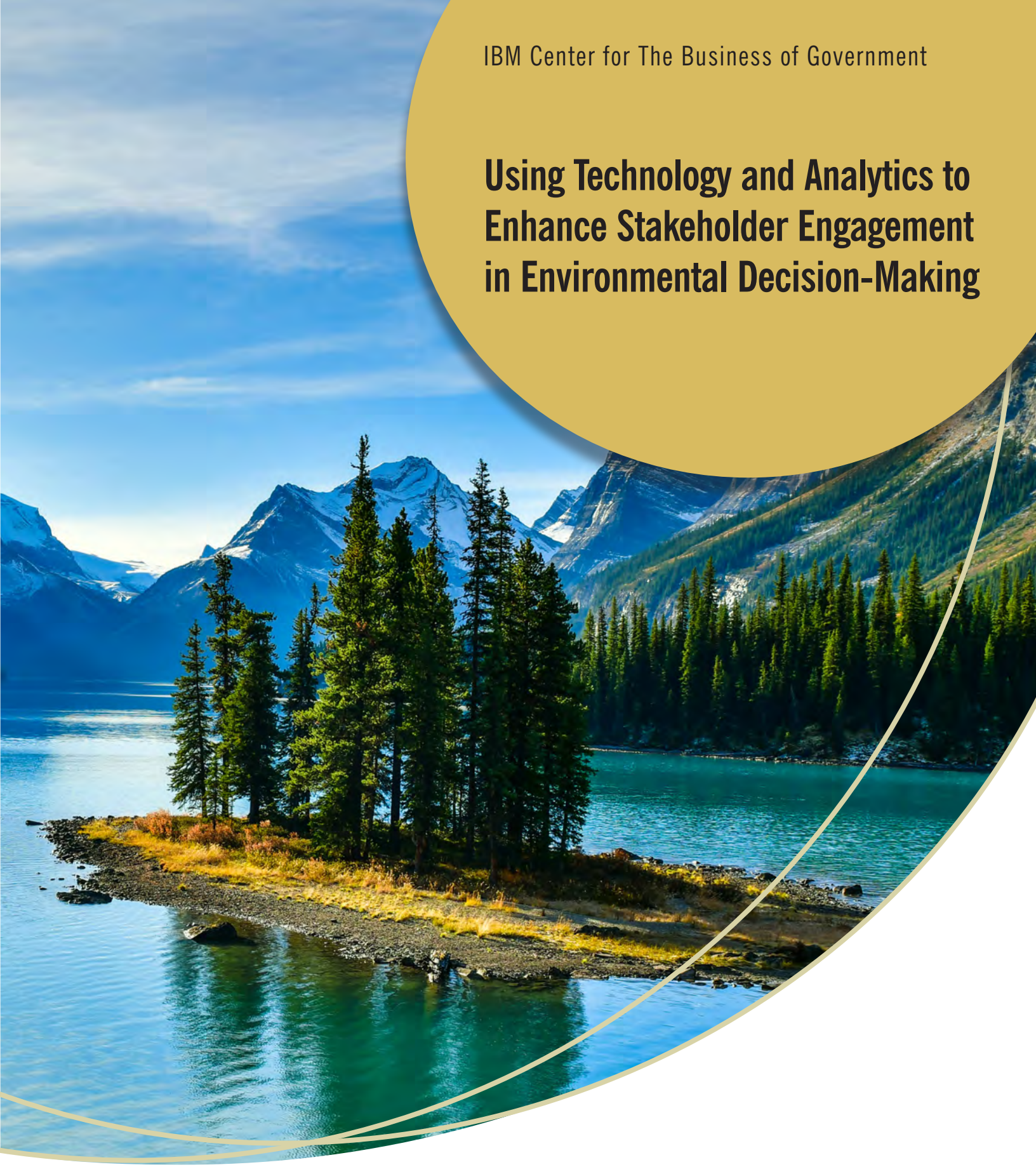
IBM Center for The Business of Government

Using Technology and Analytics to Enhance Stakeholder Engagement in Environmental Decision-Making



Jenna Yeager
Public Lands Foundation

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The Business of Government
2021

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FOREWORD

On behalf of the IBM Center for The Business of Government, we are pleased to publish this new report, *Using Technology and Analytics to Enhance Stakeholder Engagement in Environmental Decision-Making,* by Jenna Yeager of the Public Lands Foundation.

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ADAM JELIC

A key provision in the National Environmental Policy Act (NEPA) calls for public participation in the environmental review of proposed actions by federal executive agencies. The law created the Council on Environment Quality (CEQ) and directed individual agencies to implement NEPA in a manner consistent with their respective department and agency missions.

This report covers NEPA activities as conducted by the four major federal land management agencies: Bureau of Land Management (BLM); National Park Service (NPS); Fish and Wildlife Service (FWS) within the Department of the Interior; and the Forest Service (FS) within the Department of Agriculture (specifically in the area of stakeholder engagement). Together, these four agencies manage over 650 million acres—a sizable portion of America's public lands.

The research by Jenna Yeager focuses on how stakeholder engagement has been facilitated through the use of technology, such as dedicated agency apps that provide relevant content to stakeholders regarding proposed actions. The report then explores how agencies can use analytics and artificial intelligence to enhance their set of engagement tools.

The author views the NEPA process through the lens of *data* and *analytics,* rather than through the more common lens of governmental policy or organizational effectiveness. The reports focuses on the *intersection* of four components: NEPA, stakeholder engagement, the four land management agencies, and analytics/AI.

The report seeks to identify what type of functionality external stakeholders need and expect when participating in agency NEPA actions. Not surprisingly, the existing stakeholder requirement frameworks were found to concentrate mostly on facilitation, trust building, communication, and similar soft skills—all critical to the success of any endeavor—but were largely silent on tools/technology. For that reason, the report leverages existing sources to create a *custom* framework containing nine stakeholder requirements, rolled up into three categories. The research also finds that meeting NEPA stakeholder expectations requires *holistic* service delivery at the agency level, not just within the NEPA program.

Two key takeaways can be derived from this research:

- The four agencies vary in their ability to fulfill the nine NEPA stakeholder engagement requirements; none currently provides adequate support for the highest stakeholder level, collaboration.
- Achieving enhanced NEPA stakeholder collaboration requires improving overall agency service delivery (e.g., data and information), not simply modernizing the key apps that support NEPA.

Yeager acknowledges there is no 'magic' path forward, nor are there only technical solutions. Analytics and AI will play an increasingly important role in the future. But in the context of stakeholder engagement, they may enable progress in a manner not necessarily visible to most stakeholders. This report ends with a summary of near-term and mid/long-term recommendations. Agencies are encouraged to adopt the recommendations that best meet their needs and align with their budgets.

This report joins a library of IBM Center research focusing on how technology and analytics can improve decision-making, including: *Silo Busting: The Challenges and Successes of Intergovernmental Data Sharing*; *More Then Meets AI Part I* & *Part II*; *Integrating Big Data and Thick Data to Improve Public Service Delivery*; and *From Data to Decisions I* & *II*.

We hope that the analysis and recommendations outlined in this report will help government agencies and stakeholders take advantage of evolving capabilities and enhance their federal environmental decision-making using technology and analytics.

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EXECUTIVE SUMMARY

Public participation in environmental review of proposed actions by federal executive agencies is a key provision of the National Environmental Policy Act (NEPA), which was enacted over 50 years ago.

The law created the Council on Environment Quality (CEQ) and directed individual agencies to implement NEPA in a manner consistent with their respective department and agency missions.

This report covers NEPA activities as conducted by the four major federal land management agencies: Bureau of Land Management (BLM), National Park Service (NPS), and Fish and Wildlife Service (FWS) within the Department of the Interior; and the Forest Service (FS) within the Department of Agriculture, specifically in the area of stakeholder engagement. Together, these four agencies manage over 650 million acres—a sizable portion of America's public lands.

The research focuses on how stakeholder engagement has been facilitated through use of technology, such as dedicated agency apps which provide relevant content to stakeholders regarding proposed actions. It then explores how agency tools could be enhanced in the future using analytics and artificial intelligence (AI).

The report views the NEPA process through the lens of *data* and *analytics* rather than through the more common lens of governmental policy or organizational effectiveness. The view is therefore narrow and focused; it's essentially at the *intersection* of four components: NEPA, stakeholder engagement, the four land management agencies, and analytics/AI.

The research sought to identify what type of functionality external stakeholders need/expect when participating in agency NEPA actions. Not surprisingly, the existing stakeholder requirement frameworks were found to concentrate mostly on facilitation, trust building, communication, and similar soft skills—which are critical to the success of any endeavor—but were largely silent on tools/technology. For that reason, it was necessary to leverage those existing sources to create a *custom* framework containing nine stakeholder requirements, rolled up into three categories:

Discovering content

Stakeholders can:

- **Review** the proposed action
- **Access agency content** pertinent to the proposed action ('what' content is searched)
- **Search agency content** pertinent to the proposed action ('how' text and spatial content is searched)
- **Download** data sets, analytical results, spatial data, APIs, etc. related to the proposed action

Analysis and context

Stakeholders can:

- **Use interactive tools** to explore the proposed action
- **Assist in agency resource analysis** performed under NEPA

Communication and collaboration

Stakeholders can:

- **Comment** on or submit alternatives for the proposed action
- **Provide data and analysis** directly to agency
- **Engage** in communications with agency re: resource issues, decisions, and pre- or post-decision monitoring

The research drew on four principal sources: 1) the author's past experience supporting automated systems in BLM and FS that are used for NEPA; 2) the author's observations while navigating the agencies' websites as a member of the public (vs. previously as an employee); 3) review of relevant content found on public sector, vendor, and other websites; and 4) communications with agency staff and managers, key vendors, and NGO (nongovernmental organization) stakeholders.

As the research progressed, it became clear that the nature of stakeholder engagement for the four agencies has evolved over the years, not simply with NEPA but also with land use planning and multiple agency activities. While many of the earlier documents refer to 'public involvement,' more recent agency initiatives speak of 'stakeholder engagement'—a much deeper type of participation.

Use of the newer tools described in the report can help mitigate some of the current barriers to participation. Interviews conducted as part of this research revealed a common thread that stakeholders often found it very time consuming to become engaged; many simply didn't have the 'bandwidth' and expertise to navigate the multiple, often confusing processes. Thus, for example, they might remain at the 'inform' level of engagement and send 'form' letters during comment periods when they'd really prefer to be at the 'consult' level for a given NEPA action. As we will see in the report, the tools offer the flexibility for stakeholders to move to higher levels of engagement.

The research also found that meeting NEPA stakeholder expectations requires *holistic* service delivery at the agency level, not just within the NEPA program. For this reason, though the automated systems of the agencies which support NEPA (e.g., BLM's ePlanning) form the *foundation,* these need to be accompanied by comprehensive and consistent delivery of agency content and context. For example, one of the nine stakeholder requirements describes the ability to find relevant information regarding *prior* NEPA actions and land use plans for the same geographical area, so that the stakeholders can assess the proposed action within the context of previous decisions.

Fortunately, the tools that agencies can employ to foster stakeholder engagement provide significant *internal* benefits as well; in fact, the internal benefits could far outweigh the external benefits, since they are applied to numerous mission objectives. For example, tools such as cognitive search and location intelligence, as described in the **'Future Opportunities'** section, can also assist in land use planning, fire rehab planning, monitoring studies, and in many more areas. Also, the tools which aid stakeholder engagement are rarely specialized tools requiring separate budget allocations.

This report ends with a summary of near-term and mid/long-term recommendations. Agencies are encouraged to adopt the recommendations which best meet their needs and align with their budgets.

INTRODUCTION

NEPA 101

Short history of NEPA

The National Environmental Policy Act (NEPA) of 1969 (PL 91-190) § 4321[1] was signed into law by President Nixon on January 1, 1970. NEPA was the first major environmental law in the United States and is often called the 'Magna Carta' of environmental laws. Importantly, NEPA established this country's national environmental policies.[2]

The Act created a new organization within the executive office entitled the 'Council on Environmental Quality (CEQ)' and directed individual agencies to implement NEPA in a manner consistent with their respective department and agency missions.

In NEPA, Congress recognized that the federal government's actions may cause significant environmental effects. The range of actions that cause significant environmental effects is broad and includes issuing regulations, providing permits for private actions, funding private actions, making federal land management decisions, constructing publicly-owned facilities, and many other types of actions. Using the NEPA process, agencies are required to determine if their proposed actions have significant environmental effects and to consider the environmental and related social and economic effects of their proposed actions.[3]

Since its inception just over 50 years ago, there have been a number of modifications and clarifications to NEPA, both from the CEQ and within the agencies. The most recent changes took effect on September 14, 2020; there may also be changes in CEQ and agency-specific direction under the Biden administration. Though some processes relating to citizen involvement have changed (such as the length of public comment periods), citizen involvement has remained a core tenet of NEPA.

Agency NEPA policy and operations

In 1978, CEQ issued binding regulations directing agencies on the fundamental requirements necessary to fulfill their NEPA obligations. The CEQ regulations set forth minimum requirements for agencies. The CEQ regulations also called for agencies to create their own implementing procedures that supplement the minimum requirements based on each agency's specific mandates, obligations, and missions. These agency-specific NEPA procedures account for slight differences in agencies' NEPA processes.[4]

This approach thus gives the agencies flexibility in the way they conduct their NEPA activities. In many ways, this is advantageous, since they are not dependent on a 'one-size-fit-all' solution that may not meet their needs. As the report will show, the agencies have thus developed various technical solutions, which address the nine stakeholder requirements in different ways. It was found that the four agencies can benefit from increased use of AI/analytics, as shown in later sections of this report.

1. "The National Environmental Policy Act of 1969 as amended," Pub. L. 91-190, 42 U.S.C. 4321-4347, January 1, 1970. https://ceq.doe.gov/laws-regulations/laws.html.
2. Executive Office of the President. Council on Environmental Quality. "A Citizen's Guide to the NEPA: Having Your Voice Heard." December 2007, 2. https://www.energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-CEQ-CitizensGuide.pdf.
3. Ibid., 4.
4. Ibid., 6.

Main types of environmental analyses conducted under NEPA

As a quick reminder, the three main types of NEPA analyses are:

- *Environmental Impact Statement (EIS)*—For major federal actions that may significantly affect the quality of the human environment, NEPA requires preparation of an EIS. An EIS is a detailed analysis of the potential environmental impacts of a proposed action and the range of reasonable alternatives. Public participation is an important part of the EIS process.[5]
- *Environment Assessment (EA)*—When the need for an EIS is unclear, an agency may prepare an EA to determine whether to prepare an EIS or to issue a Finding of No Significant Impact. An EA is a brief analysis. The agency's procedures provide notification and comment opportunities for host states and tribes. The agency also may provide notification and comment opportunities for other interested people. The agency then considers any comments received, makes revisions as appropriate, and issues the EA.[6]
- *Categorical Exclusion (CE, CX, or CatEx)*—The agency's NEPA regulations list classes of actions that normally do not require an EIS or an EA because, individually or cumulatively, they do not have the potential for significant environmental impacts.[7] Examples in the four land management agencies include vegetation treatments (such as fire rehabilitation and restoration), road maintenance, and grazing allotment fence reconstruction. The agencies' use of CEs has increased over the years, such as shown in the recent revision of Forest Service NEPA regulations. The new FS rule creates six new CEs, combine two existing CEs into one, and expand two others.[8]

Though this report will not delve into the details of these NEPA processes, it is important to keep in mind how these actions influence the type and level of stakeholder engagement. For example, there is likely to be considerably more interest (e.g., as judged by the sheer number of comments) for an EIS as compared with an EA, and the composition of the stakeholder community may also be different. The timeframes to complete the NEPA analysis will be far different as well.

A common thread—geospatial

One common characteristic of all federal land/resource management activities is that they involve location—an activity takes place at a particular location on the landscape. The area involved may be small (e.g., 1,000 acres) or very large (e.g., major watersheds). Agencies use the CE, EA, or EIS processes to determine the impact of those changes on the current environment and make predictions regarding the impact on future environments. All nine stakeholder requirements described throughout this report contain a geospatial component. The **'Future Opportunities'** section describes how cross-cutting 'location intelligence' can help meet those requirements.

5. U.S. Department of Energy. "DOE, NEPA, and You: A Guide to Public Participation." (2010). https://www.energy.gov/sites/prod/files/nepapub/nepa_documents/RedDont/G-DOE-NEPA_Brochure.pdf.
6. Ibid., 1.
7. Ibid., 1.
8. USDA Forest Service. "National Environmental Policy Act (NEPA) Compliance—Final Rule." *Federal Register.* November 19, 2020. https://www.federalregister.gov/documents/2020/11/19/2020-25465/national-environmental-policy-act-nepa-compliance.

NEPA analysis performed concurrently with other agency analysis

Natural resource activities are conducted by the agencies daily in response to many different drivers. NEPA is just one of them. Some of the other efforts include land use planning, compliance with the Endangered Species Act (ESA),[9] inventory and monitoring, and many more. NEPA activities (especially EISs and some EAs) are often conducted simultaneously with these other activities—the most common being revisions to land use planning documents (e.g., Forest Plan Revisions in FS, Resource Management Plan revisions in BLM).

Virtually all of these activities are conducted by interdisciplinary staff, not just NEPA program personnel. Similarly, decisions are made by the respective line officer (e.g., BLM district manager), not the NEPA local, state, or national program manager. This report covers only the subset of natural resource efforts and decisions that are conducted using NEPA to inform agency resource decisions. Thus, although these resource allocation decisions use NEPA methodology, they cannot properly be termed 'NEPA decisions.'

Agencies and stakeholders both benefit from having these efforts take place concurrently. An example is the recently completed BLM Browns Canyon (Colorado) RMP/EIS,[10] which provided a much-needed update to the underlying Resource Management Plan (following the established land use management plan revision processes) while at the same time addressing the impacts of the preferred alternative (using NEPA analysis processes). This combined approach was found to be more efficient (allowing both the RMP and EIS to be completed under the tight timeframes) and provide greater consistency, since the data sets, analysis processes, and stakeholder engagement practices were in synch. A significant additional benefit was that the Forest Service updated their land use planning documents for this co-managed area (a 'Forest Plan Revision') and shared (co-authored) the EIS.[11]

Similar tandem efforts could also include data/information in support of the Clean Water Act,[12] National Historic Preservation Act,[13] Clean Air Act,[14] and many others. The data can simply be analyzed and rendered in different formats as appropriate. To achieve that consistency, as this report will show, sound data management processes are needed to fulfill the data-driven objectives of the individual agencies.

Project scope

This research has a rather narrow scope: to describe how stakeholder engagement in NEPA is currently facilitated using a variety of automated processes—and how involvement can be enhanced in the future.

The research focuses on the four federal land management agencies who have the largest areas under their jurisdiction—namely, the Bureau of Land Management (BLM), National Park Service (NPS), and Fish and Wildlife Service (FWS) within the Department of the Interior; and the Forest Service (FS) within the Department of Agriculture. The key automated systems ('apps') from each agency that have external-facing components are:

9. "Endangered Species Act of 1973, as amended." Pub. L 93-205. 1973. https://www.fws.gov/endangered/esa-library/pdf/ESAall.pdf.
10. USDI Bureau of Land Management. "Record of Decision and Approved Resource Management Plan, Browns Canyon National Monument." July 2020. https://eplanning.blm.gov/eplanning-ui/project/69924/510.
11. USDA Forest Service. "Browns Canyon National Monument, Record of Decision and Approved Plan Amendment for the Pike and San Isabel National Forests & Cimarron and Comanche National Grasslands Land and Resource Management Plan." July 2020. www.fs.usda.gov/nfs/11558/www/nepa/106065_FSPLT3_5329869.pdf.
12. Environmental Protection Agency. "Clean Water Act." 1972. https://www.epa.gov/laws-regulations/summary-clean-water-act.
13. National Conference of State Historic Preservation Officers. "National Historic Preservation Act of 1966." https://ncshpo.org/resources/national-historic-preservation-act-of-1966.
14. Environmental Protection Agency. "Summary of the Clean Air Act." 42 U.S.C. §7401 et seq. (1970). https://www.epa.gov/laws-regulations/summary-clean-air-act.

- BLM: ePlanning/National NEPA Register[15]
- NPS: Planning, Environment and Public Comment (PEPC)[16]
- FWS: Environmental Conservation Online System (ECOS)[17]/Information for Planning and Consultation (IPaC)[18]
- FS: Schedule of Proposed Actions (SOPA)[19]

The report focuses on how stakeholder engagement has been facilitated through use of technology, such as these dedicated agency apps which provide relevant content to stakeholders regarding proposed actions, including the gathering and analysis of public comments. The report then explores how agency tools could be enhanced in the future using analytics and artificial intelligence (AI). 'Stakeholder engagement,' 'analytics,' and 'artificial intelligence' are described briefly in the sections below.

As can be seen, this research views the NEPA process through the lens of data and analytics (and associated workflows) rather than through the more common lens of governmental policy or organizational effectiveness. The recommendations (using analytics/AI) thus transcend the individual NEPA programs and suggest ways in which the agencies can function in a more interdisciplinary fashion by leveraging data as an enterprise asset.

Key concepts

Stakeholders

The Udall Center for Environmental Conflict Resolution provides an excellent definition tailored to natural resource agency decision-making. In general, stakeholders may include:

- Potentially- and clearly-affected governmental agencies and nongovernmental economic, cultural and environmental organizations with motivation and resources to participate on an ongoing basis
- Loosely-organized or non-organized groups and individuals interested in participating in specific areas that affect them
- Members of the public who may or may not participate, but need to remain informed about the project along with other stakeholders[20]

Note that 'stakeholders' include a large pool of interested parties, such as citizens, companies in the private sector, NGOs, state and local governments, tribal governments, and other federal agencies. The methods of engagement often follow specific protocols (e.g., tribal consultation or consultation with state governments). (There are, of course, *internal* agency stakeholders as well, but they are not discussed here).

15. USDI Bureau of Land Management. "ePlanning" (includes National NEPA Register). (Website) https://www.blm.gov/programs/planning-and-nepa/eplanning.
16. USDI National Park Service. "Planning Environment and Public Comment." (Website) https://parkplanning.nps.gov/.
17. USDI Fish and Wildlife Service. "Environmental Conservation Online System." (Website) https://ecos.fws.gov/ecp/.
18. USDI Fish and Wildlife Service. "Information for Planning and Consultation." (Website) https://ecos.fws.gov/ipac/.
19. USDA Forest Service. "Schedule of Proposed Actions (SOPA)." (Website) https://www.fs.fed.us/sopa/. Note—SOPA is the only external-facing part of the eMNEPA (Electronic Management of NEPA) suite; thus, in this report only SOPA is referenced).
20. Morris K. Udall and Stewart L. Udall Foundation, John S McCain III National Center for Environmental Conflict Resolution. "Principles for Effective Stakeholder Engagement in Infrastructure Permitting and Review Processes." Undated (2014+?), 1. https://www.udall.gov/documents/Institute/Udall-InfrastructureStakeholderEngagementPrinciples_Final.pdf.

Stakeholders also include minority and low-income populations as well as tribes and indigenous communities who are covered by the environmental justice provisions of NEPA and related guidance, such as Executive Order 12898.[21] Best practices can be found in a number of documents, such as the 'Community Guide to Environmental Justice and NEPA Methods.'[22]

It should be noted that particularly over the past decade there has been a gradual and subtle shift in the terminology used by the four agencies, as reflected not only in NEPA documents but also in such areas as agency strategic and tactical (action) plans, annual work plans, and others.

One indication of this shift is the more frequent use of the term 'stakeholder' vs. 'citizen.' 'Stakeholder' connotes that these individuals are not simply commenters or citizens who wish to share their thoughts in a neutral capacity; in the true sense of the word, they usually have an interest, a stake in the decisions that are made. Natural areas that they value, like for hunting and fishing, could be adversely affected by the proposed action. They wish to be heard and influence the outcome.

Engagement

Many stakeholders wish to participate more fully in NEPA, not just be informed about the proposed actions or simply attend a public meeting. They want the opportunity to submit comments but wonder if the agency really intends to listen. Some stakeholders, either as individuals or as representatives of NGOs, have significant expertise in resource issues and want to be included in an active manner, for example, by developing alternatives to proposed actions. This is a deeper, more active role—a truly *engaged* manner of participation.

As the research progressed, it became clear that the nature of stakeholder engagement for the four agencies has changed over the years, not simply with NEPA but also with land use planning and multiple agency activities. While many of the earlier documents refer to 'public involvement,' most now reference 'stakeholder engagement.' A 2018 Forest Service initiative, 'Toward Shared Stewardship Across Landscapes—an Outcome-based Investment Strategy'[23] references the term 'stakeholder' more than 40 times and contains numerous occurrences of words like 'engage,' 'involve,' 'coordinate,' and 'co-manage.' This document reflects the high degree of importance that the agencies have demonstrated in reaching out and actively engaging a wide range of interests.

Another reference expresses this change as 'capacity-building vs. event-oriented approaches' to engagement . . . to be truly effective, public engagement should never be a 'one and done' affair . . . to have lasting impact, public engagement must move beyond any event, beyond the 'project' phase, to become an evolving set of community practices and habits among leaders and the public that become embedded in the life of the community.[24]

'Public involvement' thus often tends to connote mostly a one-way channel of communication (from the public to the agency) in a series of separate events, as compared with 'stakeholder

21. Executive Office of the President. "Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," February 11, 1994. https://ceq.doe.gov/nepa-practice/justice.html.
22. Federal Interagency Working Group on Environmental Justice and NEPA Committee. "Community Guide to Environmental Justice and NEPA Methods: Working Towards Collaborative and Innovative Solutions." March 2019. https://www.energy.gov/sites/prod/files/2019/05/f63/NEPA%20Community%20Guide%202019.pdf.
23. USDA Forest Service. "Toward Shared Stewardship Across Landscapes—an Outcome-based Investment Strategy, FS-1118." (August 2018). www.fs.usda.gov/sites/default/files/toward-shared-stewardship.pdf.
24. Center for Advances in Public Engagement. "Public Engagement: A Primer from Public Agenda." 2008. https://metrocouncil.org/Handbook/Files/Community-Engagement/PublicEngagementPrimer.aspx.

engagement,' which is an active interchange of ideas (two-way) involving a deeper level of participation, a higher stakeholder interest in the final outcomes, and a continuing (vs. single event) relationship between the stakeholders and the agency.

There are a number of models which demonstrate the spectrum of engagement. One which particularly resonates for this research was created by the International Association for Public Participation (IAP2), whose graphic is shown below:[25]

Figure 1: IAP2 Spectrum of Public Participation

Increasing Impact On The Decision

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/ or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision-making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advoce and innovation in formulating solutions and incorporate your advice and recommenda-tions into the decisions to the maximum extent possible.	We will implement what you decide.

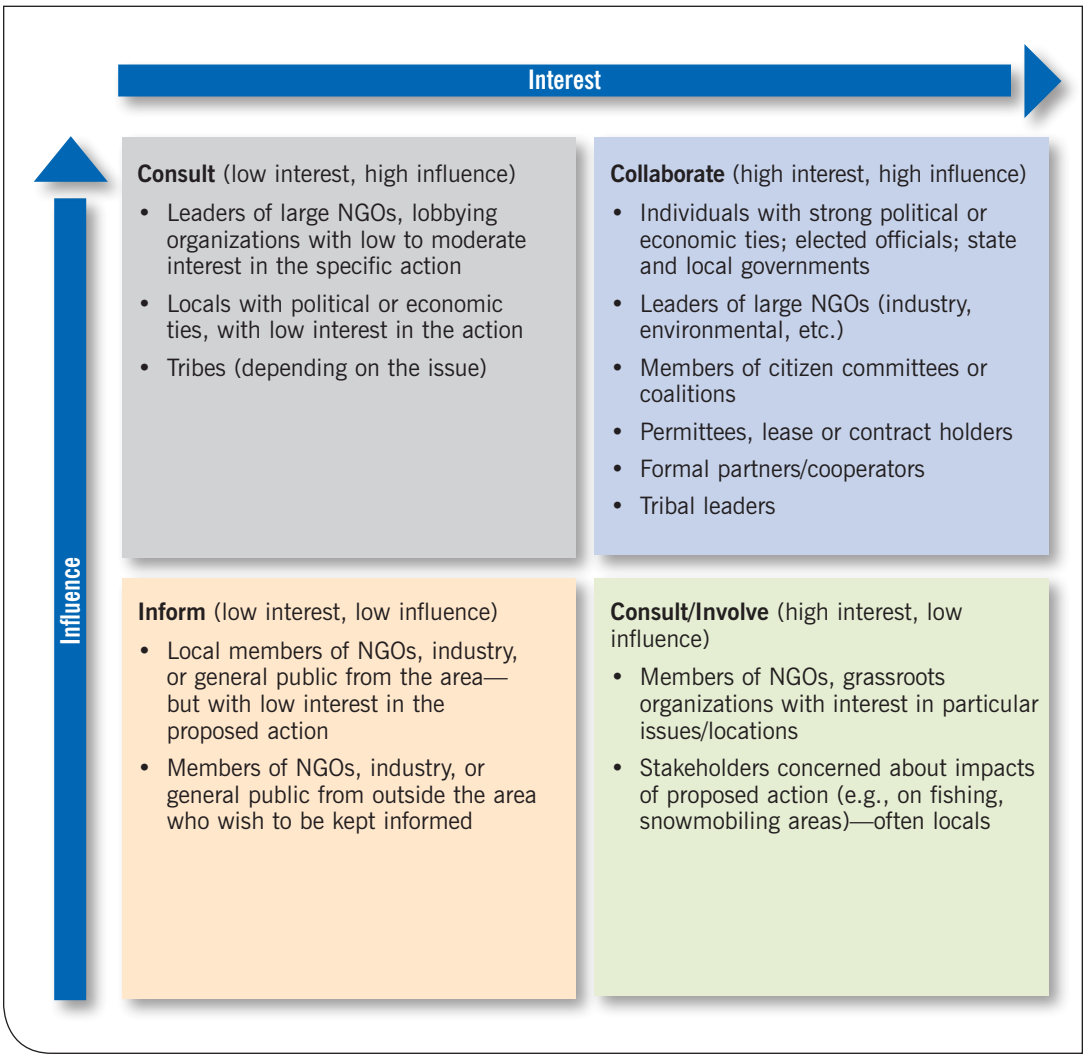
IAP2's Sectrum of Public Participation was designed to assist with the selection of the level of participation that defines the public's role in any public participation process. The Spectrum is used internationally, and it is found in public participation plans around the world.

Source: © IPA2 International Federation 2018. All rights reserved. 20181112_v1.

Another common portrayal of stakeholder management is a matrix which compares stakeholder interest and influence. The graphic below follows the format used by many similar matrices but is customized to provide examples for NEPA engagement.

25. IAP2. International Association for Public Participation. "IAP2 Spectrum of Public Participation." (Graphic), 2018. Reprinted with permission. (c) International Association for Public Participation. www.iap2.org.

Figure 2: Sample interest/influence (or power) matrix



It's also important to note that the level of stakeholder interest will likely vary depending on the specific proposed action. For example, local members of a national environmental organization may have a high interest in an action in their county (and want to be consulted/involved) but have a lower interest in a proposed action in a neighboring state (just want to be informed). Tracking these various interests and interrelationships for numerous stakeholders is a complex task, but, as will be shown in the **'Future Opportunities'** section, there is now specific stakeholder engagement software (often supported by analytics/AI) which can facilitate the task.

One of the desired outcomes of this research is that the four agencies, by implementing some of the recommendations, will simply make it easier for stakeholders to engage—at whatever participation level they desire.

The benefits of successful stakeholder engagement for the agencies are well documented so need little discussion here. As a reference, however, a BLM guide captures the benefits well: "Collaborative stakeholder engagement and dispute resolution processes often serve to mend or improve the overall relationship between parties because the focus is largely on identification of interests and common goals and on cooperation . . . preventing or resolving

conflict through these processes can reduce or resolve protests, appeals, and litigation and result in savings of time, budget dollars, and public resources."[26]

Analytics/artificial intelligence (AI)

The field of analytics is extremely broad, with many excellent definitions in the scientific literature and on the web. For the purposes of this report, the definition provided by SAS, a leader in analytics solutions, will be used:[27]

> *Analytics uses data and math to answer business questions, discover relationships, predict unknown outcomes, and automate decisions. This diverse field of computer science is used to find meaningful patterns in data and uncover new knowledge based on applied mathematics, statistics, predictive modeling, and machine learning techniques.*

A cursory overview of the types of analytics is provided below. Though there is inevitable variation among the numerous experts in the analytics field, many refer to four types (here, using Microsoft Azure's definitions):[28]

- Descriptive—What's happening? Usually in the form of dashboards that display current and historical sensor data, statistics, KPIs (key performance indicators), and alerts
- Diagnostic—Why is something happening? Diagnostic capabilities are often extensions to dashboards that allow users to drill into the data, pivot it in multiple ways, compare it, and visualize trends and correlations in an ad hoc way
- Predictive—What will happen? Usually implemented through machine learning models that are trained with historical data and deployed to the cloud so that they can be used by end-user applications
- Prescriptive—What actions should I take? Prescriptive analytics is still in its early stages. Often an extension of predictive analytics, where the user is presented with the steps a machine learning (ML) model took to reach a conclusion or prediction. While this is not quite a recommendation, it may provide some insight into the reasoning of the ML algorithm to hints at a recommendation

While it would be a fascinating study to see how each of these types of analytics applies to stakeholder engagement, such an effort would be well beyond the scope of this report. Similarly, there are multiple sources from which to select a definition for artificial intelligence (AI). In fact, because AI is often a buzzword—and usually very high on the 'hype' spectrum—the range of definitions can be overwhelming. For this report, the following definition seems appropriate:

26. USDI Bureau of Land Management. *National Natural Resources Policy for Collaborative Stakeholder Engagement and Appropriate Dispute Resolution: What BLM, Communities, and the Public Need to Know for Preventing Conflict and Resolving Disputes Involving Public Lands and Resources.* October 2009. https://www.blm.gov/sites/blm.gov/files/Services_CADREngagementandADRGuide.pdf.
27. SAS Inc. "Text Analytics for Executives: What Can Text Analytics Do for Your Organization?" White Paper (109630). Downloaded January 8, 2021. https://www.sas.com/content/dam/SAS/en_us/doc/whitepaper1/text-analytics-for-executives-109630.pdf.
28. Microsoft Azure. "Describe, Diagnose, and Predict with IoT Analytics." September 4, 2018. https://azure.microsoft.com/en-us/blog/answering-whats-happening-whys-happening-and-what-will-happen-with-iot-analytics.

Artificial intelligence (AI), also known as machine intelligence, is a branch of computer science that aims to imbue software with the ability to analyze its environment using either predetermined rules and search algorithms, or pattern recognizing machine learning models, and then make decisions based on those analyses.[29]

There are also variations on the meaning of the abbreviation 'AI.' Many of these seek to show that artificial intelligence is not a 'black box' solution but simply a valuable tool to be used in conjunction with other tools. Accenture, for example, speaks of AI as 'applied intelligence,'[30] while Gartner references several terms, including 'augmented intelligence.'[31]

This report highlights potential areas in which analytics/AI can help address the unmet (or partially met) stakeholder requirements. For example, the four agencies often receive thousands of comments from the public regarding proposed actions, such as construction of a new road. Currently, analysis of these comments for the most part is performed by human interpreters, often a tedious process; however text analytics (a subset of descriptive analytics—see above) could be used to help parse and categorize the large number of comments, thus allowing the staff more time to evaluate the concerns/comments and potentially refine the proposed action.

What's out of scope

The following items are worthy of further review but are considered out of scope:

- Facilitation techniques, alternative dispute resolution processes, etc.
- Trust building, relationship building, and similar soft skills
- Meeting management—e.g., how to organize in-person meetings, facilitate discussions, etc.
- Common user and office automation apps such as email routing, virtual whiteboards, collaboration sites (e.g., Microsoft Teams), conferencing apps (e.g., Zoom), etc.
- Specific technical solutions, such as selection of a particular product(s); instead, the report concentrates on types of functionality provided in the marketplace

29. Technopedia.com. "What Does Artificial Intelligence (AI) Mean?" 2021. https://www.techopedia.com/definition/190/artificial-intelligence-ai.
30. Accenture Federal Services. "Applied Intelligence—Ready for Government." Accessed January 4, 2021. https://www.accenture.com/us-en/services/us-federal-government/artificial-intelligence.
31. Gartner Inc. Information Technology Glossary. "Augmented Intelligence." Accessed January 7, 2021. https://www.gartner.com/en/information-technology/glossary/augmented-intelligence.

Research Approach

The previous section provided an overview of the various components of this research—NEPA, stakeholder engagement, the four land management agencies, and analytics/AI. The first three components have a wealth of accumulated knowledge. Analytics/AI has roots in work done decades earlier, however it has seen exponential growth in recent years. Each component, when viewed in isolation, clearly contains its own substantial body of knowledge.

The research challenge was thus exploring the *intersection* of the four components—where are the touch points? How do they interrelate? How much cross-cutting research has been conducted? Can we extract understandable, meaningful, and actionable insights from this research that assist natural resource managers in their decision-making?

Since the research was undertaken to evaluate the current state and to make recommendations for future actions, it was evident that some type of framework was necessary. Not surprisingly, however, no such framework that touched all four components could be found. As a result, a custom framework was created, which leveraged a number of existing sources[32] [33] [34] [35] and reflected the practitioner-oriented nature of this research.

The stakeholder framework

Nine different requirements for NEPA stakeholder engagement were identified in the new framework; these were grouped into three categories, as shown below:

Discovering content

Stakeholders can:

- **Review** the proposed action
- **Access agency content** pertinent to the proposed action ('what' content is searched)
- **Search agency content** pertinent to the proposed action ('how' text and spatial content is searched)
- **Download** data sets, analytical results, spatial data, APIs, etc. related to the proposed action

Analysis and context

Stakeholders can:

- **Use interactive tools** to explore the proposed action
- **Assist in agency resource analysis** performed under NEPA

Communication and collaboration

Stakeholders can:

- **Comment** on or submit alternatives for the proposed action
- **Provide data and analysis** directly to agency
- **Engage** in communications with agency re: resource issues, decisions, and pre- or post-decision monitoring

32. USDI Bureau of Land Management. *National Natural Resources Policy for Collaborative Stakeholder Engagement and Appropriate Dispute Resolution*. October 2009. https://www.blm.gov/sites/blm.gov/files/Services_CADREngagementandADRGuide.pdf.
33. Center for Advances in Public Engagement. "Public Engagement: A Primer from Public Agenda," p.2. 2008. https://metrocouncil.org/Handbook/Files/Community-Engagement/PublicEngagementPrimer.aspx.
34. Yalta Amsalu. Kahoots: "Collaboration Your Way. Transforming Public Sector Stakeholder Engagement: Effective Digital Channels and Strategies—A Public Sector Guide." (undated). http://www.kahootz.com/wp-content/guides/Transforming_public_sector_stakeholder_engagement.pdf.
35. Ruell, Emily W, Nina Burkardt, and Ryan M. Donovan. U.S. Geological Survey, in cooperation with the Bureau of Land Management. "A Survey of Bureau of Land Management Employees on Collaboration and Alternative Dispute Resolution. Open–File Report 2015–1015." 2015. https://pubs.er.usgs.gov/publication/ofr20151015.

Using the framework

The first step was to use the new framework to assess to what extent the four agencies are *currently* meeting the requirements. This was the 'current status' or 'as-is' portion of the analysis. For example: BLM's ePlanning/NEPA Register app was found to offer significant functionality for the 'search agency content' requirement; the author was able to find related land use plans and NEPA decision documents that provided valuable context for a sample of (new) NEPA proposed actions described in the online app.

Online research was conducted by the author (logging into the agency websites as a member of the public) and feedback from agency interviews was gathered in order to develop the current 'as-is' baseline for the four agencies. The interviews were conducted with a wide variety of individuals from NGOs and political offices, data/analytics vendors in the marketplace, and agency personnel (from business and technical areas). The interviews served to confirm and refine many of the author's observations.

As the researched evolved, it was found that the focus on *individual* apps for a particular stakeholder requirement was found to be too narrow. Instead, it was more appropriate to consider a *suite* of agency apps and services that could be summarized by the term 'agency service delivery.' What this means in practical terms is that a number of requirements can be met *outside* of the specific NEPA software suite. Illustrative examples are the latter three requirements in the 'discovering content' portion, which tap into *agencywide* search and query functionality, well beyond the NEPA program itself.

Since much of the information was quite detailed, however, it needed to be 'rolled up' to a higher level and summarized in the **'Current Status'** portion of this report.

The next step was to investigate how these nine stakeholder requirements could be addressed by vendor solutions in the marketplace. For example, in the public comment analysis example we saw previously, text analytics tools could make this task much more efficient. Similarly, data visualization/BI (business intelligence) tools provided by any number of vendors would allow agencies to better meet the stakeholders' 'use interactive tools' requirement.

Information on the potential use of these tools was derived from vendor websites and through a series of interviews with selected vendors. Results are described in the **'Future Opportunities'** section of the report.

Current Status—Addressing Stakeholder Requirements

This section presents the research findings on how well the agencies are currently meeting the nine stakeholder requirements. Typically, the four agencies have websites dedicated to each NEPA proposed action, referred to as 'NEPA project websites' in this report.

Discovering content

This category refers to the ability of stakeholders to discover information about the proposed action itself, as well as other information which provides necessary background and context. What agency content is searched and how it is searched are key elements.

Stakeholders can review the proposed NEPA action

Stakeholders are notified of the upcoming NEPA action, can read a description, and can access relevant documents and maps that the agency provides. Also includes 'upcoming NEPA' notices (e.g., on local websites and/or RSS feeds) as well as mail/email notices sent using mailing lists.

The role of this requirement in enhancing stakeholder engagement is straightforward. It provides the basic information regarding the proposed action and how to participate. It often contains maps in pdf format, and provides information for all types of stakeholders—from those who simply want to be informed to those who want to be involved and collaborate.

BLM *currently* provides information through its ePlanning portal, while NPS uses the PEPC (Planning, Environment & Public Comment) system. The Forest Service does not have an equivalent site, but does publish quarterly updates to the Schedule of Proposed Actions (SOPA) (national site), while the Fish and Wildlife Service posts at the individual (refuge) level. Some stakeholders remark that the content provided is insufficient (e.g., not providing key documents, shapefiles, or sufficient background.)

Stakeholders can access agency content pertinent to the proposed action ('what' content is searched)

Stakeholders can see lists of current and past agency NEPA, land use planning, and other documents/data and access them. These additional documents and spatial data (beyond what the agency includes as part of the NEPA package) help provide background and context.

The role in enhancing stakeholder engagement centers around the frequent stakeholder need for additional background information in order to understand and comment on the proposed action, such as what other resource decisions have been made in this area, how the actions align with existing land use plans, etc. This requirement covers the ability of the stakeholders to discover and access that content. The more relevant the content the stakeholders can access, the better they can understand the issues and provide more insightful feedback.

Currently, BLM's ePlanning/NEPA Register repository contains a large number of NEPA documents that may be related to the proposed action; similar functionality exists in the PEPC system (NPS). The Forest Service does not have an equivalent public-facing NEPA site, but stakeholders may find relevant documents by navigating other FS sites. BLM, NPS, and FS all have external-facing data portals, such as those that use ArcGIS Online (AGOL),[36] a product from ESRI, a geographic information system company. FWS often posts content at the individual unit (refuge) level, so information on related projects may be found there.

36. ESRI. ArcGIS Online (AGOL). (Computer application/webpage). Overview found at https://www.esri.com/en-us/landing-page/product/2019/arcgis-online/overview.

Stakeholders can search agency content pertinent to the proposed action ('how' text and spatial content is searched)

Stakeholders can use a variety of search methods, including 'canned' terms or keywords for text queries; or 'canned' spatial filters (e.g., county boundaries) or user-supplied geometry (e.g., polygons) to query agency documents/data.

The role in enhancing stakeholder engagement involves providing stakeholders with tools that can make more meaningful, targeted searches with highly relevant results (vs. long lists of documents that they need to sort through). Stakeholders then can gain a better comprehension of the proposed action and can formulate recommendations.

Currently there is considerable variability among the four agencies with respect to this functionality. All feature 'basic' search functionality on the NEPA project landing page (to keep it straightforward), then an 'advanced search' button. All four agencies provide keyword searches (e.g., 'Canada lynx'), though it was found to be easier and more efficient with the BLM and NPS sites. Only two NEPA-related apps allow user-supplied geometry—Talking Points[37] (FS) with limited use, and IPaC (FWS).

Stakeholders can download data sets, analytical results, spatial data, APIs, etc., related to the proposed action

Stakeholders can receive data and analysis from agency that will allow them to conduct their own analyses as they evaluate and make recommendations regarding the current NEPA proposed action. Stakeholders can determine what data is most relevant for their needs.

This functionality *benefits a small but highly informed and influential subset of stakeholders* (such as regional and national environmental organizations) that can perform their own analyses. It should be noted, however, that as more and more free apps become available, a larger group of stakeholders will be able to conduct data capture and analysis.

Currently the four major natural resource management agencies are actively involved in publishing more of their data externally, such as through internal websites, ArcGIS Online (AGOL), data.gov, partnerships with nonfederal organizations, etc. Many local and state/regional offices with active land use planning and NEPA actions provide copies of digital data (e.g., ESRI shapefiles) that can be downloaded by the public using links at the NEPA site itself. Agencies often make APIs (application program interfaces) available to developers. Depending on the nature of the agreement, cooperating agencies and partners (such as universities) may have direct access.

Analysis and context

This category covers two stakeholder requirements that allow stakeholders to see the proposed action in context (what's the big picture?). Giving stakeholders the ability to analyze the action using interactive tools (such as visualizations or 'viz') adds another dimension to their understanding. This category also includes the ability for stakeholders to analyze comments made by others (if provided by the agency) and to assist the agency with development of alternatives. For the most part, agencies are not currently addressing these requirements, as virtually all of the NEPA analysis at this stage is done internally; however, in the future these advanced tools could allow stakeholders to be engaged in a more collaborative fashion.

37. ESRI, Inc. in conjunction with Forest Service. Talking Points Collaborative Mapping (software app). https://proceedings.esri.com/library/userconf/proc15/papers/890_503.pdf.

Stakeholders can use interactive tools to explore the NEPA action

In interactive sessions, stakeholders can select data layers for display, create visualizations and dashboards, develop summaries, etc., regarding the proposed action. A more sophisticated version of this would be users being able to conduct 'what if' scenarios—e.g., modifying the location of a proposed road, adding in their own data to the visualization, etc.

This functionality *brings a new dimension* to external-facing agency NEPA websites by moving beyond simple documents, tables, pdf maps, etc. into the interactive environment, in which stakeholders can choose various views of the data, run animations (simulations), access dashboards, etc. Use of the interactive environment provides *an additional learning and comprehension channel for stakeholders.*

Currently, no agencies appear to offer this functionality for NEPA projects at a regional/state or national level, though there may be some offices and/or programs that provide at least some of this functionality. For example, some offices provide an ESRI interactive story map, which allows uses to zoom in, pan, turn data layers on and off, etc.

Stakeholders can assist in agency resource analysis performed under NEPA

This functionality covers the role of stakeholders in the development of the NEPA analysis, as appropriate. The nature of the stakeholder participation will vary greatly, depending on the type of action (CE, EA, EIS). Though much of this analysis tends to be performed by the agencies (or their contractors), stakeholders occasionally participate in some capacity.

In many cases, agencies *work with stakeholders to formulate the alternatives and provide input for the draft/final documents*—such as through citizen coalitions and stakeholder committees. Active groups may submit comprehensive alternatives to be analyzed in a Draft EIS.[38] Agencies may also request stakeholder assistance in interpreting their (or another group's) comments during the comment analysis process.

Currently, the majority of this work is done internally using the agency interdisciplinary teams, other resource specialists, and managers. Stakeholder participation may take various forms depending on the nature of the proposed action and the engagement approach used by the local office.

Communication and collaboration

This third category refers to a suite of practices that foster close communication and coordination, including submission of public comments. Looking back at the levels of stakeholder engagement in the **'Research Approach'** section, one could characterize *current* agency activities as largely supporting 'inform' and 'consult,' and, in some cases, 'involve.' Future improvements, however, can allow the agencies to function more at the 'involve' and 'collaborate' level.

Stakeholders can comment on NEPA proposed actions

This requirement covers what content stakeholders can submit to the agencies as well as how they can comment. '*What*' entails the type of comment (text or spatial, attachments, etc.), while '*how*' covers the methods they use to comment (e.g., dedicated agency website, public meeting, email to staff, etc.). This item also includes the ability to see comments that others have posted (and, in turn, provide a response, if so designed).

38. Manti-LaSal Conservation Alternative (group). "Conservation Alternative." January 2, 2021 draft. https://www.mantilasalconservation-alternative.org/the-conservation-alternative-1.

Stakeholder engagement is enhanced by the ability to make public comments—one of the most visible and critical features of NEPA. Thus, tools need to be effective and comprehensive, and able to accommodate text and spatial comments at a minimum.

All four agencies *currently* provide guidance on how to comment (e.g., how to make 'substantive' comments). BLM and NPS have robust apps which provide information regarding the proposed NEPA action and have instructions on how to submit comments through their respective apps. FS has a national website with a public comment feature that can be enabled, but oftentimes relies on unstructured emails to the listed contact. FS can also enable a reading room at many stages, so users can see comments that others have posted. (Also, if the local FS office is using Talking Points, comments submitted there can be translated over to the internal Comment Analysis and Response Application system (CARA).[39] FWS does not have a national app for pushing out info on upcoming NEPA actions but does provide contact info. The ability for stakeholders to provide spatial comments using the agencies' NEPA-related apps is limited; spatial comments, however, can be submitted through other channels (e.g., email with attachments).

Stakeholders can provide data and analysis directly to agency

Stakeholders can furnish data and analysis to the agency regarding this project (e.g., through citizen science).

This functionality *represents a higher level of stakeholder engagement (i.e., collaboration),* augmenting the current capability, which largely limits input to the designated comment processes and formats. This requirement is for the agencies to be able to successfully import and leverage stakeholder-provided data and analytics.

The research did not discover any *current* channels for stakeholders to supply data/analytical results under the NEPA umbrella. No agencies have NEPA-focused portals that provide for input of scientific, georeferenced, repeatable, independently verifiable data visible to all users regarding the proposed action. All four agencies, however, have vehicles for importing data/analytics, though the approaches and maturity levels tend to vary—and the internal workflows to make that information available to inform the individual NEPA proposed action often do not exist.

Stakeholders can engage in communications with agency regarding resource issues, decisions, and pre- or post-decision monitoring

This category includes communications between the agency and stakeholders regarding ongoing resource issues (not necessarily NEPA-related), such as frequent discussions held in advance of publication of the intended NEPA action—or analysis of the outcomes of implemented actions, such as road construction or fire rehab. The latter category includes monitoring reports and similar analyses that inform downstream activities such as adaptive management.

39. USDA Forest Service. "Comment Analysis and Response Application." (Computer system—internal). Referenced in: https://www.usda.gov/sites/default/files/documents/fs-electronic-management-nepa-pia.pdf.

Effective stakeholder engagement tools, which collect, interpret, and summarize all channels of communication with the agency, *can help gain the trust of stakeholders* who know that their input is being acknowledged. Another benefit is that stakeholder interactions with different programs and different initiatives in the agency can be handled in a consistent and holistic manner, without them needing to repeat the same information to different offices/resource programs.

Currently, agencies merge the information collected in this step with the extensive amount of information from previous communications, plans, decisions, etc. Unfortunately, agencies usually store and interpret this content in multiple, disconnected ways. Stakeholder communications from, for instance, the FS Ranger District may not be shared with or readily visible to the FS Supervisor's Office. Communication records are often siloed. Automated tools are rarely used; often the content is found in stakeholder spreadsheets, standalone databases, etc.

Current status—summary observations

Clearly, there's considerable variation among the agencies with respect to how well they are currently meeting the nine stakeholder requirements. Agencies that display a higher level of maturity in these areas may be better positioned to leverage the newer tools (listed in 'Future Opportunities' below) in a shorter timeframe than the other agencies.

The research did not find any specific instances of AI and analytics currently being applied directly to NEPA stakeholder engagement. That's not surprising, considering that AI (and, to some extent, advanced analytics) are relatively new—and being applied first in other management areas and disciplines. As their use in NEPA (and specifically stakeholder engagement) begins, best practices and policies will be developed.

Future Opportunities

Overview

This section focuses on key types of technology identified during the research which have the potential of enhancing NEPA stakeholder engagement.

For the most part, this new functionality can be embedded into or interface with *existing* apps working in the background. In fact, all of categories listed below support *enterprisewide* mission needs; they are not 'standalone,' specifically targeted to stakeholder engagement only.

The technical disciplines below (e.g., cognitive search) are used across many programs and departments, though organizationally one unit (e.g., Data Management Program or Data Analytics/Data Science Program) may play a lead coordination role within the agency. Similarly, these disciplines are often directly or indirectly referenced in a variety of agency plans, such as IT strategic plans or the agency's digital strategy, rather than in a specific technical plan (e.g., 'agency Text Analytics Plan.')

This section is targeted to agency staff, managers, and executives within the agencies, so that they can become familiar with the technology at a high level, coordinate with their technical staffs, and begin to see how it can apply to their work (thus increasing business value), considering the sideboards described in the section entitled **'Common Factors that Influence an Agency's Next Steps.'**

Interview results showed that though none of the four agencies have used these new tools (except for perhaps location intelligence) on an agencywide basis specifically for NEPA environmental analysis, all appear to have familiarity with the tools. In some cases, the agencies are using the functionality listed below in other program areas, such as performance reporting (e.g., dashboards using business intelligence/data visualization) or in research and development (R&D).

The lists below are grouped by the familiar categories and are expressed in terms of tools—tools for discovering content, tools for analysis and context, and tools for communication and collaboration. The lists then examine each type of underlying technology or discipline, including how it uses AI/analytics and how it contributes to stakeholder engagement.

The report also describes the dependencies—what infrastructure/processes need to be in place in order to effectively leverage these new technological approaches? Unfortunately, as seen in the previous section, the four agencies generally show low to medium levels of maturity in many of these foundational areas.

In order to crosswalk the types of technology to established marketplace frameworks, the entries make reference to categories as described by Gartner, Inc.[40] (many of them with 'Magic Quadrant'[41] reports or 'Peer Insights' reviews).[42] For example, 'Visualizations and BI' are most closely associated with Gartner 'Analytics and Business Intelligence Platforms.'[43]

40. Gartner. "About us: Gartner equips executives across the enterprise to make the right decisions and stay ahead of change." https://www.gartner.com/en/about.
41. Gartner. "Gartner Magic Quadrant & Critical Capabilities." https://www.gartner.com/en/research/magic-quadrant.
42. Gartner. "Gartner Peer Insights." https://www.gartner.com/reviews/home.
43. Gartner, Inc. Gartner Peer Insights. "Analytics and Business Intelligence Platforms.' Accessed February 2, 2021. https://www.gartner.com/reviews/market/analytics-business-intelligence-platforms.

Tools for discovering content

Cognitive ('smart') search

Definition: Cognitive search is the new generation of information gathering technology. Using artificial intelligence (AI) capabilities such as natural language processing and machine learning to ingest, understand, and query digital content from multiple data sources, users receive results that are more relevant to their intentions. Cognitive search solutions are key in delivering the most valuable experiences to customers and employees alike.[44]

Representative Gartner categories: Content Collaboration Tools,[45] Content Services Platforms,[46] Insight Engines[47]

Role of analytics/AI: AI provides the 'cognitive' part, such that the algorithms can understand the context of the query (including past queries from the same user) and respond accordingly, yielding a prioritized list of results. Feedback loops using machine learning will make the query 'smarter' over time—in the back office, analytics/AI assists with data management/data governance/data-related workflows. Note: cognitive search involving geospatial data (geospatial search) is covered under **'Location intelligence'** below.

Dependencies: Mature data management and data governance processes; sound internal supply chain processes. Discoverable data stores. AI-assisted query software with machine learning feedback. Individual user profiles or personas.

How it supports stakeholder engagement: If the agency provides 'smart' search capabilities, stakeholders can explore additional content (data, documents, images, etc.) that they consider useful for their evaluation, such as previous resource decisions informed by NEPA analysis, monitoring results, etc. Optimally, cognitive search functionality would be enabled through an external, user-friendly search interface (e.g., 'show me evaluations over the past five years covering the outcome of sage grouse habitat restoration in Southeast Idaho').

Tools for analysis and context

Visualizations and BI

Definition: Business intelligence (BI) leverages software and services to transform data into actionable insights that inform an organization's strategic and tactical business decisions. BI tools access and analyze data sets and present analytical findings in reports, summaries, dashboards, graphs, charts and maps to provide users with detailed intelligence about the state of the business.[48] Data visualization is the process of translating large data sets and metrics into charts, graphs and other visuals. The resulting visual representation of data makes it easier to identify and, share real-time trends, outliers, and new insights about the information represented in the data.[49]

44. Coveo Solutions, Inc. "The Forrester Wave: Cognitive Search Q2." Accessed January 4, 2021. https://www.coveo.com/en/resources/reports/forrester-wave-cognitive-search.
45. Gartner, Inc. Gartner Peer Insights. "Content Collaboration Tools Reviews and Ratings." Accessed January 8, 2021. https://www.gartner.com/reviews/market/content-collaboration-tools.
46. Gartner, Inc. Gartner Peer Insights. "Content Services Platforms (CSPs) Reviews and Ratings." Accessed January 8, 2021. https://www.gartner.com/reviews/market/content-services-platforms.
47. Gartner, Inc. Gartner Peer Insights. "Insight Engines Reviews and Ratings." Accessed January 8, 2021. https://www.gartner.com/reviews/market/insight-engines.
48. CIO.com. "What is Business Intelligence? Transforming Data into Business Insights." Accessed January 4, 2021. https://www.cio.com/article/2439504/business-intelligence-definition-and-solutions.html.
49. IBM. Analytics. "Data Visualization: Find the Story Hidden in Your Data." Accessed January 5, 2021. https://www.ibm.com/analytics/data-visualization.

Representative Gartner categories: Analytics and Business Intelligence Platforms, Insight Engines, Data Management Solutions for Analytics,[50] and Data and Analytics Service Providers[51]

Role of analytics/AI: Analytics/AI can help identify the issues stakeholders are most concerned about and guide the way the information is presented. The interactive visualization sites can provide descriptive analytics based on stakeholder input. Analytics/AI can help agencies understand and design for what the stakeholders are expecting/needing as they navigate the NEPA project websites.

Dependencies: User-friendly websites (created using user-centered design). Agencies must have BI and visualization expertise available to the NEPA project staff. NEPA staff must know what the likely issues and stakeholder audiences are in order to deliver highly relevant content. If external-facing interactive tools are used (vs. simple displays), then the support requirement is even greater.

How these tools support stakeholder engagement: Using BI and data visualization tools in NEPA analysis would provide an additional, richer dimension for stakeholders to understand the proposed action not simply through words or static maps (largely the case now), but through graphics, charts, animations, dashboards, videos, and similar presentation vehicles. To date, these tools have seldom been used for stakeholder-facing NEPA activities in the four agencies. The reasons vary from agency to agency, but usually involve staffing/funding shortages; just trying to address the significant NEPA workload often leaves little time to explore new possibilities.

Text analytics

Definition: Text analysis is designed to derive value from text data when it is no longer humanly feasible to manually review and categorize that content. It allows organizations to augment and scale the human act of reading, organizing, and quantifying text—with the added benefit of uncovering patterns and information buried within.[52] In the context of this report, using text analytics agencies can collect, parse, interpret, and categorize huge amounts of text data, wherever they are found—e.g., in public comments, agency policy documents, legal decisions, etc.

Representative Gartner categories: Content Collaboration Tools, Content Services Platforms, Insight Engines

Role of analytics/AI: AI plays a central role with text analytics, being able to ingest huge quantities of structured or unstructured information and deriving insights.

Dependencies: Content used for analytics must be organized and accessible. Though some agencies may have text analytics expertise in house, there are many vendors who provide these services; thus, in-house, 'on prem' functionality is not necessary.

How it supports stakeholder engagement: Stakeholders benefit from the agencies becoming more timely in their analyses/feedback. In addition, use of AI-assisted text analytics has the

50. Gartner, Inc. Gartner Peer Insights. "Data Management Solutions for Analytics Reviews and Ratings." Accessed January 8, 2021. https://www.gartner.com/reviews/market/data-warehouse-solutions.
51. Gartner, Inc. Gartner Peer Insights. "Data and Analytics Service Providers Reviews and Ratings." Accessed January 8, 2021. https://www.gartner.com/reviews/market/business-analytics-services-worldwide.
52. SAS Inc., ibid. ["Text Analytics for Executives: What Can Text Analytics Do for Your Organization." White Paper (109630). Downloaded January 8, 2021, https://www.sas.com/content/dam/SAS/en_us/doc/whitepaper1/text-analytics-for-executives-109630.pdf.

potential for better tracking and interpreting comments, even identifying issues that human interpreters might miss. In the interviews with BLM and the Forest Service, both agencies mentioned that they are contemplating or have undertaken small proof-of-concept projects that use text analytics.

Sentiment analysis

Definition: Sentiment analysis is contextual mining of text which identifies and extracts subjective information in source material, and helping a business to understand the social sentiment of their brand, product, or service while monitoring online conversations.[53] Common platforms include social media, blogs, postings on agency websites, and emails.

Representative Gartner categories: Content Collaboration Tools, Content Services Platforms, Location Intelligence[54]

Role of analytics/AI: Because of the sheer potential volume of observations—likely in the hundreds or thousands for even small projects—AI plays a central role in sentiment analysis. Adding in the temporal and spatial dimensions—when and where were these sentiments expressed?—definitely requires the type of automated processing that AI provides.

Dependencies: Agencies need a vehicle through which they can collect and interpret the observations, ultimately placing them in categories or action areas. As with other areas, agencies need not have the in-house expertise but can contract out to a number of qualified vendors.

How it supports stakeholder engagement: Sentiment analysis gives agencies yet another communication channel. This type of analysis may be valuable at any stage, such as during pre-scoping (what issues are being raised?), during comment analysis periods (another channel the agency can tap into), or during alternatives analysis. In this manner, stakeholder feedback can be captured and interpreted, even though stakeholders may not be actively involved. Interview results did not show any of the four agencies using sentiment analysis as part of their NEPA analysis, but (anecdotally) it appears that sentiment analysis is conducted in other program areas.

Semantic analysis

Definition: Semantic analysis describes the process of understanding natural language–the way that humans communicate–based on meaning and context . . . it analyzes context in the surrounding text and it analyzes the text structure to accurately disambiguate the proper meaning of words that have more than one definition.[55] In the context of this report, semantic analysis of NEPA comments could identify nuances in word selection or intonation that human interpreters could miss.

Representative Gartner categories: Content Collaboration Tools, Content Services Platforms, Insight Engines

53. Shashank Gupta. "Sentiment Analysis: Concept, Analysis and Applications." (Blog). January 7, 2018. https://towardsdatascience.com/sentiment-analysis-concept-analysis-and-applications-6c94d6f58c17.
54. ESRI. Newsroom. "Five Myths About Location Intelligence." Accessed January 6, 2021. https://www.esri.com/about/newsroom/arcuser/five-myths-about-location-intelligence/.
55. Expert System. "Natural Language Processing Semantic Analysis: A Definition." (Blog). March 3, 2020. https://www.expert.ai/blog/natural-language-process-semantic-analysis-definition/.

Role of analytics/AI: Semantic analysis builds on a strong academic and operational basis. As above, the algorithms can interpret huge quantities of information; plus, the machine learning portion can become more accurate over time.

Dependencies: As with other types of functionality shown above, the key dependency is to assemble all the relevant, trusted documents/comments, so that the algorithms can deliver adequate results.

How it supports stakeholder engagement: Stakeholders, especially those from under-represented demographics, may use words or expressions in their oral and written comments whose nuanced meanings may be missed by the agency staff members who are analyzing stakeholder input. Semantic analysis, aided in the back office by AI, provides tools that may successfully interpret nuances and subtleties, taking into account cultural and historical perspectives. An example: the term 'environmental justice' has a much different meaning for indigenous communities than it does for most environmental organizations, as discussed by the Native American author Dina Gilio-Whitaker.[56]

Location intelligence (location analytics)

Definition: Put simply, location intelligence is the ability to derive business insights from geospatial information. Those with well-developed location intelligence abilities use geographic information systems (GIS), maps, data, and analytical skills to solve real-world problems, specifically business problems.[57] Location intelligence (LI) is achieved via visualization and analysis of geospatial data to empower understanding, insight, decision-making, and prediction. By adding layers of data—such as demographics, traffic, and weather—to a smart map, organizations gain location intelligence as they understand why things happen where they do. As part of a digital transformation, many organizations are relying on GIS technology to create location intelligence.[58]

Representative Gartner categories: Location Intelligence, Government Open Data Management Platforms,[59] Content Services Platforms

Role of analytics/AI: Analytics has traditionally played an important role in location intelligence, such as providing spatial descriptive analytics (e.g., map layers with attributes). With the advent of AI, analytics can play an even greater role, such as advanced spatial analysis that discovers relationships that human interpreters might not see, especially when there are hundreds or thousands of features. Also, analytics can play a huge role in image classification and change detection (e.g., changes in vegetation cover over past 30 years).

Dependencies: Agencies must have the relevant GIS software (e.g., ESRI) and staff expertise in order to maximize the effectiveness of location intelligence. They must also have the trusted spatial data identified and available for analysis.

How it supports stakeholder engagement: Resource decisions informed by NEPA analysis are inherently spatial. They affect an area on the landscape. Location intelligence expands upon the functionality described above (BI visualizations) by providing the geospatial component in making resource allocation decisions—e.g., how the various natural features interact with or

56. Dina Gilio-Whitaker. *As Long as Grass Grows: The Indigenous Fight for Environmental Justice, from Colonization to Standing Rock.* Beacon Press: Boston. April 2, 2019.
57. ESRI, ibid. [Newsroom. "Five Myths About Location Intelligence."]
58. ESRI. "Location Intelligence: Driving Digital Transformation." https://www.esri.com/en-us/location-intelligence.
59. Gartner, Inc. Gartner Peer Insights. "Government Open Data Management Platforms Reviews and Ratings." accessed January 8, 2021. https://www.gartner.com/reviews/market/government-open-data-management-platforms.

impact each other under different scenarios. All four agencies have a long history of using geospatial tools for solving business needs; that progress has continued as the discipline of location intelligence has transitioned into what many are now calling GeoAI.[60]

Tools for communication and collaboration

Stakeholder engagement tools

Definition: Stakeholder engagement software is used by organizations to analyze their stakeholders, to create communication and engagement plans, to log information about the interactions they have with communities and to ensure compliance with regulations.[61] Stakeholder engagement is a never-ending process. Companies must continually earn the trust and acceptance of their stakeholders. This ongoing cycle entails a number of steps, but they all fall under three key phases of stakeholder engagement: **Plan** (The importance of building a solid stakeholder engagement plan cannot be overstated); **Engage** (Only after you have a solid plan in place are you ready to engage with stakeholders); and **Measure** (The only way engagement teams can be certain their engagement strategy is on-track, on-schedule and on-budget is by measuring the outcomes of their engagement efforts.)[62] [63]

Representative Gartner categories: Business Process Management Processes,[64] CRM and Customer Experience Implementation Services[65]

Role of analytics/AI: AI is playing an ever-increasing role in stakeholder management/customer management, as the software can track hundreds of thousands or millions of interactions—and discern patterns and interrelationships.

Dependencies: Desired stakeholder information is visible, accessible, and updated on a continuous basis. Management must see the value of stakeholder engagement and commit the resources to make it effective.

How these tools support stakeholder engagement: Greater stakeholder trust/confidence in agency, seeing that their feedback has been received, acknowledged, and incorporated into the decision- making process, especially for groups who have traditionally been underrepresented (even though they may be directly impacted by the proposed action). Also, greater trust from seeing that agency is following a defined, transparent process, including meeting environmental justice requirements and tracking/responding to communications made at any time, such as following designated comment periods. More efficient for stakeholders, since agencies can leverage the comprehensive record of past stakeholder communications using stakeholder profiles.

60. ESRI. "Future Impacts on GeoAI and Mapping." https://www.esri.com/about/newsroom/arcuser/geoai-for-mapping/.
61. Wikipedia. "Stakeholder engagement software." Accessed January 9, 2021. https://en.wikipedia.org/wiki/Stakeholder_management#Software.
62. Patrick Grégoire. Borealis. "Gains that can be Achieved with the Stakeholder Engagement Methodology." November 18, 2020. http://www.boreal-is.com/blog/gains-achieved-stakeholder-engagement-methodology/.
63. Note. 'Stakeholder engagement' appears to have some similarities with the more common term 'CRM, or Customer Relationship Management'; however it's beyond the scope of this report to explore the similarities and differences. Per Salesforce. Inc.: "Customer relationship management (CRM) is a technology for managing all your company's relationships and interactions with customers and potential customers . . . a CRM system helps companies stay connected to customers, streamline processes, and improve profitability." https://www.salesforce.com/ap/crm/what-is-crm/.
64. Gartner, Inc. Gartner Peer Insights. "Business Process Management Platforms Reviews and Ratings." Accessed January 8, 2021. https://www.gartner.com/reviews/market/business-process-management-platforms.
65. Gartner, Inc. Gartner Peer Insights. "CRM and Customer Experience Implementation Services, Worldwide Reviews and Ratings." Accessed January 8, 2021. https://www.gartner.com/reviews/market/crmandcustomerexperienceimplementationservicesworldwide.

Tools for agencies to incorporate stakeholder data/analytics (e.g., citizen science)

Definition: In citizen science, the public participates voluntarily in the scientific process, addressing real-world problems in ways that may include formulating research questions, conducting scientific experiments, collecting and analyzing data, interpreting results, making new discoveries, developing technologies and applications, and solving complex problems.[66] There are robust tools in the marketplace which allow agencies to import and transform stakeholder-provided data so that it can be used in the resource decision-making process.

Representative Gartner categories: Data Preparation Tools,[67] Data Integration Tools,[68] Master Data Management Solutions[69]

Role of analytics/AI: AI/analytics working in the background can streamline the process of rendering imported data, such as in matching/associating attributes, reconciling data captured using different protocols, creating/modifying data, and other similar data wrangling activities.

Dependencies: Well-defined existing workflows that can be enhanced; policy and governance in place.

How these tools support stakeholder engagement: Adoption of 'newer' agency data wrangling tools, many with AI in the back office, will significantly deepen stakeholder engagement, moving from simply written comments to actual data—be it in the form of observations, data sets (including geospatial), or analytical results. Current agency NEPA policy encourages this level of engagement; the newer tools make it easier. Judging from the interviews, all four agencies have some experience with citizen science in certain program areas (and the NEPA programs could certainly participate as well).

Some cautions in using AI/analytics

As with any 'smart' technology that relies on models and statistics, agencies must take into account the risks of the software yielding incorrect, incomplete, or misleading results. Since the algorithms are developed using training data and then refined using machine learning (ML) or similar techniques, bias may be introduced into the process.

A recent article speaks to this issue:

> *Given that public agencies are held to a higher standard when it comes to technical systems, agencies must ensure that they maintain values of transparency and fairness for algorithms. Stakeholders should have the right to receive an explanation so as to ensure fair process. It is also vital that governments pay particular attention to how these systems might introduce bias in an effort to increase efficiency. As AI systems are deployed, it is highly recommended that agencies find ways to "open up" the systems for inspection and audit, to ensure that the public understands how the system operates and can trust its outcomes.*[70]

66. Citizen Science. "About CitizenScience.gov." Accessed January 4, 2021. https://www.citizenscience.gov/about/#.
67. Gartner, Inc. Gartner Peer Insights. "Data Preparation Tools Reviews and Ratings." Accessed January 8, 2021. https://www.gartner.com/reviews/market/data-preparation-tools.
68. Gartner, Inc. Gartner Peer Insights. "Data Integration Tools Reviews and Ratings." Accessed January 8, 2021. https://www.gartner.com/reviews/market/data-integration-tools.
69. Gartner, Inc. Gartner Peer Insights. "Master Data Management Solutions Reviews and Ratings." Accessed January 8, 2021. https://www.gartner.com/reviews/market/master-data-management-solutions.
70. Kevin C. Desouza. *Delivering Artificial Intelligence in Government: Challenges and Opportunities.* The IBM Center for the Business of Government, 2018. http://businessofgovernment.org/report/delivering-artificial-intelligence-government-challenges-and-opportunities.

Clearly, the four agencies described in this report would be wise to develop formal structured plans for implementing AI, including how to identify and mitigate bias. While the risks associated with stakeholder engagement may be relatively low, they must be taken into account. The following are some examples of types of bias which could occur in the context in NEPA stakeholder engagement:

- Comment analysis—The AI-assisted software could fail to detect duplicate, 'form letter,' stolen-identity, bot-generated, spurious, or inappropriate content; or the in-house analysis could misinterpret or skew comments from various demographics, such as communities of color.
- Sentiment analysis—Similar to comment analysis, the algorithms could miss or misinterpret stakeholder sentiments.
- The proposed action 'package' on the NEPA project site or in the public room—If AI is used to develop the content that's posted regarding the proposed action (including relevant maps and documents), it's possible that bias could skew the information that's being presented.
- Search and query—Some of the stakeholder queries may be misinterpreted or not access key data stores.
- Downloadable data sets—AI-assisted tools in the back office could skew which data sets or APIs are listed.

Common Factors that Influence an Agency's Next Steps

Activities that enhance NEPA stakeholder engagement can occur only within the much broader context of the agency as a whole—its mission, priorities, strategic direction, funding, technology infrastructure, and many other aspects. Add to that the even broader perspective of department and governmentwide guidance, and the task may seem overwhelming—but it need not be.

The approach below recognizes these factors, but in restricting the view to only those items relevant to analytics-assisted NEPA stakeholder management, the scope is more bounded and understandable—and the implementing actions can be realistically defined.

Given this context, there are five major areas or factors that influence how agencies can plan and implement activities that enhance stakeholder engagement:

- Collaborative government (including partnerships)
- Open data (including discovery, access, and sharing)
- Federal and department AI and science policies
- Information technology considerations
- Agency policies and priorities

The following paragraphs provide some illustrative examples and highpoints.

Collaborative government (including partnerships)

Over the years, there has been a coalescing around the concept of collaborative government. Many directives and executive orders as well as legislation have put an emphasis on cross-agency collaboration, and on some level, made such collaboration a requirement.

At the national level, one of the frequently referenced areas of recent federal guidance, regarding collaboration, can be found in the Open Government Directive, M-10-06, December 8, 2009.[71] A key phrase in a related document[72] speaks to collaboration: "Collaboration improves the effectiveness of government by encouraging partnerships and cooperation within the federal government, across levels of government, and between the government and private institutions."

Another key document is the President's Management Agenda, 2018.[73] Strategy 4 (Commercialization, Innovation, and Public Use) states: "Facilitate the use of federal government data assets by external stakeholders at the forefront of making government data accessible and useful through commercial ventures, innovation, or for other public uses. This includes use by the private sector and scientific and research communities; by states, localities, and tribes for public policy purposes; for education; and in enabling civic engagement."[74]

The national offices of the four agencies play a key role in interpreting federal and departmental direction regarding collaboration activities and in providing guidance (and often

71. Executive Office of the President. Office of Management and Budget. "Open Government Directive, M-10-06." December 8, 2009. https://obamawhitehouse.archives.gov/sites/default/files/omb/assets/memoranda_2010/m10-06.pdf.
72. National Archives and Records Administration (NARA), Office of Government Information Services. "OGIS Q&A updated February 1, 2010: Open Government Directive December 2009)." https://www.archives.gov/files/ogis/open-gov-directive-qa.pdf.
73. Executive Office of the President. "The President's Management Agenda: Modernizing Government for the 21st Century." 2018. https://trumpadministration.archives.performance.gov/PMA/Presidents_Management_Agenda.pdf.
74. Ibid., 17.

resources) to their subordinate offices. They often also support national agreements with stakeholder groups, such as with NACo (The National Association of Counties)[75] or the National Association of State Foresters.[76]

At the *state/regional and local/field office levels of the four agencies,* there has been a rich history of cooperation and collaboration with a wide spectrum of stakeholders for many decades. These offices typically have the flexibility to determine which of their local efforts have the greatest priority, and can develop specific plans on how to engage stakeholders. An excellent example is the FS Shared Stewardship program mentioned previously, which is a national effort with local implementation.

Stakeholders benefit from collaborative government by being acknowledged as key players in the NEPA analysis process, helping to inform the agency of their concerns, and working collaboratively with other stakeholders to find solutions.

Open data (including discovery, access, and sharing)

Federal governmentwide guidance on data is another factor that must be considered in formulating next steps for enhancing NEPA stakeholder engagement. As with collaborative government above, the concept of making federal data available to the public is not new, but over the past two decades the policies have become more defined.

One of the more visible steps was the creation of the data.gov website in 2009, a national repository of federal data that is populated with data sets provided by the agencies (as a reference, data.gov showed 192,180 data sets as of February 8, 2021.) A subsequent action was the publication of the Open Data Policy—Managing Data as an Asset, M-13-13, May 9, 2013.[77] Further direction was provided in the OPEN (Open, Public, Electronic, Necessary) Government Data Act, Title II of PL 115-435, January 14, 2019, which placed the agency requirement to populate data.gov into statute rather than policy.[78]

Recent direction has come in the publication of the Final Federal Data Strategy—Leveraging Data as a Strategic Asset—and 2020 Action Plan,[79] part of the President's Management Agenda, 2020. This comprehensive document highlights a number of principles and practices, followed by a list of 20 priority actions for 2020.

The plan groups the 40 practices into three broad categories:

- Building a culture that values data and promotes public use
- Governing, managing, and protecting data
- Promoting efficient and appropriate data use

The plan contains a large number of references to stakeholders, such as "assess and balance the needs of stakeholders," "share data between state, local, and tribal governments and federal agencies," "support federal stakeholders," and "support nonfederal stakeholders." The

75. National Association of Counties, https://www.naco.org/.
76. National Association of State Foresters, https://www.stateforesters.org/.
77. Executive Office of the President. Office of Management and Budget. "Open Data Policy, M-13-13." May 9, 2013. https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2013/m-13-13.pdf.
78. Foundations for Evidence-Based Policymaking Act of 2018, Title II: Open, Public, Electronic, and Necessary Government Act, or the OPEN Data Act. Pub L. 115-435. (2018). https://www.congress.gov/115/plaws/publ435/PLAW-115publ435.pdf.
79. Executive Office of the President. "Federal Data Strategy 2020." (2020). https://strategy.data.gov/assets/docs/2020-federal-data-strategy-action-plan.pdf.

plan also contains numerous references to artificial intelligence, specifically "preparing data for use in artificial intelligence," as well as analytics (including spatial analytics).

Open data (and related efforts) provides direct support to the first category of tools in the stakeholder engagement framework—"tools for discovering content." With the data in hand, *stakeholders can actively and effectively analyze resource issues and alternatives,* facilitated through use of AI and analytics.

Federal and department AI and science policies

A recent memorandum from the new administration—regarding scientific integrity and evidence-based policymaking—emphasizes that scientific and technological information, data, and evidence are central to the development and iterative improvement of sound policies, and to the delivery of equitable programs, across every area of government.[80]

In addition, there are two previous executive orders that relate to the use of AI in the federal government.

Executive Order 13859, entitled 'Maintaining American Leadership in Artificial Intelligence,' dated February 11, 2019,[81] presents a strategy for a concerted effort to promote and protect national AI technology and innovation. The Initiative implements a whole-of-government strategy in collaboration and engagement with the private sector, academia, the public, and like-minded international partners.

Executive Order 13960, entitled 'Promoting the Use of Trustworthy Artificial Intelligence in the Federal Government,'[82] dated December 3, 2020, establishes guidance for federal agency adoption of artificial intelligence to more effectively deliver services to the American people and foster public trust in this critical technology.

These policies provide high level guidance regarding the use of AI, which the USDA, Department of Interior (DOI), and the respective four agencies are mandated to follow. Each agency will plan and implement AI and science delivery actions that best align with Office of Management and Budget (OMB) and department direction and their agency priorities and resources. The near-term role for analytics/AI in stakeholder engagement may predominantly be one of back-office support for tasks such as facilitating access to relevant content (e.g., prior NEPA decision documents) or comment analysis.

Stakeholders benefit by knowing that the agencies are required to make evidence-based natural resource decisions, assuring them that their fact-based input must be duly considered during the NEPA analysis. Stakeholders can also benefit by potentially seeing quicker agency feedback on their comments because of efficiencies gained in the agency's comment analysis process.

80. Executive Office of the President. "Memorandum on Restoring Trust in Government Through Scientific Integrity and Evidence-Based Policymaking." January 27, 2021. https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/memorandum-on-restoring-trust-in-government-through-scientific-integrity-and-evidence-based-policymaking/.

81. Executive Office of the President. "Executive Order 13859: Maintaining American Leadership in Artificial Intelligence." February 11, 2019. https://www.govinfo.gov/content/pkg/FR-2019-02-14/pdf/2019-02544.pdf.

82. Executive Office of the President. "Executive Order 13960: Promoting the Use of Trustworthy Artificial Intelligence in the Federal Government Maintaining American Leadership in Artificial Intelligence." December 3, 2020. https://www.govinfo.gov/app/details/DCPD-202000870.

Information technology considerations

Similar to the way in which agencies need to examine their current policies and resources in planning their next steps, they also need to take into account their existing IT infrastructure and near-term IT enhancements to determine which actions are even feasible. Any analytics/AI solutions need to be compatible with existing IT infrastructure capabilities and/or be accompanied by a funded upgrade path.

Federal IT procurement has its own set of rigorous financial controls and approvals, which require sound business cases as well as detailed technical implementation plans. As mentioned various times throughout this report, the agency tools that provide enhanced stakeholder engagement are not single-purpose tools requiring special funding, but rather multipurpose tools capable of meeting a host of internal needs. Two of the most visible regulations are:

- *The Federal IT Investment Acquisition Reform Act,* part of Public Law 113-291, December 19, 2014.[83] FITARA is a historic law that represents the first major overhaul of federal information technology in almost 20 years.
- *Management and Oversight of Federal Information Technology,* OMB M-15-14.[84] The purpose of this June 10, 2015, memorandum is to provide implementation guidance for the Federal Information Technology Acquisition Reform Act (FITARA) and related information technology management practices.

It is highly recommended that the agencies leverage their enterprise architecture expertise in order to ensure a holistic approach based on all the technical guidance they have (such as that contained in their relevant IT Strategic Plans). The USDA IT Strategic Plan FY 2019-2022[85] is one example. Strategic Goal 2 (Cultivate Data-driven Capabilities and Culture) states: "USDA's ability to leverage its data as a strategic asset and to take a leadership role in the changing agricultural data landscape are key success factors in the department's vision for a facts-based, data-driven, and customer-focused organization."[86]

The enterprise architecture staff can play a valuable coordination role in adapting existing functionality from other program areas for use in NEPA analysis. Oftentimes innovative work being done in one program area (e.g., the IT staff supporting the data warehouse) may not be readily visible to or understood by NEPA personnel, however the architecture staff is often well positioned to serve as a translator and facilitator.

Stakeholders benefit by accessing agency platforms (hardware, software/apps, network, etc.) that provide a more satisfying, positive customer experience (CX). In terms of the framework, stakeholders benefit by being able to find desired content, obtain context, and use the agency-provided tools for communication and collaboration.

83. Federal IT Investment Acquisition Reform Act (FITARA), part of Pub. No. 113-291. December 19, 2014. https://www.congress.gov/113/plaws/publ291/PLAW-113publ291.pdf#page=148%5D.
84. Executive Office of the President. Office of Management and Budget. "Management and Oversight of Federal Information Technology, M-15-14." June 10, 2015. https://obamawhitehouse.archives.gov/sites/default/files/omb/memoranda/2015/m-15-14.pdf.
85. U.S. Department of Agriculture. The USDA IT Strategic Plan, FY 2019-2022. *Ver 1.0*. October 2019. https://www.ocio.usda.gov/strategic-plan.
86. Ibid., 12.

Agency policies and priorities

There's a broad suite of direction in both departments and in the individual bureaus regarding customer/stakeholder engagement (not specifically tied to NEPA). This type of direction, while often somewhat general in nature, nevertheless sets the high-level goals and objectives to which the NEPA-specific actions will tier.

These goals and objectives are contained in numerous types of documents, including agency strategic plans, agency IT strategy plans, departmental goals, etc. By extension, these activities also include bureau and department action plans for implementing directives such as the President's Management Agenda.

The geographic extent of the public lands managed by the four agencies is huge, surpassing 650 million surface acres (not counting subsurface areas and marine environments)—adding to complexity of agency tasks.

Two department-wide documents provide high-level direction and can be briefly mentioned here. The DOI Strategic Plan 2018-2022[87] contains a number of references to stakeholder engagement, such as "engaging the nation in cooperative stewardship." For its part, the USDA Strategic Plan FY 2018-2022[88] describes a number of stakeholder engagement activities, such as contained in Strategic Goal 6: Ensure Productive and Sustainable Use of our National Forest System Lands.[89]

Agencies, of course, have numerous ongoing efforts as shown in annual work plans and projects. BLM, for example, has undertaken an effort to modernize its decision support and planning implementation business processes, and has a similar effort underway for updating its GIS infrastructure. For its part, FS continues to implement the recommendations in its Environmental Analysis and Decision Making (EADM)[90] effort.

In addition, agencies face the usual challenges—funding constraints, workforce planning issues, changing priorities, multiple programs competing for the same dollars, cross-agency project coordination, etc.

If the agencies do an adequate job of sorting out the often-competing priorities and develop clear workplans which can be communicated externally, *NEPA stakeholders will benefit* by having clarity regarding the agencies' activities. Within the context of NEPA analysis, for example, stakeholders will have clearer vision of when and how they can attend public meetings, provide comments, join task groups, and how their efforts can fit into the 'big picture.'

Factors to consider—summary observations

As is typical in the federal environment, there are clearly a number of factors which need to be taken into account by the four resource management agencies in any type of work they do; NEPA stakeholder engagement is no different. As we have seen, most of the existing guidance is at a fairly high level, which can provide general sideboards for agency action but is not prescriptive ('cookbook').

87. U.S .Department of the Interior. Strategic Plan for FYs 2018-2022. 2018.www.doi.gov/sites/doi.gov/files/uploads/fy2018-2022-strategic-plan.pdf.
88. U.S. Department of Agriculture. USDA Strategic Plan FY 2018-2022. May 2018. www.usda.gov/sites/default/files/documents/usda-strategic-plan-2018-2022.pdf.
89. Ibid., 45.
90. USDA Forest Service. Environmental Analysis and Decision Making (ongoing interdisciplinary effort). https://www.fs.usda.gov/managing-land/eadm.

RECOMMENDATIONS

Charting a path forward

Using the approaches outlined in this report, individual agencies can examine the maturity of stakeholder engagement within their organizations, then identify the key objectives they wish to address—in other words, what specific problems do they wish to solve in the near term? In the longer term? Do they have resources that can be dedicated to the effort? And how do these stakeholder engagement objectives relate to the agencies' other high priority work?

By way of example, an agency may decide that they wish to improve their comment analysis process or provide more content regarding the proposed action (e.g., links to maps from ArcGIS Online vs. simply pdfs). It's quite possible that the more 'complex' requirements, such as those which support the 'collaboration' level of engagement, may need to be future endeavors.

As has been shown, choosing the best path forward will depend on a number of factors, some of which are common—and others of which are unique to each agency—as described in the **'Current Status,'** 'Common Factors,' and other sections. Thus, this report cannot offer any specific solutions; however, some high-level summary recommendations are listed below. Agencies can select the actions which they deem most appropriate in their mission to manage the public lands.

In moving forward, close coordination with agency technical staff—including enterprise architecture—and contractors will facilitate solutions that can better enhance overall agency mission delivery. Note that the first steps may be *foundational;* that is, agencies need to develop these types of functionality in order to properly leverage advanced analytics/AI in the future.

The narrative below provides specific examples of actions that agency managers and executives can take in order to better meet the stakeholder engagement requirements described throughout this report. The 'good news' is that most of these actions can be taken in small, iterative steps vs. relying on large, complex projects. While some of the near-term actions may have few dependencies, the majority of the mid- to long-term actions normally require certain infrastructure, processes, or skills to be in place in order to gain the expected efficiencies. The near-term activities will help establish the foundational capabilities that then can be expanded and enhanced.

For the sake of clarity, the requirements below are grouped by the *type of functionality* (tools) and by *timeframe* (near-term, mid/long-term)

Near-term recommendations (< 1 yr.)

Tools for discovering content

- Provide more consistent agencywide NEPA project website 'look and feel,' with more relevant content; conduct user surveys across multiple demographics
- Create/augment/update NEPA document repositories
- Enhance search and query functionality for NEPA repositories, including spatial search
- Make data/content easier to discover and access by strengthening internal data management/ data governance processes

- Make data/content download sites more visible; provide links from NEPA project sites to key agency download sites

Discussion: These proposed actions represent some of the actions that the agencies could consider in beginning to address (or improve the way they address) the requirements that center around giving stakeholders the ability to ***review the proposed action, access agency content pertinent to the proposed action*** (*'what'* content is searched), ***search agency content pertinent to the proposed action*** (*'how'* text and spatial content is searched), and ***download data sets, APIs, etc.*** It's important to note that while the first three requirements involve NEPA-specific sites, all four depend on functionality that extends beyond the NEPA program and are more multidisciplinary in nature. For example, the agency functionality that makes it easier for the public to discover, view, and download data or the functionality to improve the layout/content of NEPA project websites is often supported by IT and business program specialists.

Tools for analysis and context

- Augment existing NEPA project sites with data visualizations, including dashboards. Make the sites interactive. Use story maps (ESRI). Use animations.
- Use text analytics to streamline the agency comment analysis process.
- Improve existing processes for analyzing the NEPA effort, especially for developing the alternatives—collaborating more closely with stakeholders.
- Begin to incorporate more sentiment analysis and semantic analysis into the NEPA process in order to get deeper insights into stakeholder perspectives.

Discussion: These proposed actions represent just some of the actions that the agencies could consider in beginning to address (or better address) the requirements that center around giving stakeholders the ability **to explore the action proposed** by the agency. As mentioned previously in the report, though no agencies appear to currently provide this public-facing functionality for NEPA activities, the agencies have expertise using these tools in other areas. Thus, NEPA program managers can adapt some of those processes for their work. In order to minimize risk, managers could initially consider limited, proof-of-concept efforts.

The recommendations for text analytics, sentiment analysis, and semantic analysis are for the agencies to begin to acquire (or enhance) these capabilities, not only for greater understanding of stakeholder input across multiple communication channels and greater efficiency in the analysis process, but also so that the stakeholders can gain more trust in the process, knowing that their feedback was taken into consideration.

Tools for communication and collaboration

- Begin to use stakeholder engagement software. Identify the key requirements, scope of effort; consider some proofs-of-concept. Perhaps, at first, limit to NEPA and land use planning. Gather the key documents/databases etc. that contain stakeholder information.
- Augment/enhance existing processes for import and use of external data (e.g., from citizen science), including workflows that make data available to NEPA project staff.
- Consider development of a 'master calendaring' system across the land use planning and NEPA programs, for the benefit of external stakeholders.

Discussion: These proposed actions represent just a sample of the actions that the agencies could consider in beginning to address (or better address) communication and collaboration requirements, which allow stakeholders to comment on or submit alternatives for the proposed

action, provide data and analysis directly to the agency, and engage in communications with agency regarding resource issues, decisions, and pre- or post-decision monitoring.

The use of stakeholder engagement software across the agency will supplement and perhaps replace existing processes, which tend to vary even within agency locations; some NEPA projects may already have established processes and artifacts (e.g., spreadsheets) in place that track stakeholder interest/influence (see p. 12) while other offices may simply have contact lists. If the agency already has customer engagement software in place, the NEPA program could see if its use would be beneficial. The benefit to stakeholders is that the agencies have the information to engage stakeholders on specific topics of interest.

Agencies can also take steps to extend data import/export capabilities to NEPA-related efforts, such as establishing workflows that allow the import of data from citizen science and rendering it for use by the various resources staffs, including for NEPA analysis.

Finally, establishment (or enhancement) of a 'master calendaring' system across multiple agency programs (e.g., land use planning and NEPA) would alert users in a standard way regarding upcoming activities. The need for this type of functionality surfaced during several interviews with NGOs. This calendaring system could work in conjunction with the stakeholder engagement software, and thus be able to send targeted alerts to stakeholders.

Mid- to long-term recommendations (> 1yr.)

Tools for discovering content

- Use analytics/AI to hone in on the most relevant content for NEPA project sites.
- Continue to augment/update NEPA document repositories, optimally offering multiagency capability.
- Enhance search and query functionality for NEPA repositories, using cognitive search and location intelligence.
- Continue to make data/content easier to discover and access across multiple disciplines by using analytics/AI.
- Continue efforts to make data/content downloads easier for stakeholders; expand use of APIs.

Discussion: These proposed actions significantly enhance the nascent functionality established earlier by leveraging the power of the underlying analytics/AI. The agency will be able to select the most relevant content/layout for the NEPA project site (using analytics/AI in the background) so that stakeholders can ***review the proposed action***. Enhanced tools will allow stakeholder to ***access*** *(more)* ***agency content pertinent to the proposed action*** ('what' content is searched) and have more sophisticated tools (again, assisted by analytics/AI) for ***searching agency content pertinent to the proposed action*** (*'how'* text and spatial content is searched). Finally, using analytics and AI, agencies can enhance stakeholders' ability to *download data sets, APIs, etc.*

Tools for analysis and context

- Expand the use of data visualization and location intelligence in highly interactive sites so that they become standard. Harvest the information from interactive sessions to inform the alternatives analysis.
- Use text analytics and associated advanced analytics/AI to streamline the agency comment analysis process across all channels.

- Continue to improve NEPA analysis, especially in developing the alternatives and collaborating more closely with stakeholders.
- Fully incorporate sentiment analysis and semantic analysis into the NEPA process.

Discussion: These proposed actions build upon and strengthen the work that was performed in the 'near-term' stage. Agencies will have enhanced capabilities that will allow more in-depth analyses, aided by analytics/AI. Similarly, if these actions are performed, the stakeholders will be able to access significantly improved ***interactive tools*** and can ***assist in the resource analysis*** in a more collaborative way by becoming familiar with the new analytical processes.

Tools for communication and collaboration

- Expand use of stakeholder engagement software so that interrelationships among stakeholders and shared issues can be identified and leveraged. If initial scope was limited, then expand so that it's interdisciplinary.
- Further streamline processes for import and use of external data (e.g., from citizen science).
- Expand the 'master calendaring' system to multiple organizational levels and program areas for the benefit of external stakeholders.

Discussion: These proposed actions represent a maturity of the tools established during the 'near-term' stage. Agencies will have detailed information regarding the stakeholder community, and not only be able to target their messaging but also—with the help of analytics/AI—look for interrelationships that they may have not noticed previously. Import of stakeholder data will be greatly facilitated.

Benefits to stakeholders will be increased capability to provide more substantive ***comments and/or submit alternatives*** for the proposed action, ***provide*** (even more) ***data and analysis*** directly to the agency, and ***engage in*** (ongoing) ***communications,*** such as leveraging monitoring reports created through the land use planning, NEPA, or other processes.

Caution—common mistakes to avoid

- Skimping on business requirements when acquiring tools (be sure you've lined out the requirements well; develop a sound business case)
- Embarking upon standalone program efforts without ties to other activities within the agency; doing 'on-offs' (it takes more time and can be complex, but creates better value)
- Considering tool acquisition and implementation to be solely an IT function (it's really a business/IT partnership and collaborative effort)
- Trying to skip steps—e.g., hiring a large group of data scientists when your agency data maturity is still low (take care of the foundational requirements first)
- Failing to properly consider what the users/customers/stakeholders want and expect ('think like the customer/stakeholder')

Conclusion

Several key takeaways can be derived from the research described in previous sections:

- The four agencies vary in their ability to even partially fulfill the nine NEPA stakeholder engagement requirements; none currently provides adequate support for the highest stakeholder level: collaboration. If the agencies implement the recommendations in this section that best match their needs (and adapt/add to, as appropriate), they will move closer to providing that type of support.
- Achieving enhanced NEPA stakeholder collaboration requires improving overall agency service delivery (e.g., data and information), not simply modernizing the key apps that support NEPA.
- Policy guidance at the federal level, as well as department and agency guidance for the four resource management agencies, emphasizes stakeholder engagement and advocates the use of appropriate technology (here, analytics/AI) to solve mission needs.

As we have seen, there is no 'magic' path forward, nor are solutions simply of a technical nature. Analytics and AI will play an increasingly important role in the future, but in the context of stakeholder engagement they may be mostly 'back office' enablers, not necessarily visible to most stakeholders.

It is expected that use of the tools described in the report can help mitigate some of the current barriers to stakeholder participation. Individual stakeholders can then determine which level of engagement they'd like to have depending on the specific proposed action. For example, they may wish to be in a 'consult' role for a particular EA but a 'collaborate' role for an EIS. With the barriers to participation removed by virtue of the improved agency tools, stakeholders will have the flexibility to decide the extent of their involvement.

Natural resource agency managers who implement the recommended changes can expect to be in a better position to comply with the mandates for greater public participation in NEPA, even as the number and complexity of interconnected issues, the sheer number of stakeholders, and the amount of data keep increasing. Stakeholder engagement in NEPA analysis can become more efficient, leading to a higher level of stakeholder confidence in the process (e.g., knowing that their comments or analyses were duly taken into account). Agencies will benefit from in savings of time, budget dollars, and public resources—lessening the need to pursue disagreements through administrative appeals or litigation.

Lastly, successes in the NEPA arena can demonstrate how these tools can be used effectively in other natural resource activities conducted by federal agencies (e.g., land use planning, permitting, etc.), as well as by state, local, and tribal governments; NGOs; and many others.

ABOUT THE AUTHOR

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Jenna Yeager is a retired Natural Resource Specialist whose federal career spanned 33 years in the Bureau of Land Management and nine years in the Forest Service. Beginning as a field forester with BLM in Boise, she progressed to the role of remote sensing training coordinator at the BLM Denver Service Center, followed by 17 years as the GIS/Remote Sensing Coordinator at the BLM Idaho State Office. In 2002 she assumed the role of IRM Advisor/Portfolio Manager for the BLM Planning and Renewable Resources Directorate in Washington, D.C., then transitioned to another national role with the Forest Service as Desktop/Mobile Computing Program Manager—and later as the agency lead for information management. She is an active member of the Public Lands Foundation, who served as her sponsor for this research report, as well as a member of the National Association of Forest Service Retirees. Her outdoor-focused volunteer activities include work with Colorado Parks and Wildlife, the Colorado Trail Foundation, the Colorado Fourteeners Initiative, and other organizations. She also served in the Peace Corps (Chile) early in her career.

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