

Artificial Intelligence Strategies and Synergy in the Federal Space

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Executive Summary

In the words of Henry A. Kissinger, American statesman and strategist, “The arrival of artificial intelligence (AI) is challenging human societies in every way.” While the government of the United States prepares to manage the technological and transformational possibilities, as well as policy and governance challenges arising from AI, the impact of AI and its potential to help the American people is significant. Therefore, using AI in federal space across different agencies can benefit from creating thematic harmony and coherence at the strategy level.

This work brings together expertise from creating/ implementing of national AI policy documents and analysis of AI departmental strategies. As of the writing of this document, five federal agencies ([VA](#), [DoD](#), [DoJ](#), [HHS](#), [DHS](#)) of the 15 executive departments have independent and explicit AI strategies and there are known use cases in all of the departments. Those without an explicit AI strategy, with some nuances and distinctions, broadly fit into two categories: the first cohort of federal agencies includes those that have mentioned AI strategy in their strategic documents, but have no specific plan to develop one, i.e., Department of State, Department of Commerce, Department of Transportation, and Department of Energy. The second group consists of federal agencies with no mention of AI strategy and no specific plan to formulate one, i.e., Department of the Interior, Department of Treasury¹, Department of Agriculture², Department of Labor, Department of Housing and Urban Development, and Department of Education. In creating the VA AI strategy, the landscape analysis outlined in this document helped provide underlying fundamentals for its design and execution and, therefore, may benefit others.

Aligned with the objectives of recent executive orders, specifically EO13859 on [Maintaining American Leadership in Artificial Intelligence](#), Executive Order 13960 on [Promoting the Use of](#)

[Trustworthy Artificial Intelligence in the Federal Government](#) as well as the [National AI R&D Strategy](#) and the National Defense Authorization Acts of 2019 and 2021, there is now a unique opportunity to bring thematic harmony to various AI strategy development initiatives across federal agencies. Given the potential and limitations of AI technologies, AI may not be equally advantageous to all federal agencies. Nevertheless, there is work and space for collaboration for those federal agencies in which AI will be an integral part of their business processes, products, and services. This paper analyzes departmental strategies and provides a purview of themes that invite and ease cross-agency collaboration, particularly common themes discovered in this analysis such as: developing standards and workforce, potential opportunities for innovation and investment, creating AI infrastructure, and establishing governance systems. Within governance, four common areas emerged: (1) community standards, (2) ethical AI, (3) interagency working groups, and (4) public trust.

To properly use the resources available for the design, development, and deployment of AI at the federal level, it may be beneficial to formulate strategies reflective of cross-agency collaboration and focused on smart spending and maximizing the positive impact of AI.

Background

The United States federal government has been investing in the research and development of technologies associated with artificial intelligence (AI) since the 1950s. The most recent AI revolution (2012) introduced deep learning, demonstrating robust solutions across all sectors. As a result, investment in AI has been declared a national priority through several avenues, including Executive Order 13859 of February 11, 2019, on [Maintaining American Leadership in Artificial Intelligence](#), Executive Order 13960 on [Promoting the Use of Trustworthy Artificial Intelligence in the Federal Government](#) and the [National AI R&D Strategy](#). The federal financial resources in AI research and development have increased exponentially to prepare the United States for a future in which AI plays a growing role in critical areas such as health, education, energy, transportation, defense, and the environment.

According to the Stanford AI Index (2021) and the NITRD's supplement to the President's FY2021 budget the spending on AI (Figure 1), specifically AI research and development (R&D), has been growing and has been leveraged across many different AI applications. Though the amount of spending and investment on AI by some federal agencies like the Department of Defense is substantial, other agencies with science-related work focus have also increased their spending on AI. For instance, in FY 2021, the National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce (Figure 2) has increased its budget to improve data infrastructure and establish cloud systems in 2021. In addition, there is also a significant amount of recent spending in non-science-related agencies such as the Department of Justice, Treasury, and the General Services Administration to increase internal efficiencies, shape policy, and provide tools to federal organizations at large.

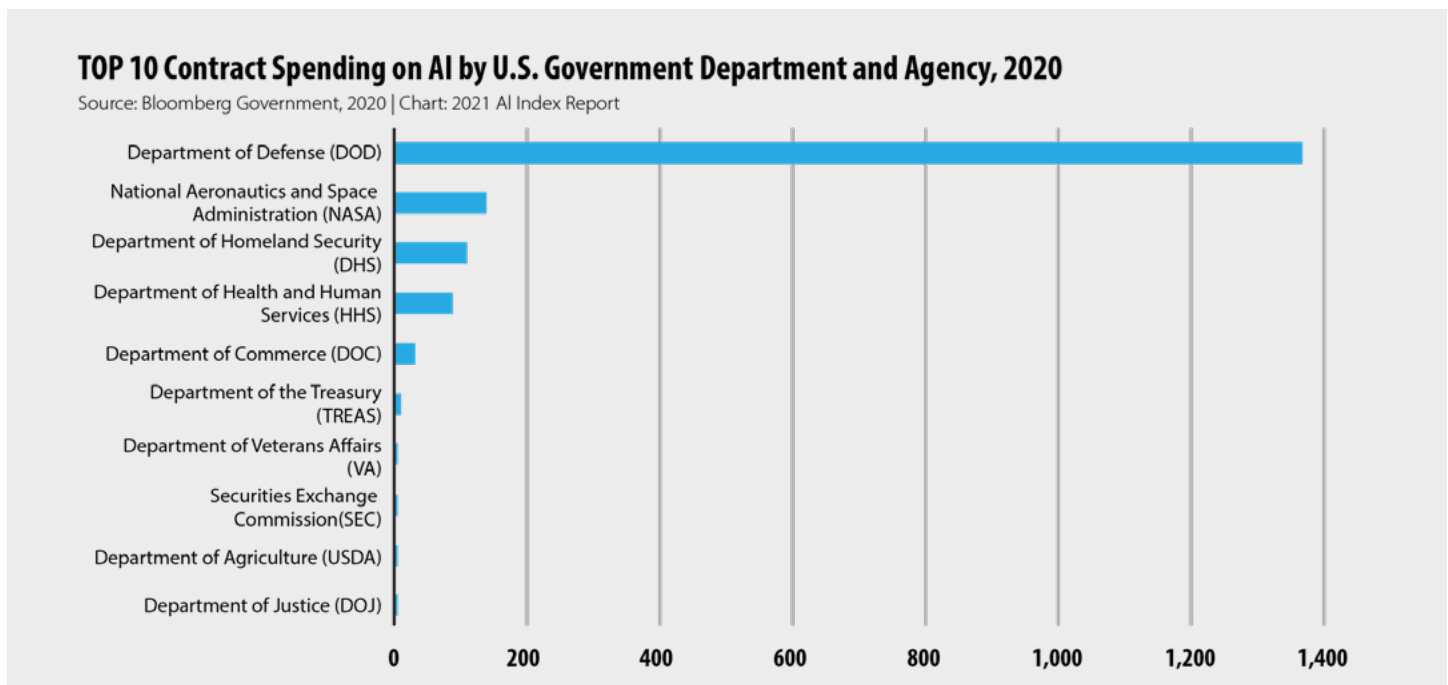


Figure 1. Stanford AI Index 2021

TOP 10 Contract Spending on AI by U.S. Government Department and Agency, 2001-20 (SUM)

Source: Bloomer Government, 2020 | Chart: 2021 AI Index Report

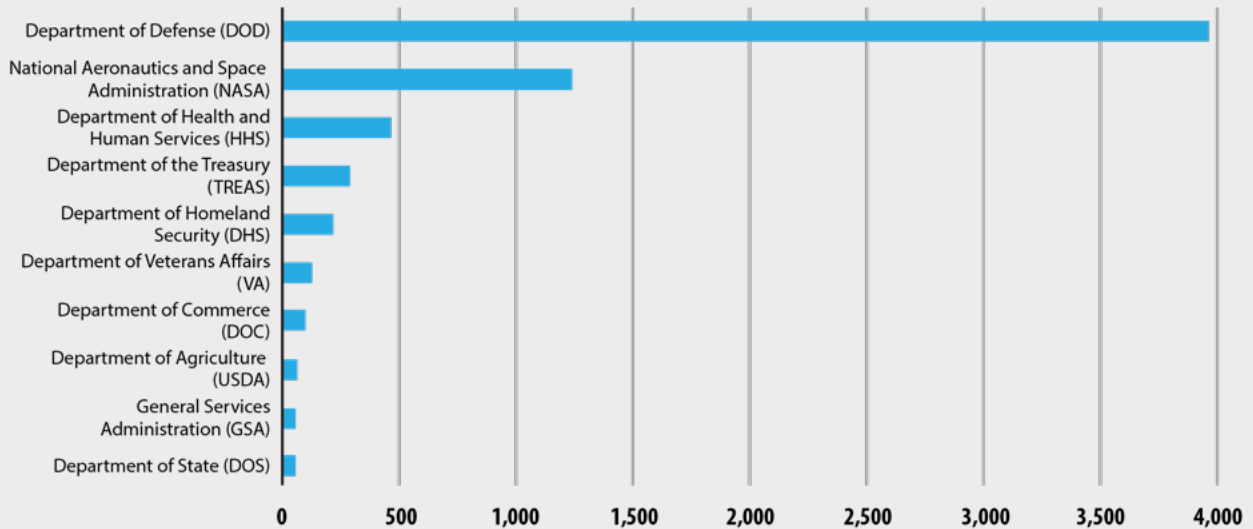


Figure 2. Stanford AI Index 2021

While the Executive Office of the President stance on AI R&D provides guidelines for research, especially as organizations move AI solutions from R&D into deployment, further work on guidance and department-level strategies, coupled with the addressing challenges of scaling an emerging technology, may be helpful to create a unified approach. Without dedicated communities of interest and unified approaches, many efforts are at risk of becoming siloed, even within the same department, making the efficient implementation of responsible and transparent AI extremely difficult. Several departments have implemented a department-wide strategy which has allowed for a cohesive internal approach, while others choose public communication standards. While the specific methodology can vary, a formal approach that leads to an transparent view of how these organizations are implementing AI will help implement the principles outlined in [Executive Order 13960 and legislation](#).

In this paper, we discuss:

- 1 The different ways executive departments are using AI.**
- 2 The organizational maturity needed for a successful AI program.**
- 3 Analysis and discovery of common themes in existing AI strategies.**
- 4 Examples of AI usage in select organizations.**

This work shows that high-level strategy allows for the organization’s cohesive and responsible use of AI. However, this paper will not cover the ethics of AI, nor does it analyze specific programs or projects. Instead, it outlines the elements essential for responsible and long-term integration at both the project and enterprise levels.

Use of Artificial Intelligence in the Federal Space: AI Operations, Acquisition and Maturity

There are three general funding models to bring AI into an organization within the federal space. Each of these models has its benefits and drawbacks and significantly impacts AI Operations (AI Operations) systems, which we will cover in this section. Additionally, organizations acquire and integrate increasingly more solutions with a broad range of technologies. The AI capability maturity (as defined by GSA) also covered in this section describes the level to which organizations acquire AI and the internal infrastructure for long-term operation and management.

Artificial Intelligence Operations

Artificial Intelligence, like human intelligence, requires learning and periodic updating to remain valid. For example, a doctor’s knowledge of their specialty area remains relevant in their early career, but can become outdated with time, necessitating continuous updating via more education/training. Similarly, to prevent outdated, responsible AI usage requires the periodic updating of algorithms to keep algorithms valid and allow for improvements and changes when unintended outcomes, such as bias, are observed at any stage of development or during deployment. The industry standard for ensuring this cycle is AI Operations, or AI Operations, and is depicted in the figure 3.

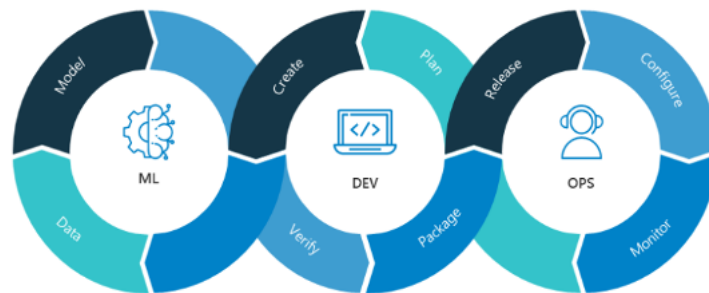


Figure 3.

As shown in the Figure 3, each stage is generally composed of different entities interacting with the algorithms ranging from the developers to the users. While this system is considered best practice, often, it is not common practice, especially when programs or use cases are developed in siloes within organizations.

Artificial Intelligence Funding Models

In-house Research & Development Model

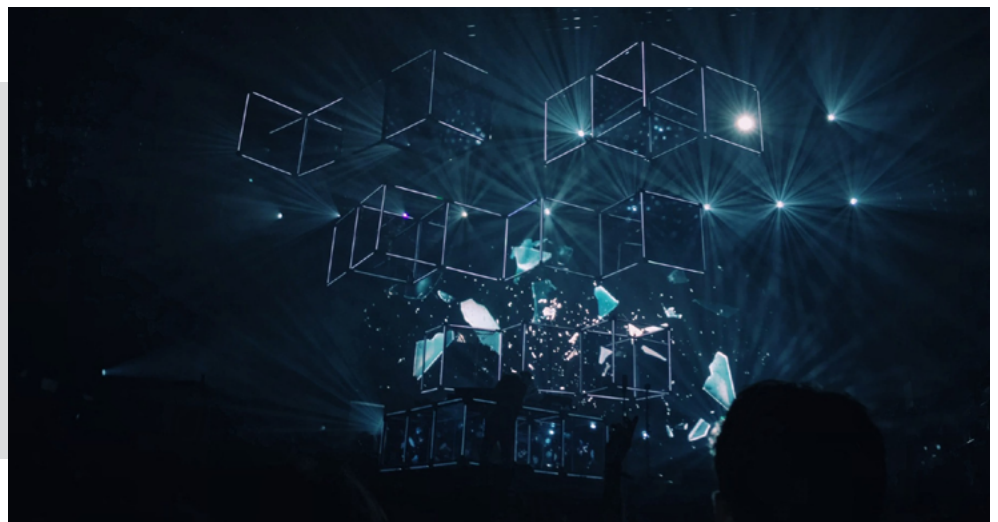
In this model, the AI talent is internal to the organization, and algorithms are designed, developed, and deployed in-house. This model allows for complete control and customization of the algorithm. However, it can be costly as it involves hiring talent for each stage of the AI lifecycle, as outlined above.

Acquisition Model

This model involves federal agencies purchasing AI through either contracts or products. This model is generally a less expensive approach; however, the opacity of this approach can lead to the algorithms not being entirely owned or understood by the purchaser (agency). Specifically, this model relies upon the developers to ensure it is operating and being appropriately maintained according to best AI Operations practices and contract language for responsible AI has not been standardized in the federal space.

Hybrid Model

This model is a combination of in-house and purchasing models. Many parts of the system are purchased in this model, but there is some opacity to the federal agencies. The federal agencies may buy the data, but train the algorithms internally. Alternative scenarios are also conceivable. For instance, the federal agencies supply the contractors with data, who develop the algorithms. Then, agencies deploy the developed algorithms. Or, as another alternative: the data may be bought from one company, the algorithm developed by a second company, and the deployment handled by a third company with oversight from a government agency. For example, the AI Tech Sprint at VA uses a version of the hybrid model, engaging VA researchers and data with external organizations.



Artificial Intelligence Capability Maturity

As a department starts its AI journey and builds its AI capabilities, several readiness, functions, and capabilities elements come into play. According to General Services Administration's Center of Excellence (COE), an organization's operational and organizational level of maturity to take on AI is measured against AI-specific functional areas and its capacity to execute and manage AI initiatives. Based on COE's AI Capability Maturity Model, there is seven Operational Maturity (People, Cloud, Security, Development, Data, Machine Learning, AI) areas and five Organizational Maturity levels (Individual project, Team Project, Program, Portfolio, Enterprise).



Figure 4.

While enterprise-level AI of Organizational Maturity can have many representations, the key concept is establishing a single ecosystem that operates across an organization, allowing algorithms and practices to be internally portable.

This focal point allows for the ease of data sharing of data, updating algorithms, facilitated auditing, decreased spending (e.g., by allowing the reuse of data), and overall, increased responsible usage of AI.

Examining Strategies by Department

While federal agencies can develop AI strategies at any level, it can be problematic if several strategies or approaches exist across programs within a department. Problems arise from different messaging and practices, standards, wasted resources, and unnecessary competition. Therefore, ideally, AI strategies should be developed, at the latest, when an organization is at level three (Program) of Organizational Maturity. At this point in the maturity model, data and algorithms are shareable across the organization. Moreover, if shown to have potential, the organization can then consider the infrastructure to allow the solution or solutions to be scaled to a departmental and affiliate level. For example, VA can develop a diagnostic tool and scale it to all Veterans hospitals.

Examining Strategies Cross Departments: Common Themes

Comparing AI strategies developed and executed by different federal agencies, four common pillars have been identified across federal departments/Agencies: (1) Workforce, (2) R&D/Innovation, (3) Infrastructure, and (4) Governance. All of these pillars are necessary for a department's AI program to function transparently and effectively.

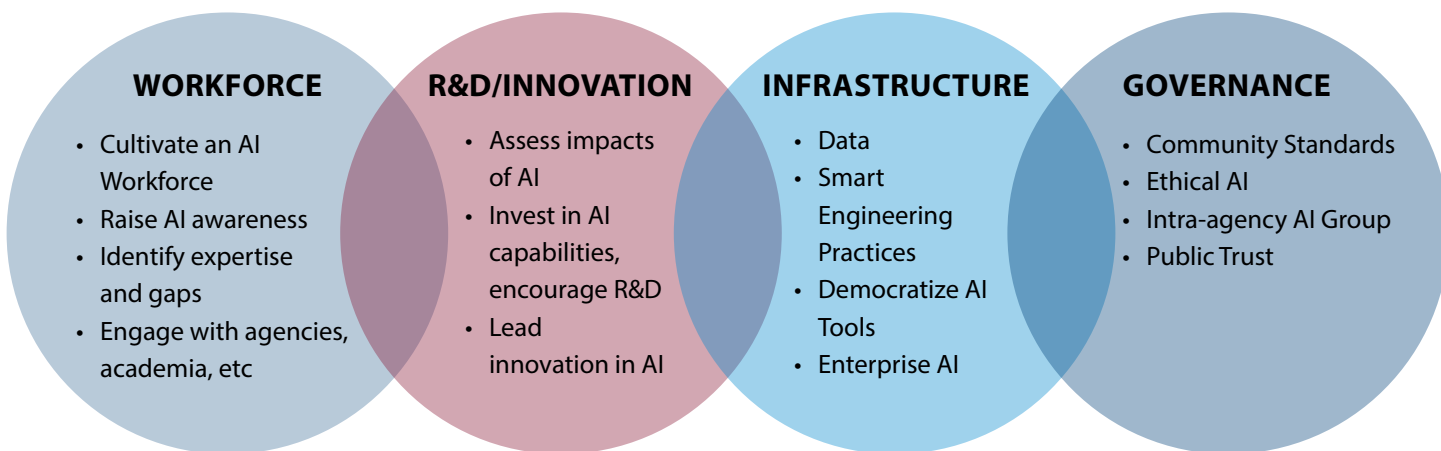


Figure 5.

Workforce

The general approach within the workforce strategic pillar is to create a culture that allows for the adoption of AI. As is common with any emerging technology, there are many hesitations to using AI, and therefore the long-term implementation and integration require education, and communication. As covered in previous sections, AI is a multidisciplinary field and its responsible usage spans many different type of employees ranging from the developers to the users. This approach creates and cultivates the internal and external community of the organization.

Depending on the organization and its preferred funding model, the approaches to the workforce pillar can vary. However, the first tactic is to identify internal expertise and gaps; based on these outcomes, an organization may hire or educate current staff on AI. Secondly, communities of interest (e.g. [AI@VA](#)) are often used as a strategy to bring together people across the department to raise awareness and provide a network to exchange knowledge, cooperate, and in some cases, aid in the execution of the department's AI strategy. Finally, many AI strategies incorporate a goal to engage with other agencies, industry, and academia to help maintain the latest applications, frameworks, and best practices, especially crucial in this rapidly evolving field.

Research & Development/Innovation

Within the area of R&D/innovation, many departments employ the priorities from the National AI R&D plan, which provides a defined list of priority areas for federal investment. Specifically, the “Make Long-Term Investments in AI Research” strategic objective encourages federal agencies to prioritize investment in the next generation of AI and innovations related to AI. Innovation requires organizational focus and readiness, and organizations must excel in designing and executing initiatives that lead to transformative innovations, impacting processes, products, and services.

In many of the strategies, the first goal addressed is to assess the potential impacts of the new

technologies by determining critical areas of applicability within the organization. When this assessment is complete, the goal is to invest in the key areas and examine their ability to adapt to the specific missions.

As there are experiments, new research is also encouraged to maximize impact. For AI, this could include adapting current and inventing new model architectures to push one of the subfields such as adversarial or explainable AI. Finally, most organizations choose a strategic goal to lead innovation in AI; that is, the goal is to further push known boundaries of the technology, thereby contributing to the field of AI.

Infrastructure

The third common strategy theme of infrastructure focuses on expanding impact across the organization to allow for solutions to be scaled using AI Operations best practices. This area is especially crucial as it ideally provides for increased efficiency and transparency and the potential for auditability if needed.

The first common strategic goal within the infrastructure theme is data, which drives these algorithms. It is easy and cheap to acquire data, but very difficult and expensive to prepare for AI applications. Leveraging the [Evidence Based Act](#) of 2018 which “requires public government data assets to be published as machine-readable data [...] and cataloged” and the Federal Data Strategy which calls for “data to be designed for use and reuse,” many departments strategies encompass ideas of maximizing the impact of data to be reused across programs, allowing for the barrier of entry across domains to be significantly lower. Tactics include creating data catalogs and model catalogs with linkages to the training data, which allows for increased transparency.

As impact extends across the organizations, enterprise AI is scaled into the organization’s infrastructure and serves as the next strategic goal. The integration methods include practices that allow different teams to use standardized procedures for storing code, data and algorithms, test and evaluation standards, and shared best engineering practices. Moreover, other common strategies include democratizing AI tools. Easing access to AI development frameworks like the Amazon Web Services enables cloud computing and enhances analytical toolboxes. This strategy also helps with debugging and explainability. Explainability

is the extent to which you can explain the internal mechanics of an ML or deep learning system in human terms. Debugging is the routine process of locating and removing computer program bugs, errors, or abnormalities, which software programmers methodically handle via debugging tools. Debugging checks, detects, and corrects errors (or “bugs”) to allow proper program operation, according to set specifications.

Finally, as mentioned previously, artificial intelligence can be flawed, ambiguous, and quickly become outdated. Therefore, AI infrastructure should include AI Operations best practices to ensure algorithms are updated periodically to remain relevant, accurate, and ethically viable. Many strategies do not explicitly mention AI Operations. However, they outline the desire for frameworks that allow for this type of updating.

Governance

The fourth common strategy theme across agencies is governance which involves explaining the guidelines and standards of how an organization uses AI. There are still very few laws on how and when AI can be used as an emerging technology. Therefore, the four common strategic goals in this area are (1) community standards, (2) ethical AI, (3) interagency working groups, and (4) public trust. Community standards and ethical AI focus on the general rules of when the organization will use AI. These standards include how often algorithms require an update and which applications they can use and keep aligned with laws and federal regulations.

Ethical concerns are also a priority, as algorithms can introduce accidental biases that the organization may not agree with. For example, the organization might use AI to sort through the hundreds of applications for jobs but later find that the algorithm discards a specific population subset, which is unethical and violates civic rights laws.

Another strategic goal agencies strive for involves communicating with other agencies AI experts through mediums such as inter-agency working groups or communities of interest. These groups serve as a space to align efforts and thoughts around AI, communicating back to the home agencies to promote the common languages and approaches.

Finally, the last common strategic goal is to preserve public trust. People need to know how AI will impact their lives. They need to understand that the funding that goes to organizations is transparent and efficient. While different for each organization, methodologies have included:

- Publishing projects on department websites.
- Allowing the public to access AI experts through speaker requests.
- Presenting at public conferences.

Learning into Practice: Department of Veterans Affairs

As discussed in the four common strategy themes section, AI systems and solutions continue to expand to new fields rapidly. A growing number of federal departments and agencies are funding AI through new and existing programs. As a provider with the nation's largest integrated health care system, the VA is proactively approaching AI. The agency's unique repository of electronic medical records has enabled its researchers and scientist to initiate and complete AI-driven medical research and innovations. The VA has recently established the National Artificial Intelligence Institute (NAII) to help develop AI research and development using the department's big data repositories and engage collaborative partners.

To articulate and formalize its institutional approach to AI, the VA has released its [AI Strategy](#). The VA prepared its strategy in consultation with over 20 VA offices. The process enabled VA to take advantage of

the analyses and experiences from leadership across the government to appropriately develop and adapt an AI strategy. The VA has recently released the VA AI Strategy and launched a website to communicate progress to the larger community.

In executing the strategy, VA has made strides in several common strategy themes within a short period. On the workforce strategic theme, The VA brought together a community of interest at the VA, [the AI@VA Community](#), and worked to develop the AI workforce certification model, Talent, Education, and Assessment Management System (T.E.A.M.S). It has successfully held AI Tech Sprints, the AI-to-Go framework, and the Covid-19 Prognostics Explainable AI tool within innovation and infrastructure, which serve as testbeds. Finally, it is working on the AI maturity model to assess the readiness of models to be deployed in the VA health care system.

1

Workforce

- Build a robust community and network around AI at the VA

2

Research & Development/ Innovation

- Prioritize and invest in AI research
- Leverage and curate gold standard data
- Creation of R&D development beds

3

Infrastructure

- Reduce barriers to translating AI advances into real-world capabilities
- Creation of R&D testbeds

4

Governance

- Adopt an AI maturity model tailored to the VA's mission

While there is still a substantial amount of work in this area, the VA has shown that working together with other AI leaders, workgroups, and industry contacts can accelerate AI in a cohesive manner that matches both the department and national goals.

Comparing and Connecting to the National Research & Development Strategy

Recalling the eight strategic areas of the National AI R&D plan, listed below, one can see that the national guidance on AI is relatively different from the AI seen in practice at the department level across government.

The eight strategic areas are:

1. Make long term investments in AI Research
2. Develop Effective methods for Human-AI collaboration
3. Understand and address the ethical, legal, and societal implications of AI
4. Ensure safety and security of AI systems
5. Develop shared public datasets and environments for AI training and testing
6. Measure and evaluate AI technologies through standards and benchmarks
7. Better understand the National AI R&D workforce needs
8. Expand public-private partnerships to accelerate advances in AI

Though several of the strategic areas of the National AI R&D are encompassed in the workforce, R&D/innovation, and governance pillars, there is also a need to research and develop AI operations (AI Operations) and infrastructure strategies to scale the impact of AI outside of a single project or lab setting. Additionally, many departments have the AI pillar of innovation, but they do not explicitly address the national R&D strategy.

Analysis and Recommendations

In writing this whitepaper, broad state of AI within federal agencies was examined through a comparative reading of various AI-related documents and strategies. As discovered in this process, there are different methods of integrating AI within the federal space. As a rule, any adopted method should be practiced methodically and transparently. As a methodology, having a formal AI strategy within a federal agency creates cohesive guidance for developing programs, eliminates repetitive funding, and increases the impact of successful solutions.

There are, of course, many benchmarks and milestones an organization must set before putting an inclusive AI strategy into practice. Through the Department of Veterans Affairs example, we see the power of leaders working to develop a strategy that creates a cohesive message on the use of AI both internally and to the public. Creating and formalizing consultation groups could serve as a powerful mechanism for leaders to share and help co-create strategies and implementations roadmaps.

Furthermore, as the strategies are brought to life, deeper collaboration is needed to solve Federal specific problems, such as developing AI with sensitive data. Extending the AI R&D strategy to include infrastructure could guide the responsible use of AI that extends beyond ethics and research. Additionally, AI accelerator programs can help agencies create training and testing environments capable of working at any agency based on the cost recovery method. Agencies could also closely work together to test the the Government Accountability Office's AI accountability framework.

Finally, successful AI projects and programs must be showcased and amplified through effective communication. Additionally, departments may communicate their programs through standardized means and/or links from ai.gov, instead of relying simply on publications or the funded research group to cite the work.

Discussion and Conclusion

At the federal level, creating a conducive environment where federal agencies could align their strategic objectives on adopting and developing AI technologies and capabilities requires a grand vision and a holistic approach. Agencies can find common policy themes, promote cross-agency thematic cooperation on AI, and propose cost-efficient and agile methods of embracing AI. Harmonizing the strategy development process for AI is paramount to the future of establishing a collaborative AI infrastructure and ecosystem capable of delivering to the American public. Finally, it may be helpful to collaborate on and establish an assessment of the AI return on investment (ROI) value needs, federal agencies' models to funding AI, and structural capacity to leverage AI's transformational potential and dexterity.

AI's integration into federal agencies can benefit from a systematic approach as a powerful technology. Analogous to the integration of computer networks, the power of AI will be harnessed when several AI systems and solutions are integrated. Through synergy and integration, it is possible to achieve the optimal outcome. Like software and knowledge at large, algorithms capture knowledge at a single time point. Therefore, it requires periodic updates, like system updates that push onto network devices. Consequently, a commitment to AI is a long-term one and needs a cohesive, multi-pronged strategy.

At the federal level, collaboration and coordination on four key strategic themes are foundational for the future of the US government's readiness for AI: (1) Workforce, (2) R&D/Innovation, (3) Infrastructure, and (4) Governance. To ensure continued success in AI and create an environment where agencies can define and devise their ideal and optimum AI strategies, it would be helpful for agencies to commit institutional and organization resources to interagency collaboration on AI. They can work together to make the national stance on AI more cohesive and transparent.

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