framework for assessing EIAs

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ABSTRACT

The National Environmental Policy Act (NEPA) provides a regulatory decision-making process that requires U.S. federal agencies to assess the purpose and socio-environmental impacts of a proposed action before deciding to move forward with that action. The multiplicity of NEPA objectives, the complex tradeoffs embedded in the Environmental Impact Assessment (EIA), and the difficulties in accessing data have presented challenges for evaluating NEPA performance. Researchers have responded with a growing array of performance dimensions and specialized measurement approaches. In this paper, we advance a performance framework for EIAs that integrates several of these dimensions and provides a conceptually coherent approach to procedural and substantive performance. The framework articulates three procedural elements (use of science and analysis, nature of public participation, and management of EIA processes); and three substantive elements (quality of both the NEPA review and action decision, and both the accountability and efficiency of the NEPA review decision). Each element is further elaborated by specific functions with specific variables as a basis for future performance measurements. We use two hypothetical use cases, drawn from public land management and federal highway planning, to illustrate how the performance concepts from the framework can be operationalized and measured.

1. Introduction

The National Environmental Policy Act (NEPA) was passed by the U. S. Congress in 1969 and signed into law by President Nixon in 1970. NEPA requires federal agencies to perform environmental impact assessment (EIA) of expected impacts and project alternatives before undertaking major planning, rulemaking, permitting, and construction actions. What was forged through near-unanimous national consensus 50 years ago, however, has become a highly contentious bellwether of partisan division (Brady, 2020). U.S. critics of NEPA have focused on the issue of project delays, prompting considerable efforts to streamline the process and reduce the time-to-completion of EIAs as the primary, if not sole, performance criterion of interest (e.g. Rosetti, 2021; Dill, 2005). This focus has overshadowed, if not discouraged, attempts to articulate and assess the ways that EIAs improve federal decision-making.

Policy analysts often define performance in terms of statutory goal achievement (e.g., reduced pollution measures, increased student achievement, improved health metrics) (e.g., Dunn, 2016). This definition gives limited analytical traction for assessing EIAs that are grounded in multiple procedural and substantive goals articulated by NEPA that collectively seek an effective, informed, and inclusive approach to decision-making. Among its stated purposes, NEPA is intended "to encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation…" (NEPA Sec. 2 [42 USC § 4321). These aims are difficult to measure, and highly contested (Cashmore et al., 2004).

Assessing EIA performance is further complicated by judicial constraints on NEPA implementation that limit its substantive effect. The U. S federal courts have interpreted NEPA's enforceable requirements

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narrowly, requiring agencies to analyze expected impacts and project alternatives before taking major actions, but neither prescribing nor proscribing any particular course of action (Lindstrom, 2000).

The difficulty in evaluating the performance of a multi-target statute such as NEPA should not diminish the importance of the task (Loomis and Dziedzic, 2018; Morgan, 2012). While participants might reasonably disagree about what constitutes a "better" agency decision, current debate about NEPA's performance tend to rely on intuition, anecdote, and ideological assumptions (e.g., Katz, 2018; DeGood, 2018). The purpose of this paper is to replace these assumptions with a set of shared, conceptually coherent, and well-defined performance constructs that can guide data-driven analysis of EIA processes, agency decision-making and results. To that end, we advance a performance framework for procedural and substantive dimensions of EIA processes.

We focus specifically on project EIAs carried out in the context of NEPA and its implementation at the national level in the U.S. One of the primary architects of NEPA, Lynton Caldwell, cautioned researchers about focusing too much at the project level: "The risk in an emphasis on impact analyses is that the purpose of NEPA may be lost in the refinement of procedures. To some extent this has, in fact, occurred" (Caldwell, 1993). We have taken on this risk, however, because there remains much to be learned over the past 50 years of NEPA implementation. With new technologies such as machine learning and the emergence of large, accessible databases of EIAs, comprehensive aggregate project analyses are more feasible. The power of systematic large-n analyses of project-level EIAs can shine a light on the practice and performance of EIAs, and how they are fulfilling the multiple purposes of NEPA.

It is important to note that NEPA itself and its environmental assessment requirement became a regulatory template for EIA laws that are practiced at the local, state, national, as well as international level (Scott et al., 2020). As of 2012, 191 of the 193 United Nations members either possessed a national EIA law or were signatories to an international EIA-related legal instrument (Morgan, 2012). Similarly, many subnational governments have adopted their own environmental review practices (i.e., California's California Environmental Quality Act (CEQA), in place since 1970). Over time, impact assessments have expanded and specialized beyond project specific EIAs to include strategic environmental assessments, policy assessments, social impact assessments, health impact assessments, and sustainability assessments (Pope et al., 2013). While these processes and their enabling laws may differ, the underlying common expectation is that public agencies should make well-informed decisions that balance tradeoffs reasonably and transparently between competing environmental, economic, and social objectives. Thus, while the framework that we advance here pertains to the implementation of NEPA at the federal level and to project specific EIAs within the U.S., there may be useful applications to performance in other contexts and applications more broadly. For example, we hope this framework or specific elements of it might have

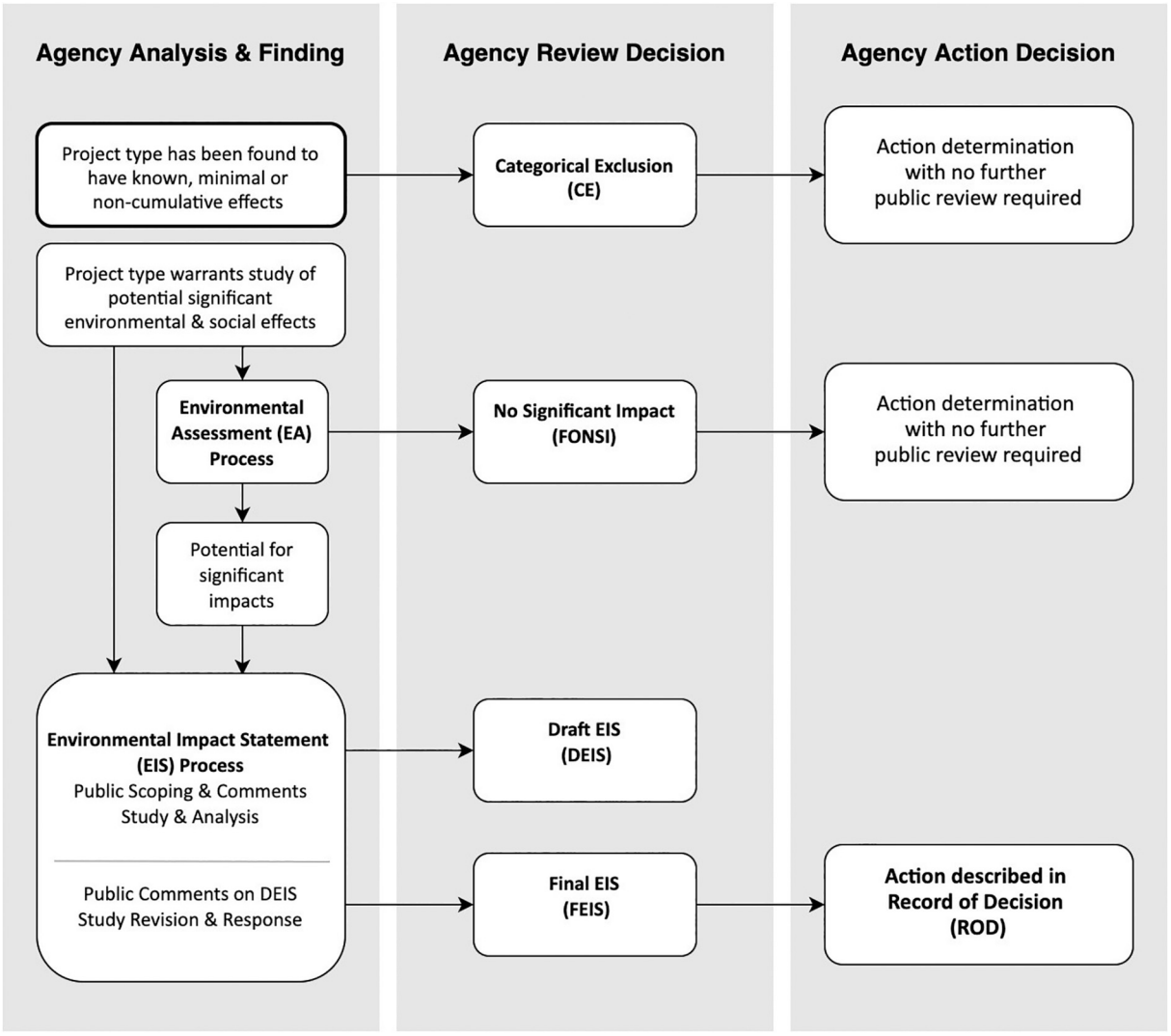

Fig. 1. Basic Environmental Impact Assessment (EIA) Process for proposed actions.

utility for analyses of pre-NEPA functions as highlighted by Ugoretz (2001) or the evaluation of EIA systems performance as studied by Kolhoff et al. (2009).

2. Background: NEPA and the EIA process

To better understand the nature of the EIA process as specified by U.S. law and regulation, we provide a brief orientation illustrated in Fig. 1. NEPA is invoked when a federal agency of the U.S. government is considering a federal action (including proposed regulations, permits, and land management plans) that may have significant environmental impacts. Before taking the action, the lead agency must first determine the extent of potential environmental and social impacts, which may involve three different levels of analysis. A proposal will be "categorically excluded" from detailed environmental review if it fits into predetermined categories defined by individual agencies. Categorical exclusions (CEs) generally apply to actions having known, minimal, and non-cumulative impacts, with no extraordinary circumstance to suggest the proposal differs from others of its kind. If an action is not eligible for a CE, a second level of analysis, an Environmental Assessment (EA), may be conducted to determine the potential of the proposed action to cause significant environmental effects. The procedures for EAs, including the extent of public participation, are largely established by the individual agencies, although the President's Council on Environmental Quality (CEQ) requires some minimum standards (CEQ NEPA Regulations, 2022). If the EA reveals that no significant impacts are likely, then the agency issues a Finding of No Significant Impact (FONSI) and the proposed action may proceed without further review.

If the agency believes a proposed action may cause significant impacts, or if the EA reveals that significant impacts are likely, the agency then proceeds to a third level of analysis and prepares an Environmental Impact Statement (EIS). EISs consist of 1) a scoping period during which the public and other government agencies are consulted to identify the range of issues and possible alternatives for analysis; 2) an assessment of the expected environmental and social impacts of the proposed action, as well as the impacts across a range of alternatives, including a "no action" alternative; 3) the preparation of a draft EIS (DEIS) for public review and comment; 4) further study, revision and response to public comments resulting in the preparation of a final EIS (FEIS); and 5) after a wait period for most agency processes, the issuance of the agency's Record of Decision (ROD) which states the agency's decision, along with any mitigation and monitoring requirements. During this process, the lead agency must consult with other federal, state, tribal and local agencies who are impacted or whose expertise is relevant. Minimum requirements for public participation are regulated by CEQ. However, the lead agency may choose to provide more extensive opportunities for public comment and/or stakeholder engagement.

EISs, EAs and CEs are names for EIA practices codified in US NEPA regulations, and other jurisdictions use other terms (e.g., Canadian "Impact Assessments" and Californian "Environmental Impact Reviews"). We refer to EISs when referencing the specific review process mandated by NEPA in the U.S., and EIAs when referencing the practice of environmental impact assessment generically. We do not address CEs further in this paper, although their use and proliferation in the U.S. should be a significant aspect of any subsequent aggregate assessment of NEPA implementation. With this description of the actual environmental assessment process in the U.S., we can turn to the research that has defined and evaluated these assessment processes over the past 40 some years.

3. What we know about EIA performance

Given the fundamental importance of federal activities to society (U.S. Department of Homeland Security, 2013) and the extensive scope of NEPA, EIA performance has long been of interest to environmental science and public policy scholars (Andrews, 1976; Jay et al., 2007; Karkkainen, 2003; Taylor, 1984; Tripp and Alley, 2003; Wishnie, 2008). Numerous literature reviews have been conducted on EIA performance and specifically effectiveness (Loomis and Dziedzic, 2018; Morgan, 2012; Veronez and Montaño, 2015; Zhang et al., 2013; Sadler, 1996). Most recently, Loomis and Dziedzic (2018) reviewed 64 empirical studies on EIA effectiveness across different dimensions and countries around the world. Interestingly, very few performance studies have been conducted on EIAs in the U.S.

Empirical studies of EIA performance tend to fall into three groups. First are studies that survey practitioners and experts to gauge their perceptions about the effectiveness of their jurisdiction's EIA practices (Loomis and Dziedzic, 2018; U.S. Government Accountability Office, 2011; Stein, 2010). These studies show that EIA practitioners consistently view the process as valuable, even if potential improvements could be made (Canter and Clark, 1997; Arts et al., 2012; Runhaar et al., 2013; Lyhne et al., 2016).

A second group of studies do not examine NEPA performance directly but evaluate some specific aspect of EIS analysis. For example, Stein (2010) evaluates whether EISs comprehensively address climate change; Gallagher and Jacobson (1993) examine the quality of EIS typography; Lees et al. (2016) examine how effectively Canadian EAs address uncertainty in environmental impacts; and Karlson et al. (2014) evaluate the quality of ecological impacts analysis in U.K. and Swedish road projects. Methodologically, these studies require analysts to identify a set of objective criteria that denote high-quality analysis and apply these criteria to a sample of individual EISs. While these studies generally find that EISs often fail to meet experts' minimal criteria, it is not clear that these results are representative of all EISs, or how EIS quality affects the broader EIA process.

A third group of studies examines the effect of EIAs on the content of agency decisions and expected environmental impacts. In an analysis of several hundred EISs issued under the Wilderness Act, for example, Ginger and Mohai (1993) find that the NEPA process has limited effect on agency decisions. In a much smaller study of 16 oil and gas EISs, Ruple and Capone (2016) come to the opposite conclusion, finding that the expected environmental impacts of proposed projects decreased substantially between the draft and final EISs, suggesting that the process helped actors identify ways to mitigate environmental impacts. [1]

Despite this growing body of empirical work (that has more than doubled in the past 20 years), there are considerable gaps in our knowledge of whether, when, and how EIA processes shape agency decisions and affect environmental and social impacts of agency activities (Loomis and Dziedzic, 2018). Most studies define performance narrowly, and few are grounded in existing social science theory about policy decision making (Emerson and Baldwin, 2019). And only a small subset of the thousands of EISs conducted in the U.S. since the 1970s have been analyzed; most studies either rely on experts' perceptions of the EIA process or empirically assess at most a dozen or two EISs. We lack systematic knowledge about how EIAs perform across important dimensions of performance, and consequently we have limited ability to help policy makers find ways to improve or streamline NEPA with minimal effect on substantive outcomes.

3.1. Conceptualizing EIA performance

There is consensus among most NEPA researchers on the multidimensionality of EIA performance (Loomis and Dziedzic, 2018; Bond et al., 2012; Cashmore, 2010; Cashmore et al., 2004; Pope et al., 2013;

[1] An interesting and possibly important factual distinction between these two studies is that EISs issued for proposed wilderness designations are legislative EISs and thus, the final decision rests with Congress – a separate entity that has its own decision-making process. On the other hand, the oil and gas decisions are made by the same entity that is responsible for the EIS on those proposed actions.

Rozema and Bond, 2015). Broadly, they frame EIA performance in terms of "effectiveness" where the EIA process directly or indirectly, in the short or long term, influences or effectuates changes in public decisions; in individual decision makers, project proponents, and stakeholders; in the organization and capacity of public agencies; and ultimately on impacts on the ground, in the community, and the public at large. While "effectiveness" remains contested by scholars and practitioners (Cashmore, 2010), key dimensions of effectiveness have been enumerated over time (Loomis and Dziedzic, 2018; Bond et al., 2013a, 2013b; Morgan, 2012; Bartlett and Kurian, 1999; Lawrence, 1997).

The two most prominent dimensions of effectiveness used by EIA researchers are procedural and substantive effectiveness. Procedural effectiveness focuses on how well the EIA process worked and adhered to procedural requirements as set forth in law and regulation (Sadler, 1996, p. 37; Cashmore et al., 2004). Substantive effectiveness relates to how well the process achieved its intended objectives (Sadler, 1996) and is a multi-faceted concept (Cashmore et al., 2004) that can include mitigation of environmental harms and changes to the decision-making process, as well as attainment of policy objectives (Loomis and Dziedzic, 2018).

Over time, researchers have added additional dimensions. Transactive effectiveness underscores the costs and efficiency of EIA processes (Sadler, 1996). Normative effectiveness takes values-based perspectives into account in assessing the resulting decisions or outcomes vis-a-vis sustainability goals or democratic standards (Chanchitpricha and Bond, 2013; Stoeglehner et al., 2009). Bond et al. (2013a) elaborate on two more dimensions of effectiveness: knowledge and learning on the part of all stakeholders through the review process and pluralism, acknowledging multi-perspectival meanings of effectiveness on the part of diverse involved and affected stakeholders. Chanchitpricha and Bond (2013), embracing the multi-faceted nature of environmental impact assessment effectiveness, combine some of these dimensions by defining EIA effectiveness as a) the extent to which it works procedurally; b) the degree to which available resources are used transactively to inform decision-making and satisfy stakeholders; c) the degree to which it achieves its intended aims substantively; and d) the degree to which stakeholders normatively learn and change their views over time as policy is implemented. They develop specific criteria for measuring these four dimensions of effectiveness and link them to the four stages in a logic model (input, process, output and outcome). Pope et al. (2018), after their efforts to assess a complex case study along all dimensions, suggest synthesizing the dimensions of normative, pluralism and learning and knowledge into one broad dimension of legitimacy added to the two prevailing dimensions, procedural and substantive.

In part following Pope et al.'s (2018) synthesizing approach, rather than add more dimensions or further differentiate among them, we advance a performance framework restructured around the two primary and most enduring dimensions of EIA processes (procedural and substantive), while integrating most of the previous dimensions into these two. We view effectiveness as one of several criteria, like efficiency and equity, that apply in different ways to aspects of procedural and substantive performance. Thus, several of the dimensions previously described are integrated into a performance framework, as either concepts/constructs themselves or related variables.

A performance framework is needed for several reasons. Because the meaning of performance is multi-faceted—and not uniform across cases—it is crucial to embed specific aspects of performance within a broader framework. There is no "one best way" to measure EIA performance, but there are many different ways that a researcher could conceivably define, conceptualize, and ultimately measure performance. Analysts can – and should – vary in whether they are interested in social, environmental, or managerial dimensions of the process; whether they conceive of performance in procedural or substantive terms; and whether they measure performance at the level of the individual EIS, the agency, the region, or the nation. The framework we present below is designed to help researchers make deliberate choices about how to conceive of, observe, and assess performance.

4. A framework for EIA performance

Our intention in this paper is to provide a more coherent and parsimonious framework for assessing the multi-functionality of the EIA process, while building on the aspects of EIA performance that have been articulated by scholars over the past several decades. Our framework is structured around the two primary *dimensions* of procedural and substantive performance as presented above. Each dimension is further parsed into three core *elements* that encapsulate the basic drivers or contributors to performance. These elements serve specific defined *functions* which become the basis for key *variables* that can be identified and measured as individual aspects of EIA performance. The list below presents the two dimensions and their respective elements. Tables 1 and 2 present the elements, functions and variables for each dimension of EIA performance.

- Elements of the Procedural Performance Dimension
  1. Use of science and analysis
  2. Nature of public participation
  3. Management of the EIA process
- Elements of the Substantive Performance Dimension

4. Quality of EIA preferred alternative and agency decision
5. Accountability of preferred alternative
6. Efficiency of EIA process and preferred alternative.

As an example of how we have integrated some of the key performance dimensions of previous researchers, take the concept of legitimacy. Pope et al. (2018) suggest creating a new performance dimension for legitimacy, which would encompass three previously articulated dimensions: normative effectiveness, pluralism, knowledge and learning. In our framework, we locate *perceived legitimacy of process* within the procedural performance dimension, as a function of the public participation process element. We locate a related concept, *perceived legitimacy of recommendation,* within the substantive performance dimension, as a function of the accountability element. Both functions are then translated into useable variables. In this way, our framework incorporates normative and transactive aspects of NEPA performance within the two main dimensions of procedural and substantive performance and offers concrete guidance about how to operationalize these dimensions, elements, and functions via variables that can then be observed and measured.

As another example of how we integrate prior EIA performance dimensions, we suggest that the transactive dimension may be better understood as one of three major elements of substantive performance. We view efficiency as a ratio and define it as the extent to which the public investment in the EIA process is commensurate with stated public benefits of the final preferred alternative.

In the next two sections we present the framework and its derivations from prior EIA research.

5. Procedural performance dimension

Through a combination of law, regulation, judicial review, and practice, NEPA has evolved into a set of procedures that govern a broad swath of federal decisions. How these procedures are carried out has been the first and predominant focus of empirical studies of EIA performance (Loomis and Dziedzic, 2018; Baker and McLelland, 2003; Bond et al., 2013b; Chanchitpricha and Bond, 2013; Sadler, 1996). The emphasis of most project evaluation studies has been on review practices

and compliance with relevant regulations. [2] In this framework we focus on three core elements that contribute to the performance of EIA procedures: (1) the use of science and analysis in the review process; (2) the nature of the public participation process; and (3) the agency's management of the review process (Table 1). The first two elements are derived directly from the state purposes of NEPA and elaborated on in subsequent regulation. The third reflects the practical role of public management capacities and practices essential to EIA review processes.

5.1. Element 1: use of science and analysis in EIA review

Use of science in the review process is the most widely studied aspect of NEPA performance. Scholars have empirically measured the quality of the science used in EISs, as well as the quality and comprehensiveness of EIS treatment of difficult-to-measure impacts, such as climate change or cumulative effects (Peterson, 2010; Karlson et al., 2014; Lees et al., 2016; and Stein, 2010). Similar measures are also used by practitioners: from 1984 to 2018 (U.S. EPA, 2021), EPA assessed the quality and comprehensiveness of EISs as a tool to help agencies improve over time.

Here, we distinguish two functions: (1.1) the quality and the scope of the information used to support agency decisions and (1.2) the quality and scope of the analysis. Informational quality refers to value and appropriateness of information used in the EIA. This function can be more specifically investigated through three variables, including: (1.1.1) the extent to which the EIA process draws upon relevant existing information, such studies conducted on similar locations or projects; (1.1.2) how the EIA process incorporates expertise to inform the review—for example, consultation with area or subject matter experts, relevant agencies, or local communities who possess traditional knowledge; and (1.1.3) how the EIA process identifies and addresses gaps in relevant knowledge by collecting new data using recognized best practices. An EIA process that incorporates sufficient informational scope and quality is one that leverages existing information where available, incorporates expertise where possible, and fills in areas of uncertainty as needed.

The quality and scope of the analysis used in the EIA is the second underlying function of an EIA's use of science and analysis. The key variables to be studied here include: (1.2.1) the extent to which consideration was given to a range of alternatives suitable for the type of project proposed for all reasonable alternatives; (1.2.2) consideration of all impacts—particularly, significant but hard-to-measure impacts–including environmental, social, cultural, economic, and equity impacts; and (1.2.3) comprehensiveness of the analysis of indirect, cumulative, and long-range impacts. These latter two impacts are particularly important for ensuring that important and consequential project impacts — such as effects on invasive species, on cultural justice, or cumulative, long-term project effects — are not ignored simply because they are difficult to quantify or accrue across multiple projects.

Existing work provides a roadmap for how such variables might be measured. For example, Peterson (2010) use a set of criteria developed by the European Union to evaluate the quality of the science and analysis in Estonian EISs. Similarly, Stein (2010) assesses EIS performance in addressing climate change by soliciting expert opinion to develop four categorical indicators of high-quality climate change assessments, and then examining EISs to determine whether those indicators are present. Because appropriate indicators of quality and scope might vary across different project types, these types of performance measures might be project-specific rather than universal across all EISs.

5.2. Element 2: nature of the public participation process

The second element of procedural performance is the nature of the public participation process. High-quality public participation is recognized as critical to NEPA and environmental regulation write large (Eckerd and Heidelberg, 2019; Hoover and Stern, 2014; Hourdequin et al., 2012; Beierle, 1998). A growing number of case studies qualitatively explore the role of public participation in the EIA process (Tang et al., 2008; Chi et al., 2014; Glucker et al., 2013), however, there have been few attempts to empirically measure the extent or quality of the public participation process.

Here, we identify three underlying functions that contribute to the performance of public participation: (2.1) the opportunities that agencies provide for stakeholders and the public to engage in the NEPA process; (2.2) the quality of the actual engagement that occurs as a result; and (2.3) the perceived legitimacy of the public participation process. Agencies' efforts to engage the public may translate into two variables: (2.1.1) efforts taken to notify the public of a proposed decision-making process; and (2.1.2) opportunities that the agency provides the public to provide comments or otherwise participate — for example, via scoping meetings, public hearings, or the duration of notice-and-comment periods and decisions to extend them. These agency efforts at engagement can be readily quantified with textual information from EISs. While such measures might not be suitable as stand-alone variables measuring opportunities for engagement, they could be compared across similar projects or otherwise benchmarked to create meaningful measures of the extensiveness of public participation opportunities, relative to a group of comparable projects.

In addition to the overall extensiveness of notification and opportunities to comment, an additional variable (2.1.3) represents the reasonableness of agency efforts to engage communities who are most likely to be affected by a proposed project. Agencies' efforts to reach out to and engage with marginalized communities could also be objectively observed and assessed, using appropriate criteria. Rowe et al. (2017), for example, synthesize a set of observable "best practices" developed by tribes and practitioners to guide agencies' tribal consultation processes. Similar indicators could be developed to assess the sufficiency of agencies' efforts to reach out to affected communities, particularly those who are marginalized or under-represented in decision making (see also Rowe and Finley, 2021).

The second underlying function contributing to the quality and level of public participation is (2.2) the quality of the public engagement that results from the opportunities extended by the agency, defined as the actual participation and contribution of stakeholders and the public in the EIA process. The quality of public participation processes may vary in a number of ways, as presented in the key variables in Table 1: (2.2.1) the extensiveness of the stakeholder participation relative to the scale of the potential impacts; (2.2.2) the diverse modes of participation – including attending meetings, providing comments, and engaging in deliberation with agency decision-makers; and (2.2.3) the diversity of interests and preferences represented in the participation process.

The third underlying function we elaborate on for public participation is (2.3) that of the perceived legitimacy of the EIA process. Legitimacy within the EIA process has been defined as "one which all stakeholders agree is fair and which delivers an acceptable outcome for all parties" (Bond et al., 2012, p. 188). This speaks to the foundational intentions of NEPA to inform the public about the potential effects of government activities and enable and promote informed public participation (Tai, 2005). Perceptions that an EIA process is fair may strengthen perceptions that the agency's action decision is also a legitimate one (Tyler, 2006), another related concept underlying the accountability of substantive performance discussed in the next section. Given the pluralistic context where differing views on legitimacy are likely to occur, we focus on perceived legitimacy here and define it as the confidence of stakeholders and the public in the EIA process. This function can be represented by three key variables: (2.3.1) stakeholder satisfaction with access to information and the opportunities to engage; (2.3.2) stakeholder satisfaction with the agencies' consideration of and response to public inputs; and (2.3.3) stakeholder perceptions of the

[2] For a thorough review of the evolution of performance evaluation of EIA projects and systems, see Loomis and Dziedzic, 2018.

Table 1
Functions & variables for procedural performance of EIAs.

Elements procedural performance	Underlying functions	Key variables
1. Use of Science & Analysis in EIA Review	1.1: Quality & scope of information Incorporation of information into the EIA review process	1.1.1. EIA incorporates relevant existing scientific knowledge 1.1.2 EIA draws on relevant expertise to inform review & analysis, including expert knowledge & local traditional knowledge 1.1.3 EIA identifies and addresses gaps in relevant knowledge by collecting new data using best practices.
	1.2: Quality & scope of analysis Extensiveness & comprehensiveness of analysis of impacts & comparison of alternatives	1.2.1 Extensiveness of alternatives compared 1.2.2 Completeness of impact assessment (environmental, social, cultural, economic, equity) 1.2.3 Comprehensiveness of indirect, cumulative, or long-range impacts analysis
2. Nature of Public Participation Process	2.1 Opportunities for public to access information & engage in EIA process Agency efforts to engage the public in the EIA process	2.1.1 Timeliness & extensiveness of public notification 2.1.2 Extensiveness of opportunities for the public to provide comments & participate 2.1.3 Reasonableness of efforts to make engagement accessible to relevant communities
	2.2 Quality of public engagement Actual participation & contribution of stakeholders & the public	2.2.1 Extensiveness of stakeholders' participation 2.2.2 Diversity of ways that stakeholders participate 2.2.3 Diversity of stakeholders' interests & substantive contributions
	2.3 Perceived legitimacy of process Confidence of stakeholders & the public in the EIA process	2.3.1 Stakeholder satisfaction with access to information & opportunities to engage in the process 2.3.2 Stakeholder satisfaction with agency consideration & response to public inputs 2.3.3 Stakeholder perceptions of EIA process as transparent, fair, & compliant with law & policy
3. Management of EIA Process	3.1 Resources applied to EIA preparation Commitment of personnel & other resources to specific EIA process & procedural compliance	3.1.1. Personnel & other resources devoted to EIA process 3.1.2 Extensiveness of coordination with cooperating agencies in EIA process 3.1.3 EIA processes comply with laws & CEQ & agency regulations and guidance
	3.2 Capacity of assigned personnel Skills, experience & training of personnel assigned to specific EIA	3.2.1 Knowledge & experience of review team leader with NEPA & managing EIA processes 3.2.2 Contribution of project personnel with NEPA experience & relevant subject area expertise 3.2.3 Professional accountability of personnel (inhouse, cooperating agencies & contractors)
	3.3 NEPA complementarity Institutional & behavioral support for NEPA at agency level	3.3.1 Alignment of agency mission & culture with NEPA Section 101 3.3.2 Commitment of resources (staff, budget) to NEPA reviews 3.3.3 Agency norms and practices influencing individual behavior, motivations & attitudes

Table 2
Functions & variables for substantive performance of EIA recommendations & agency action decisions.

Elements of substantive performance	Underlying functions	Key variables
4. Quality of EIA Recommendation and Agency Decision	4.1 Substantiated recommendation Preferred alternative is informed by the analysis in EIA process	4.1.1 Changes, refinements or improvements made from initial proposal & preferred alternative to final recommended alternative 4.1.2 Incorporation of information & analysis as well as public comments into final recommended alternative
	4.2 Substantively beneficial recommendation Final preferred alternative creates net public benefits with respect to environmental, social & economic considerations	4.2.1 Final preferred alternative weighs expected environmental, social & economic benefits & addresses tradeoffs 4.2.2 Change in level of expected environmental impacts from initial proposal to recommended alternative 4.2.3 Equity of the distribution of environmental risk in final preferred alternative
	4.3 Substantiated decision Consonance of agency action decision with recommended alternative	4.3.1 Consistency of agency action decision with recommended alternative 4.3.2 Consistency of conditions in mitigation & monitoring requirements in action decision with recommended alternative and EIA analysis
5. Accountability of Final Preferred Alternative	5.1 Responsive recommendation Preferred alternative is responsive to expressed concerns	5.1.1 Agency considers & responds to comments, concerns, or issues raised by project proponents, cooperating agencies, other governments, stakeholders & the public
	5.2 Perceived legitimacy of recommendation Cooperating agencies, other governments, stakeholders & the public view the preferred alternative as legitimate	5.2.1 Cooperating agencies, other governments, stakeholders & the public perceive the recommendation takes their interests & concerns into account 5.2.2 Stakeholders perceive that the recommendation is just. 5.2.3 If contested, administrative & judicial tribunals uphold NEPA review.
6. Efficiency of EIA Process and Preferred Alternative	6.1 Efficient decision Public investment in EIA process is commensurate with stated public benefits of preferred alternative	6.1.1 Quality of preferred alternative commensurate with public resources & time spent on EIA process 6.2.2 Accountability of the preferred alternative is commensurate with public resources & time spent on EIA process

degree of transparency and fairness of the process and compliance with law and policy.

5.3. Element 3: management of the EIA process

The third element of procedural performance addresses management of the EIA process. This is an area that is more frequently examined in EIA system studies (Loomis and Dziedzic, 2018). This dimension incorporates three underlying functions: (3.1) the resources and procedures used to produce the EIA; (3.2) the capacity of personnel assigned to the EIA process; and (3.3) the extent to which agencies' formal protocols and informal norms support EIA production and NEPA compliance.

The first underlying function (3.1) focuses on the resources committed to the EIA preparation in complying with the specific EIA processes and procedures. Key variables to operationalize this function include: (3.1.1) personnel and other resources devoted to the EIA; (3.1.2) the extensiveness of coordination with cooperating agencies; and (3.1.3) the extent to which the EIA process complies with the law and CEQ and specific agency regulations and guidance.

The capacity of those assigned personnel also matters. Drawing from United Nations Development Programme, 2007, Kolhoff et al. (2009) refer to capacity as "the ability of individuals, institutions and societies to perform functions, solve problems, and set and achieve objectives in a sustainable manner." (p. 272). We conceptualize capacity more specifically as derived from the skills, experience and training of those involved in carrying out the EIA (3.2). The variables we have articulated relate concretely to the use of this capacity in the context of EIA processes: (3.2.1) the knowledge and experience of the EIA team leader in conducting NEPA reviews; (3.2.2) the contribution of project personnel with NEPA experience and their relevant subject area expertise; and (3.2.3) the professional accountability of personnel, in particular, whether they are located within the lead agency, cooperating agencies, or working as contractors.

The third underlying function contributing to EIA management is (3.3) NEPA complementarity, defined as the formal and informal support for NEPA provided by the lead agency responsible for conducting the EIA. Largely measured at the agency level, these may include: (3.3.1) the alignment of agency mission and culture with NEPA, Section 101; (3.3.2) the commitment of agency level resources to NEPA review in overall staffing and budgets; and (3.3.3) existing norms and practices within the agency that may influence staff behaviors, motivations and attitudes. There is evidence that the norms, attitudes, and beliefs of personnel preparing the EIA can influence the process and its management (Auer et al., 2011; Stern et al., 2010). For some researchers, these might be considered control variables. We would expect interaction between NEPA complementarity and resources and staff capacity available to EIA processes.

6. Substantive performance dimension

Substantive performance refers to the extent to which the substance of an agency's recommendation and final decision is affected by the EIA process (Loomis and Dziedzic, 2018; Baker and McLelland, 2003; Bond et al., 2013b; Chanchitpricha and Bond, 2013; Sadler, 1996). Continuing the numbering scheme from Table 1, we articulate four elements that compose substantive performance presented in Table 2: the (4) quality of NEPA recommendations and decisions; (5) accountability of the final preferred alternative, and (6) efficiency of the EIA process and preferred alternative.

6.1. Element 4: quality of recommendation and decision

The first element of substantive performance highlighted is (4) the quality of the recommendation and decision. In essence, we want to know the extent to which the review produces a recommendation that produces public value. This is the central question for substantive performance and, in the case of NEPA, perhaps the most difficult. We identify three underlying functions reflecting decision quality: (4.1) a substantiated recommendation; (4.2) a substantively beneficial recommendation; and (4.3) a substantiated decision. A substantiated recommendation is one that is informed by the EIA process, evidence for which could be found in two key variables: (4.1.1) Changes, refinements or improvements made from the initial proposal and preferred alternative to the recommended alternative; and (4.1.2) the incorporation of information and analysis as well as public comments into the final preferred alternative. Variable 4.1.1, for instance, has been operationalized in a study of 16 BLM oil and gas EISs by Ruple and Capone (2016). They found that several expected environmental impacts were higher in the draft EISs and lower in the final EISs, suggesting that the final EISs incorporated information and analysis from the review process and ultimately reduced the environmental impacts of the analyzed oil and gas projects (Ruple and Capone, 2016).

A substantively beneficial function (4.2), in contrast, refers to the extent to which net benefits would accrue to the public were the recommended action approved and implemented, considering environmental, social, and economic project costs and benefits. We identify three key variables that can be used individually or collectively to distinguish among NEPA decisions for this construct: (4.2.1) the extent to which the final preferred alternative weighs expected environmental, social and economic benefits; (4.2.2) the nature and extent of change in the level of expected environmental impacts from the initial proposal to the review decision; and (4.2.3) the level of equity in the distribution of environmental risk in the final preferred alternative.

Finally, U.S. agencies do not have to choose the action recommended by the EIS. Thus, decision quality is also reflected in the action decision, defined as the final agency determination. In the case of an EIS, this is recorded in the Record of Decision (ROD). Many action decisions are fully aligned with the final preferred alternative and provide terms and conditions for action on the selected alternative. But this is not always the case. Accounting for this potential discrepancy in performance, we identify an underlying function of substantiated decisions (4.3) that refers to the consonance of action decisions with the EIA recommendations. Two variables arise here: (4.3.1) the consistency of the action decision with the agency's preferred alternative in the FEIS; and (4.3.2) the consonance of approval conditions and mitigation requirements adopted in the ROD with those recommended as part of the preferred alternative in the FEIS.

6.2. Element 5: accountability of the review decision

The next element of substantive performance is (5) the procedural accountability of the review decision. Procedural accountability refers to the quality of the agency's decision-making process (Dawson and Maricut-Akbik, 2021) in terms of soliciting and addressing feedback other agencies and levels of government, stakeholders affected by the proposed action, the public at large (West, 2004). Procedural accountability does not mean that a decision satisfies everyone, particularly when stakeholders have competing or unrealistic demands. Instead, procedural accountability increases perceptions of fairness and legitimacy (Hibbing and Theiss-Morse, 2002; Grimes, 2006; Bond et al., 2018) by addressing, or at least acknowledging, expressed concerns, and making people feel like their voice has been heard (Ulbig, 2002). Accordingly, a (5.1) review decision is responsive to the extent that it acknowledges and responds in some way to expressed concerns. One key variable has been defined as: (5.1.1) the extent to which the agency considers and responds to comments, concerns, or issues raised by project proponents, cooperating agencies, other governments, stakeholders & the public. The (5.2) perceived legitimacy of the review decision refers to the how the cooperating agencies, other governments, stakeholders & the public view the decision. Three key variables have been developed for this construct: (5.2.1) Cooperating agencies, other governments, stakeholders & the public perceive that the decision takes

their interests and concerns into account; (5.2.2) Stakeholders perceive that the decision is just; and (5.2.3) if contested, administrative & judicial tribunals uphold NEPA analysis.

6.3. Element 6: efficiency of the review decision

The final element of substantive performance (6) is the efficiency of the review decision. While prior literature has identified a concept of "transactive effectiveness" (Chanchitpricha and Bond, 2013; Loomis and Dziedzic, 2018), this term has not been well-developed. Although it is tempting to equate efficiency with time spent to finalize an environmental review, this provides an incomplete picture of whether the decision process was efficient. For example, an environmental review might take a very long time because it identified significant harms and required modifications to the proposed project; in such an instance the additional time is not evidence of inefficiency but rather evidence of the effectiveness of EIA to avoid significant harms. Here, we define the underlying function of efficiency (6.1) as the public investment made in an EIA process commensurate with the public benefits provided by the review decision.

Two variables are identified for operationalizing this efficiency function: the first relating decision quality (public value created and public harms avoided) to the EIA costs (6.1.1); the second relating the accountability of the decision (its responsiveness to expressed concerns) to the costs of conducting the EIA (6.2.2). Measures of efficiency then would require the construction of the ratio of the quality and/or responsiveness of the decision to the time and other resources spent on review.

7. Use-case demonstrations for evaluating performance

Conceptual frameworks are meant to serve as roadmaps for coherent inquiry (be they scholarly or applied research). Once concepts are clarified and variables consistently specified, researchers can design appropriate measures with which to assess the quality and/or quantity of the variables under study in a given case. Having developed this framework for evaluating the procedural and substantive performance of EIAs, the multiplicity and complexity of the variables become quite apparent, as do the measurement challenges. While the authors of this study initially attempted to include key measures for each variable in our framework, we quickly recognized that actual measures will vary considerably across analysts, given the variation in potential research questions, access to case information, and data collection techniques. Also, as comprehensive as our framework is on these two dimensions, it would be daunting to expect a fully comprehensive analysis of EIA performance using all the identified variables. More probable and feasible, however, is that analysts would hone in on a particular subset of elements, functions and variables pertinent to their inquiry, the framework serving as landscape scale map from which they then choose a viable route to their specific destination.

With that in mind, we developed two hypothetical use case applications to demonstrate how analysts might use the framework to evaluate selected concepts of procedural performance (Use Case 1) and substantive performance (Use Case 2). In both use cases, we assume that the analysts will use the individual EIA as the main unit of analysis; that the analyst will undertake an appropriate case selection and/or sampling strategy to identify a number of EIAs to include in the analysis; and that the text of the EIA will provide the primary underlying data source for the analyst to operationalize the variables identified in the use case.

7.1. Use Case 1: agency use of wildfire-relevant science in land management plans

Our first hypothetical use case focuses on wildfire management in the American West. Federal land agencies must mitigate the risk of wildfires spreading from federal lands to neighboring communities (Kelly et al., 2019). In recent decades, scientific research on wildfire has burgeoned, and a range of different researchers might have different questions about land management agencies' performance in incorporating this new knowledge into the EIA process. At the most local level, communities in fire-prone areas might want to know whether nearby land management agencies are using the most up-to-date science in their EIA processes. Regional public authorities might want to compare performance across multiple land management agencies to identify high-performing agencies to serve as role models, or low-performing agencies who could use additional capacity building. Academic researchers might be interested in learning whether land management agencies who incorporate new science into their EIAs have more success in preventing and managing fire damage. While these research questions vary, they all require the analyst to conceptualize and measure performance in some way.

This first use case illustrates a hypothetical analyst (who could be from a public agency or a university research institution) who wishes to evaluate land management agencies' *procedural performance* in incorporating scientific knowledge about wildfires into their land management plans. The procedural performance element most closely aligned with these questions is function 1.1 (Table 1), the quality and scope of information used in the EIA review process. Table 1 lists three potential variables for assessing the quality of information: (1.1.1) the use of relevant scientific knowledge; (1.1.2) the use of relevant expertise, including non-academic expertise and traditional knowledge; and (1.1.3) the identification and addressing of gaps in relevant knowledge through the use "best practices" to collect new data.

The approach to measuring the first variable (1.1.1) – use of relevant scientific knowledge – may depend somewhat on the state of relevant scientific knowledge in the given domain. Here, the analyst could use a two-step process to first identify recent or prominent publications and products (e.g., data tools or modeling programs), and then assess whether those resources have been referenced in the EIA's citations and footnotes. To complete the former task, the analyst might consult with subject matter experts, or use Web of Science or similar databases to identify the recent or highly cited resources. To complete the latter task, the analyst can track citations, footnotes, and similar references found in the EIS itself, which provides a straightforward measurement of where and what information is entering into the agencies' planning for this issue. Readily available bibliometric tools can then be applied to the EIA's citations to create quantifiable measures of whether or to what degree relevant scientific resources were consulted. Both the data and the analyses must be assessed independently. This measurement strategy would not capture whether the EIA made *good use* of these sources—this is captured in function 1.2, quality & scope and analysis – but it would serve to quantify what scientific information and resources are being used in the EIS.

Finally, it is important to note that simply measuring the use of scientific resources, by itself, does not necessarily tell the analyst whether the EIA performed well on function 1.1. To assess performance, the analyst must develop some sort of evaluative criteria, benchmark, or threshold, against which the agency's actual use of scientific information may be compared. In other words, variable 1.1.1 could be operationalized to measure the degree to which an EIA incorporates relevant scientific information, but to assess whether the observed degree is consistent with high-performing EIA, the analyst will need to define criteria and assess whether or not the observed use of science is consistent with those criteria. A comparative analysis across a well-constructed sample of multiple projects, of course, can provide a basis for determining relative performance levels.

7.2. Use Case 2: integration of community perspectives in federal highway projects

Our second hypothetical use case focuses on federal highway reconstruction and expansion and draws attention to NEPA's potential

role in mitigating negative social impacts of federal activities, particularly growing concerns over environmental injustices that are initiated or exacerbated by federal activities. Historically, federally subsidized highway projects in the U.S. have been disproportionately – and intentionally – routed through communities of color, causing significant economic disruption, diminished quality of life, and negative health outcomes for remaining residents (Archer, 2020; Bullard et al., 2004; Retzlaff, 2019). Most of the initial buildout of the U.S. highway system occurred prior to NEPA's passage, and thus with no requirement for community consultation or engagement. But starting in 1970, highway expansions would have been subject to NEPA's public participation requirements. And in 1994, President Clinton issued an Executive Order on Environmental Justice (59 CFR 7629) that now requires agencies to use the NEPA process to assess whether federal projects are likely to have disproportionate effects on communities of color.

Federal agencies charged with NEPA oversight and performance evaluation, project proponents seeking to comply with CEQ EJ regulations, and EJ advocates, among other analysts and researchers, might wish to assess or compare how effective agencies were in engaging communities of color in the NEPA process, in including environmental justice concerns as part of the EIA analysis, or in producing review decisions that respond to community concerns. Others might wish to see if agency performance on environmental justice has changed over time, whether the 1994 Executive Order has reduced environmental justice concerns, or whether there are regional patterns in the persistence of environmental justice problems.

This use case illustration specifically concerns an analyst who wishes to assess federal agencies' NEPA *substantive performance* in integrating community perspectives in federally funded highway reconstruction and expansion projects. Given this context, the Federal Highway Administration might be interested in conducting an internal review to evaluate its own substantive performance in providing an accountable review decision that is responsive to environmental justice concerns (concept 5.1, Table 2). The primary variable in our framework relevant to this inquiry would be the responsiveness to expressed concerns is how the agency considers and responds to issues raised by stakeholders during the EIA process (5.1.1, Table 2). In this case, responsiveness is most likely manifested in two ways—either through changes made to the project itself in response to comments and concerns, or through how the agency responses to the comments and concerns received in a responsive and substantive manner.

Measuring both behaviors at scale poses significant methodological challenges—the research must assess both the nature of the comments and concerns received and then assess how and whether the agency responded to this input. Thus, the analyst must first spend enough time with the text to identify and characterize environmental justice-related input on the project. Then, the analyst must assess whether and how the agency made any changes to the analysis, the findings, or the recommendation of the EIS in response to this input. Finally, because agencies can be responsive to comments even when no change to the EIS is made (e.g., by answering a query or providing clarification the commentor), the analyst must assess the nature of the agencies' comment response. While some aspects of this measurement process might presumably be automated, the holistic nature and subtextual features of responsiveness indicate that accountability may, for now, remain an important dimension of substantive performance that is well-suited to qualitative analysis in small-*n* studies.

8. Discussion

The performance of EIA has come under increasing scrutiny from both scholars and practitioners. While the scholarly community has put considerable effort into identifying and conceptualizing multiple dimensions of EIA performance (Chanchitpricha and Bond, 2013; Pope et al. (2018), many of these dimensions remain under-studied, or studied through practitioners' perceptions of the system rather than through empirical observation of the way that EIA systems function at the project level. In their recent review of the literature, Loomis and Dziedzic (2018) identify several areas where additional research is needed, including more studies that include multiple dimensions of effectiveness; more empirical testing of the relationships between dimensions; more comparative sub-national research; and more understanding of whether and how the EIA process changes decision-making over time. In this paper, we advance a framework that is designed to help analysts respond to these calls for more research. Our framework builds on existing scholarship on the main *dimensions* of performance, but fills a critical gap by providing analysts with a range of possible variables that can be used to operationalize dimensions of performance, using text drawn from EIA documents. These variables can then be used to engage in the kinds of analysis that Loomis and Dziedzic (2018) identify as key gaps – including exploring relationships between multiple dimensions of performance, assessing how EIA affects decision making over time, or engaging in cross-case comparison.

The example use-cases both demonstrate single-target research questions: (1) to what extent are scientific resources related to wildfire science being used in EIAs? and (2) how well and to what extent are highway project EIAs engaging local communities and responding to potential environmental justice concerns? Considering these questions reveals the power of our framework to focus inquiry on specific questions while embedding that inquiry within a broader framework of NEPA performance. But they also suggest that our framework could be used to ask more complicated questions about the relationships between or among various types of procedural and substantive performance, a major research gap identified by Loomis and Dziedzic (2018).

In the wildfire case, for example, our use case describes how an analyst might operationalize procedural performance variables related to the use of wildfire science in the EIA process. The analyst might then go on to operationalize substantive performance variables described in our framework, such as whether the final preferred alternative reflected the latest scientific recommendations. Similarly, in the second use case, the analyst might sample a wide range of transportation EISs, and use them to assess whether there are relationships between the quality of public engagement (an element of procedural performance) and the agency's responsiveness to stakeholders (an element of substantive performance). Indeed, enabling researchers, policymakers, and stakeholders to examine relationships among performance variables, and to do so using a common vocabulary that organizes inquiry along common dimensions, is a core aim of this framework.

Similarly, our framework proposes a set of variables that can be used to compare performance across implementing agencies or over time. Several scholars have raised questions about how the EIA process itself affects decision making over time presumably, agencies conducting EIA learn from their experiences, and over time this learning may proactively shape the kinds of projects that agencies propose and the decisions that they make (Jones and Morrison-Saunders, 2017; Loomis and Dziedzic, 2018). Our framework can be used to shed light on these questions by offering a set of variables that analysts could apply to individual EIAs over time – to explore, for example, if procedural performance changes as agencies gain experience with the process, or whether agencies with more EIA experience have better substantive performance.

Our framework also draws attention to the efficiency of the EIA process, an element that the literature often refers to as "transactional effectiveness" and has recognized as under-studied empirically (Loomis and Dziedzic, 2018). The traditional approach of considering transactional effectiveness as a unidimensional concept is challenging in the case of a decision-making framework such as NEPA because transactional effectiveness is relative in nature. It is not clear, for instance, whether an EIA took too long or cost too much without considering these costs relative to the value of the information generated. Our framework provides analysts with guidance about how to more fully operationalize these "transactional" elements in relation to one another.

The value of a multi-criteria performance framework is not simply that it presents a more comprehensive view, but further that it provides a means by which to capture these sorts of tradeoffs. The performance measures we identify are rooted in normative ideas about good governance generally and the role of EIA specifically and emphasize the value of responsiveness and legitimacy in agency decision-making. However, to truly assess "performance," most analysts will need to define their own criteria against which to evaluate EIA performance using the measures in our framework. For example, if an analyst establishes accountability as an important dimension of performance, they might then develop indicators, based on the variables in sections 5.1.1 through 5.2.3, that can be used to categorize EIA processes into "low accountability" and "high accountability" categories. In other words, we provide variables that operationalize elements of performance, but leave it to the individual analyst to define which dimensions are most critical to performance, as well as how to define whether "performance" has been met in an individual case.

We also provide this framework during a time when researchers are developing new and innovative tools for treating text as data. Indeed, this is no accident: this paper was written by a group of collaborators at the University of Arizona who are interested in developing and using these tools to better evaluate NEPA processes. While a full explication of the potential for computational tools and machine learning processes is outside the scope of this paper, we want to emphasize that new and emerging computational tools offer significant potential to automate or reduce the labor costs of obtaining the variables and measures that we offer here for assessing NEPA. We urge researchers from a wide range of disciplines to embrace both the challenge and the potential benefits that might come from a fuller assessment of NEPA's performance.

9. Conclusion

This article has proposed a novel performance framework for evaluating EIA processes along six elements—three procedural and three substantive—and it has identified underlying functions and primary variables to be measured for each function. Our framework addresses conceptual challenges to evaluating NEPA. Prior NEPA research has often been driven by data used largely because they were easily available. In the absence of a framework for performance, it is difficult to draw any firm conclusions from such data. Now, existing data can be viewed in the context of the full suite of performance functions relevant to evaluating NEPA as a complex, multi-target statute.

We recognize, of course, that even the most robust conceptual framework does not solve the practical problems associated with compiling information inputs. NEPA researchers have often been stymied by measurement challenges–which may account for the tendency to simply count whatever can most easily be observed. These challenges are perhaps best illustrated by the difficulty locating and obtaining EISs and their supporting documents.

Fortunately, many measurement problems will be lessened as the outputs of NEPA become more accessible. Some federal agencies provide NEPA documents digitally, and there are efforts to centralize aspects of federal decision-making processes through, for example, the http://regulations.gov website. Non-government efforts also exist, including the *NEPAccess* project, with which the authors are involved. This effort is hosted by the University of Arizona and is providing a large-scale, query-able database of NEPA documents coupled with a learning platform that includes artificial intelligence analytic resources (http://NEPAccess.org).

Evaluating NEPA performance is pressing. Debates over NEPA reform continue to grow in intensity. Understandably, in the absence of robust, rigorous data, the discourse surrounding NEPA reform has been largely ideological in nature. Our framework has transformative potential, allowing policymakers and researchers to investigate NEPA performance and to propose data-driven improvements.

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