Emerging Technologies and Acquisition

How Blockchain, RPA, Data Analytics, and AI are Enabling Federal Procurement Transformation

Emerging Technology Community of Interest / Acquisition Community of Interest

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Synopsis

One of the major drivers of procurement reforms in recent times has been the advent of technology in the federal acquisition process. From being an enabler to becoming a key driver of procurement's strategic transformation — technology is allowing procurement organizations to demonstrate true transformative effects across the federal government. With technology, procurement will no longer be just a purchasing or sourcing function, but instead transform into playing the role of an innovator, integrator, and collaborator, impacting agencies in myriad ways and driving overall performance for government IT management.

New and emerging technologies such as blockchain, robotic process automation (RPA), artificial intelligence (AI), and big data can help procurement find new avenues to transform, and in the process, drive greater spending visibility, increased compliance, enhanced accuracy, as well as achieve significant cost savings. As digital procurement and procurement transformation gain momentum, procurement organizations must identify and implement the right technology that will bring the desired value. This paper will look at the various technologies being implemented throughout procurement organizations across the federal government today.

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American Council for Technology-Industry Advisory Council (ACT-IAC)

The American Council for Technology-Industry Advisory Council (ACT-IAC) is a non-profit educational organization established to accelerate government mission outcomes through collaboration, leadership and education. ACT-IAC provides a unique, objective, and trusted forum where government and industry executives are working together to improve public services and agency operations through the use of technology. ACT-IAC contributes to better communication between government and industry, collaborative and innovative problem solving, and a more professional and qualified workforce.

The information, conclusions, and recommendations contained in this publication were produced by volunteers from government and industry who share the ACT-IAC vision of a more effective and innovative government. ACT-IAC volunteers represent a wide diversity of organizations (public and private) and functions. These volunteers use the ACT-IAC collaborative process, refined over forty years of experience, to produce outcomes that are consensus-based. To maintain the objectivity and integrity of its collaborative process, ACT-IAC welcomes the participation of all public and private organizations committed to improving the delivery of public services through the effective and efficient use of technology. For additional information, visit the ACT-IAC website at www.actiac.org.

Emerging Technology Community of Interest and Acquisition Community of Interest

This paper is a joint effort between the ACT-IAC Emerging Technology and Acquisition Communities of Interest (COI). The **Emerging Technology COI** mission is to provide an energetic, collaborative consortium comprised of leading practitioners in data science, technology, and research, engaged with industry, academia, and public officials and executives focused on emerging and leading technologies, which transform public sector capabilities. The **Acquisition COI** mission is to connect Government (procurement and program) and industry to new ideas and approaches to improve Federal acquisition in a forum that enables collaboration, encourages exploration and innovation, and generates results that have impact and endure.

Disclaimer

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Introduction and Executive Summary

If the acquisition workforce had an "official" mission statement that could guide their efforts, it would most likely be summed up in these two paragraphs from the Federal Acquisition Regulation (FAR): [1]

> The vision for the Federal Acquisition System is to deliver on a timely basis the best value product or service to the customer, while maintaining the public's trust and fulfilling public policy objectives. Participants in the acquisition process should work together as a team and should be empowered to make decisions within their area of responsibility.

Along with this, the FAR outlines:[2]

> Procurement policies and procedures that are used by members of the Acquisition Team. If a policy or procedure, or a particular strategy or practice, is in the best interest of the Government and is not specifically addressed in the FAR, nor prohibited by law (statute or case law), Executive order or other regulation, Government members of the Team should not assume it is prohibited. Rather, absence of direction should be interpreted as permitting the Team to innovate and use sound business judgment that is otherwise consistent with law and within the limits of their authority. Contracting officers should take the lead in encouraging business process innovations and ensuring that business decisions are sound.

Figure 1: *Notional Acquisition Life Cycle*

Not only is the acquisition workforce entrusted with obtaining the American taxpayer the best possible value in the procurements they deliver, the individuals who assist those members of the acquisition workforce - the participants in the acquisition process - play an essential role in achieving that mission.

Similarly, if the acquisition workforce had a mandate, it would be to use any and all means available to them within the four corners of the law in order to innovate and implement those processes and procedures which allow for quick adoption of emerging technologies, as well as adaption within and throughout the public sector. In fact, for those teams with the budget and

staff constraints that many smaller programs and projects have, using the freedom to pursue those ideas is necessary for success.

To that end, the use of emerging technologies to transform federal procurement has accelerated under the direction of the Office of Federal Procurement Policy (OFPP). OFPP is a component of the Office of Management and Budget (OMB) whose mission is to provide overall direction for government-wide procurement policies, regulations, and procedures and to promote economy, efficiency, and effectiveness in acquisition processes.[3] Joanie Newhart, associate administrator of acquisition workforce programs within OFPP, said at the FedScoop 2019 IT Modernization Summit, that her office and the federal Chief Acquisition Officer Council are "Focused on emerging technology and how can we use it in acquisition. We think it's going to explode this year, so we want to get in front of it and use it wisely."[4] This shift in using technology to transform a traditionally manual, paper-based process such as federal procurement had its roots in the previous administration's President's Management Agenda (PMA). That PMA outlined the strategies needed to address the critical challenges where the federal government as a whole still operates in the past.[5]

Further, the PMA outlined various Cross-Agency Priorities—or CAP—goals for each of central areas of transforming government.[6] As stated on the website for the CAP Goals: [7]

> As a subset of Presidential priorities, CAP Goals are used to implement the President's Management Agenda and are complemented by other cross-agency coordination and goal-setting efforts. CAP Goals are updated or revised every four years with each Presidential Administration's term.

Furthermore, the PMA outlined:

> CAP Goals fall into four categories: key drivers of transformation, cross-cutting priority areas, functional priority areas and mission priority areas.

This mission and this mandate are part of the reason why the United States of America serves as the global leader in emerging and innovative technologies. In fact, the FAR provides public servants with the platform to partner with the engine of the American economy - those businesses, both large and small, that develop these advancements. This freedom to improve and iterate upon existing procurement processes is an essential component of keeping our position as global leaders. It is also essential to helping ensure the government promotes those technologies and tools that provide the greatest return on the investment being made with taxpayer dollars.

Further, these technology initiatives were also directly aligned with the CAP Goal: "Shifting from Low-Value to High-Value Work"[8] and "Frictionless Acquisition", respectively.[9] These two CAP Goals combined created the vision and the future of federal procurement through shifts in technology, practices, and culture through the continued action plans and focused leadership being executed to realize these goals. However, the goal statement of the "Frictionless Acquisition" CAP Goal encapsulated the future state of federal procurement where emerging technologies can have a major impact:

> *"The Federal Government will deliver commercial items at the same speed as the marketplace & manage customers' delivery expectations for acquisitions of non-commercial items by breaking down barriers to entry using modern business practices and technologies."*[10]

In order to effectively make use of capabilities in emerging technologies for use in future procurement, it is imperative that those who participate in acquiring emerging technologies keep in mind who the ultimate end users of their procurements are. Whether it is the American citizen interacting with an agency or department, an employee benefiting from automation or other assistive technologies, or even industry partners, understanding who it is that will ultimately derive value from the work being performed is key.

Defining that value being derived by that ultimate end user is the first step an innovative acquisition process participant must take. This will lead to a number of goals being satisfied including but not limited to:

- Developing requirements around the true objectives of the project.
- Selecting evaluation factors that will ensure focus is placed on technical brilliance.
- Sharing the solicitation with communities and in locations that will encourage participation from those sources in industry who have innovative solutions, but not necessarily established firms with a federal sector business footprint (i.e., non-traditional firms).[11]

It is hoped that the concepts discussed in this white paper will help any participant in the procurement process, whether directly involved in the acquisition itself, or indirectly as support staff. Additionally, that the practical advice and frameworks presented here provide members of the acquisition workforce, whether new or experienced, a starting point for discussions within their agencies and departments on the art-of-the-possible. Finally, this white paper will also begin to connect those individuals who wish to learn more about what we have presented to one another, as a robust network of collaborators will be the quickest way to promote innovation that sticks.

In closing, having developed these during a period which saw the regular forces of daily operations and the irregular forces of a national emergency declaration, combine to impact the American public in profound ways. The ACT-IAC Emerging Technology and Acquisition Communities of Interest proudly recognize the members who volunteered the precious time they had remaining after supporting their agencies to this effort.

Approach Methodology

Understanding the importance of utilizing emerging technologies, both within general efforts to support the mission of a program, as well as to support the procurement process itself, a project approach, broken into phases, was utilized. By outlining this process, the hope is that others can verify, validate, and even replicate the information utilized to derive these conclusions. With four different phases, during which a number of different individuals graciously assisted the core

group of authors, this research was performed with a degree of mindfulness as it related to the FAR and the limitations -- as well as the flexibilities -- it offers.

Seeing that all supplements build off this body of regulations, it serves as the foundation for any and all efforts that can be implemented to improve the efforts that make up the acquisition lifecycle and the procurement process in general. With that holistic view in mind, the viewpoints of those involved in developing requirements, acquisition planning, contracting, and post-award contract administration were required from the private sector and public sectors. Public sector individuals held positions that constitute those considered part of the acquisition workforce, such as Contracting Officers, Contracting Specialists, Contracting Officer Representatives, Project Managers, and Program Managers.

With the current state defined and key performance indicators (KPIs) ready to be measured, the next phase involved interviews with individuals from the various agencies represented in the use cases (Internal Revenue Service, Department of Homeland Security, and Health and Human Services) who held the roles identified as essential to understanding the issues being researched. These interviews were designed to be free-flowing conversations that included a set of predefined questions while permitting the interviewee to provide their observations on current workflows. They took place among four government settings and among enough of the private sector to provide a review of cross-industry leading practices.

The intention of these interviews was to identify key friction points across several domains, including processes, people, and policies. Through these discussions, a review of current and emerging technologies and capabilities was performed, identifying the factors that contribute to successful implementations. These factors identified were broadly categorized into those that should be considered for ongoing use, as well as those which had room for improvement.

Similarly, it was important to use these interviews to identify the actual key technologies, processes, and people that are implicated in any discussion related to the procurement and use of these advances. The technologies identified included blockchain, robotic process automation (RPA), data analytics, and artificial intelligence (AI). The processes implicated were those related to training of the workforce itself, application of advanced techniques, and continuous improvement of business workflows and processes themselves. The people involved are the end-users, dedicated trainers, technical subject matter experts (SMEs) involved in the implementation of these advances, and staff that can support programs with the integration of technologies throughout the enterprise.

With these discussions completed, Phase 3 involved the vetting of the technology, people, and process combinations that were suggested. The various impacts, both measured and theoretically possible, were analyzed to find those that suggested they would provide a positive impact to those KPIs. Using industry and government examples to provide the qualitative and quantitative data necessary for this analysis, several use cases and organizations were identified.

Once that analysis was completed, Phase 4 involved writing this paper. Much like the concept of Continuous Acquisition Improvement, discussed further below, the recommendations and conclusions of this white paper should be considered ripe and ready for the next iteration. This

document should be considered a living document, with nothing permanent or sacrosanct. What works today may not work tomorrow, and similarly, that perfect state tomorrow may need something different done today.

Identifying Emerging Technologies

As determined through the phased approach of this project, the four key emerging technologies identified as having the potential to improve the government are **blockchain, RPA, data analytics,** and **AI**.

Blockchain, along with the concept of smart contracts and ledgers, have been used in several successful applications in industry and government alike. In the public sector, one of the more intriguing applications of blockchain technology to the procurement process is the work being performed by the Department of Health and Human Services (HHS) "Accelerate" program. As the first blockchain-based program in the federal government to get an authority to operate (ATO), HHS not only provides technical advances, but also procurement advances that have shaped several important conversations about what is possible.

RPA, which has been utilized by agencies such as the Internal Revenue Service (IRS), General Services Administration (GSA), Department of Labor (DOL), and the Army to create a number of different bots (e.g., Contractor Responsibility Determination, Section 508 Clause Review, etc.) has provided immediate results. Furthermore, the way in which these bots were developed, procured, and integrated into these agencies has provided several opportunities to implement new technologies. The sheer amount of data that can be collected using these bots can be used as an opportunity rather than an end goal.

Collecting that data, whether in order to satisfy requirements outlined in the Open, Public, Electronic and Necessary (OPEN) Government Data Act, the PMA, or any other number of statutes and policies, allows for several **data analytics** related advances. The collection, organization, and visualization of all this data to be used in decision-making processes is one of the more tangible forms of emerging technology. It also makes it one of the easier advances to misunderstand when it comes to the importance of applying modern practices to the evaluation of the services and products associated with its use. This data is critical as it holds valuable insights and patterns that can help organizations assess potential risks, find new business opportunities, and most importantly, improve the overall efficiency and productivity of organizations.[12]

AI and Machine Learning (ML) allow data scientists to delve deep into massive volumes of data and uncover meaningful insights from it. Once the differences in modern data analytics versus previous iterations of the technology are understood, AI becomes possible. As one of the latest entrants into the emerging technology space, and one of the most compelling in terms of potential and importance, it is absolutely necessary for the public and private sector to work together to determine the optimal and most efficient path forward in terms of buying, using, and enhancing AI. The reports published by the National Security Commission on Artificial Intelligence (NSCAI) leave no doubt as to the need for the acquisition workforce to be prepared to use and

procure AI, and the hope is that the conclusions of this research will be one of the building blocks towards establishing that necessary competency.

Solutions Identified

Industry best practices adapted for public sector use cases have shown the identified categories of impediments are not only surmountable, but that there are several ways in which teams can implement their optimal solutions. The ultimate result is utilizing agile techniques in the processes associated with emerging technologies and modernization at an agency. In acquisitions, this can be done by treating the procurement package as a product while incentivizing and encouraging positive behaviors and thinking when it comes to continuous improvement.

Pilot IRS DATA Act, Internal Revenue Service

One part of modernization efforts at the Internal Revenue Service (IRS) is focused on improving financial and non-financial procurement data. To improve the accuracy and transparency of data in the Federal Procurement Data System – Next Generation (FPDS-NG), as well as the compliance with the Digital Accountability and Transparency Act of 2014 (DATA Act), IRS launched its DATA ACT initiative. The solutions to the project were focused on reducing manual work, shifting personnel from low-value to high-value tasks, in conjunction with Office of Management and Budget memorandum M-18-23, "Shifting From Low-Value to High-Value Work", and the PMA's CAP Goal number six; "Shifting From Low-Value To High-Value Work".[13]

Current State

The Treasury Inspector General for Tax Administration (TIGTA) conducts audits of the IRS's compliance with the DATA Act. The DATA Act requires federal agencies to report financial and award data in accordance with established data standards. The data is then published on USAspending.gov, for use by decision-makers and the American taxpayer. The 57 DATA Act data elements[14] include Parent Award ID, Current Total Value of Award, Action Date, and Primary Place of Performance Congressional District. In its Fiscal Year 2019 report, TIGTA reported inaccuracies across the 57 DATA Act data elements, ranging from 5 to 52 percent.[15] In its planned corrective action responding to the audit, the IRS committed to develop a quality assurance review process to ensure DATA Act information is accurate.

The data that IRS certifies, and TIGTA audits for DATA Act compliance, is derived from the IRS data in FPDS-NG. Prior to Pilot IRS DATA Act, a senior level IRS employee would manually correct FPDS-NG as needed in response to TIGTA audit errors, inquiries from the Office of the Chief Financial Officer (OCFO), and errors identified within IRS Procurement. Manual corrections took roughly three minutes per data element. Applying the TIGTA audit accuracy error rate to a year's worth of IRS contract actions, it would take nearly two full-time equivalent staff to correct data element errors.

Description of the Portfolio

According to the Pilot IRS webpage on IRS.gov: [16]

> *Pilot IRS is an iterative procurement technique focused on outcomes that allows the Internal Revenue Service (IRS) to test new technologies on faster timelines. If a solution fails to meet expectations, then it will not proceed to the next phase of funding. This methodology creates an agile approach to identify, test, and deploy solutions that support the mission, regardless of whether the solution, technology, or service currently resides within the IRS or the federal government.*

Like all federal agencies, the IRS is under several mandates to modernize its operations and its mission of administering the nation's tax code. However, the IRS lacks any research and development capability or special acquisition authorities such as other transaction authority (OTA) or a commercial solution opening program to rapidly procure emerging technologies for these modernization efforts. Further, as previously mentioned, the IRS does not have funds allocated for research and development.[17]

To solve this issue, the Office of the Chief Procurement Officer (OCPO) used FAR Parts 12 and 13 to create Pilot IRS; a phased, incremental funding procurement initiative that will let the agency test new technologies on faster timelines with reduced risk. This initiative was also in keeping with modular contracting best practices, as outlined in guidance provided by the OFPP.[18] Under Pilot IRS, the agency issues a proposal under what is referred to as a "Solution Challenge", specific problems that the IRS is trying to solve with emerging technologies. The IRS issued a request for proposals for the first solution challenge, DATA Act Improvements, on August 23, 2019.[19] The Pilot IRS DATA Act had three goals:

1. Improve the data which resides in FPDS-NG.
2. Limit the amount of manual work required by government personnel in improving the IRS data.
3. Achieve incremental improvement in IRS data in the near term – the aspirational goal was to improve data no later than 31 December 2019.

Constraints

The Pilot IRS DATA Act team faced four general constraints: culture, budget, security, and information technology onboarding, especially the Enterprise Life Cycle (ELC). Culture and budget remain mostly within IRS Procurement's control and have therefore been more navigable. To manage concerns surrounding use of robotics process automation solutions, the team has worked to socialize the high benefits and low risks of the solution. Examples included:

- Held demonstrations of the solutions to showcase capabilities and controls.
- Controlled the pace of corrections and completed full quality checks of results.
- Notified contracting personnel before making any FPDS-NG change, to prevent any surprises or fear of data manipulation.

To date, IRS Procurement has funded the Pilot IRS DATA Act. As the project is a top priority for IRS Procurement, the program was able to secure the necessary funding. This may become more challenging for Phases 4.1 (scaling and deployment) and beyond, as budgets may be constrained by pandemic-related priority shifts.

Another major constraint identified outside of IRS Procurement was the IRS ELC process. The IRS requires information systems-related business changes to be approved through the ELC process. ELC outlines project paths and numerous required artifacts.

However, the IRS found that there was little, if any, ability to tailor the ELC process to fit the scope of the project at hand and the need for rapid prototyping and development. Pilot IRS DATA Act will likely run into delays, which could potentially be significant as the team navigates the process and seeks ELC approvals. Currently, there is not a streamlined approach to ELC for RPA projects, though ELC and the Office of the Chief Information Officer (OCIO) hopes to develop one in the near future.

Transformation Enablers

The Deputy Chief Procurement Officer was a staunch supporter of innovative technologies and the main champion of Pilot IRS DATA Act. The willingness to take risks, while doing so incrementally and continually evaluating return on investment (ROI), is critical to this project's success. Pilot IRS DATA Act was solicited substantively different from how the government normally buys technology, resulting in non-traditional contractors that had not previously done business with the federal government submitting responses. Pilot IRS aggressively streamlined a cost-effective approach to testing and deploying technology solutions that had an immediate impact on its mission and how the IRS supports the American taxpayer.

Stakeholders

Pilot IRS DATA Act impacts a wide array of stakeholders:

- IRS OCPO—Executives, Procurement Innovation Branch, all Contracting Officers and Contract Specialists, contract writing system team (Procurement for the Public Sector and Folders Management)
- IRS OCFO—Financial personnel collaborating with OCPO for DATA Act submissions
- IRS OCIO—Information technology personnel providing IRS laptops and necessary licenses to contractor personnel, as well as involved in the ELC process
- IRS ELC—includes multiple IRS business units such as Privacy, Government Liaison, and Disclosure and Security Risk Management Office

Technology Selection

Pilot IRS DATA Act was solicited as Solution Challenge One under the Pilot IRS framework. The intent of the Pilot IRS DATA Act solicitation was to acquire innovative tools to meet the three goals previously mentioned and the IRS was open to any viable solution to achieve the goals. The solicitation was well received by industry, resulting in 38 proposals. Comparative evaluations in accordance with FAR 13.106-2(b)(3) were used to determine the best value based on: Technical

(capability of the solution to meet the primary goals), Past Performance, and Price. The requirement was solicited as an agile modular approach that would allow flexibility to pivot as needed and this has contributed to the program's success as additional within scope items have been identified throughout the phases.

Based on the written proposals, ten contractors were selected to participate in technical demonstrations of their solution, to include discussion on Phases 2-4, ROI, and funding levels. Five contractors were ultimately selected to receive contracts and funding for Phase 1 (Proof of Concept). The technical solution of each selected contractor was slightly different, allowing the IRS to make funding decisions in future phases based on the contractor(s) whose solution proved to be the most promising. Two of the five selected contractors received funding to continue into Phase 2, and both remaining contractors continue to support this requirement and improve their solutions in Phase 4.

These contractors developed and began to deploy solutions using RPA, natural language processing (NLP), and AI. The contractors' solutions review data in FPDS-NG and on contract documents, compare data elements between the two data sets, and correct FPDS-NG as requested. Recent modifications to the DATA ACT contracts, which began in Phase 4, have contractors expanding their solutions to interact with the contract writing system.

Accomplishments to Date

Through the recently completed Phase 3, IRS Procurement realized significant Return on Investment (ROI). ROI, by contractor, was 78 percent and 116 percent over break-even, comparing the amount of labor hours and costs associated with manually performing these actions. Assuming the contractors were tasked with correcting a year's worth of DATA Act errors, the contractors' solutions could replace the work of nearly two full-time equivalents per year.

Specifically related to the DATA Act, IRS Procurement used one contractor's solution to correct data elements in real-time, which is especially critical as DATA Act certifications moved from quarterly to monthly. The Pilot IRS DATA Act team loaded the contractor's spreadsheet "corrections file" with 20 FPDS-NG dates signed that required correction. These errors were identified by the OCFO in preparing for the monthly DATA Act certification. The team is about to correct an additional 178 FPDS-NG dates signed, representing nearly two percent of annual volume in this high error rate data element. For this batch of corrections, the team used the solution of the second contractor: the contractor's AI solution extracted dates signed from contract award documents, compared the data with that in FPDS-NG, and identified discrepancies.

IRS Procurement was also able to quickly deploy one contractor's solution to review and correct COVID-19-related FPDS-NG data. The contractor's RPA bot scans FPDS-NG weekly for Department of the Treasury (USDT) contract actions related to COVID-19 and corrects the requested FPDS-NG data elements in less than one-quarter of a second per element. As of June 22, 2020, IRS Procurement corrected 76 COVID-19-related data elements with this solution.

Artificial Intelligence for Past Performance Prototypes and Piloting Initiative, Department of Homeland Security, Procurement Innovation Lab

Led by the Department of Homeland Security (DHS), OCPO, Procurement Innovation Lab (PIL), this project, focused on the Contractor Performance Assessment Reporting System (CPARS). CPARS is an evidence-based acquisition modernization project under the OFPP Acquisition Modernization Plan and is part of the "Frictionless Acquisition" CAP Goal of the President's Management Agenda.

The CPARS AI effort focuses on improving the ability of the acquisition workforce at DHS to rapidly access relevant records from CPARS. The CPARS system serves as the central repository of contractor past performance assessment records. Contracting officers are required to consider contractor past performance when conducting source selection as part of the federal contracting process, and CPARS is the place they can access information to do so.

For several years, in reverse industry days (RIDs) and acquisition innovation roundtables (AIRs), as well as more informal meetings, industry raised concerns related to CPARS including issues related to data quality and stating that contracting officers were not using the system for acquisitions. The federal acquisition community, those on the front lines of contracting, shared similar concerns. CPARS has a wealth of data, with over 1 million records for over sixty-thousand vendors, but it is hard to rapidly access assessment reports that are relevant to a given source selection.

The difficulty leads to some less than ideal outcomes, primarily workarounds (like past performance questionnaires that operate outside of the CPARS system), but also a reduction in the quality of data in the system. This is part of a Catch-22 – the perceived value of the CPARS system is reduced when it is difficult for acquisition professionals to get data out of it, leading to diminished perceived value of their time spent inputting quality data into the system. Three out of four acquisition professionals identified the past performance evaluation process as an opportunity for intelligent automation to support the workforce. The challenge was then raised to industry: can emerging technology such as ML and AI help federal contracting professionals rapidly access relevant records from CPARS for a given source selection (set of vendors against a specific requirement, or solicitation) and provide them insight into the data that can aid them as they review and evaluate a vendors' past performance?

Description of the System or Portfolio

The type of solution solicited fell into the class of decision support systems, where ML solutions (falling under the general term of AI) are used to support the knowledge discovery process of a human. Such decision support systems are common within the business intelligence (BI) community where metrics and performance measures are summarized through interactive dashboards. Other terminology common to this domain is visual analytics, where researchers explore design principles and practices for creating novel tools and techniques to support analysis.

For the problem of using CPARS data during past performance analysis, this can be thought of as a classic information retrieval problem, which can be augmented through interactive visualizations. Given a series of records for a particular Dun and Bradstreet (DUNS) number, one can envision a tool that can graph average past performance histories related to the DUNS number, show outliers from the average, and support interactive filtering and drill-down into records. Underlying the summary and filtering can be machine learning techniques that can process text to help identify records that fall into the same business domain as the Statement of Work (SOW) being solicited. Text analysis (again falling under the umbrella of AI) can also be applied to the contracting officer notes to highlight sentiment within a textual description that may indicate mismatches to quality score rankings (for example, providing a score of "satisfactory" in a given performance metric, but having text descriptions that indicate unsatisfactory work).

While many deep learning solutions (another class of AI) rely on millions of records for training, this class of problem can leverage novel text analysis solutions (such as Bidirectional Encoder Representations or BERT), to support the information retrieval process. In this solution space, the goal is to order records based on relevancy, as well as highlight potential problematic records based on quality metrics and text descriptions related to past performance. By developing advanced search functions, aggregations and filters, the manual search process can be considerably improved, leading to efficiencies in procurement.

Such tools do not replace the human decision-making process. Instead, AI is used to augment the normal workflow done by the Contracting Officer. Historically, aggregation of scores, trend analysis, and text summary analysis were manual processes. By providing tools that can automatically aggregate scores, visuals that enable trend analysis, and highlights of potentially relevant text, decision support tools can reduce the cognitive burden on Contracting Officers and make them more efficient. As such, Contracting Officers will not rely on mechanistic comparisons, but they will utilize the decision support system to make their own informed decisions.

Future State

Ultimately, the prototyping and piloting initiative for CPARS AI solutions intends to have multiple FedRAMP accredited cloud-based commercial Software as a Service (SaaS) solutions for federal agencies to procure and utilize to improve the work life of our federal acquisition workforce and to support more meaningful outcomes of source selection past performance evaluation.

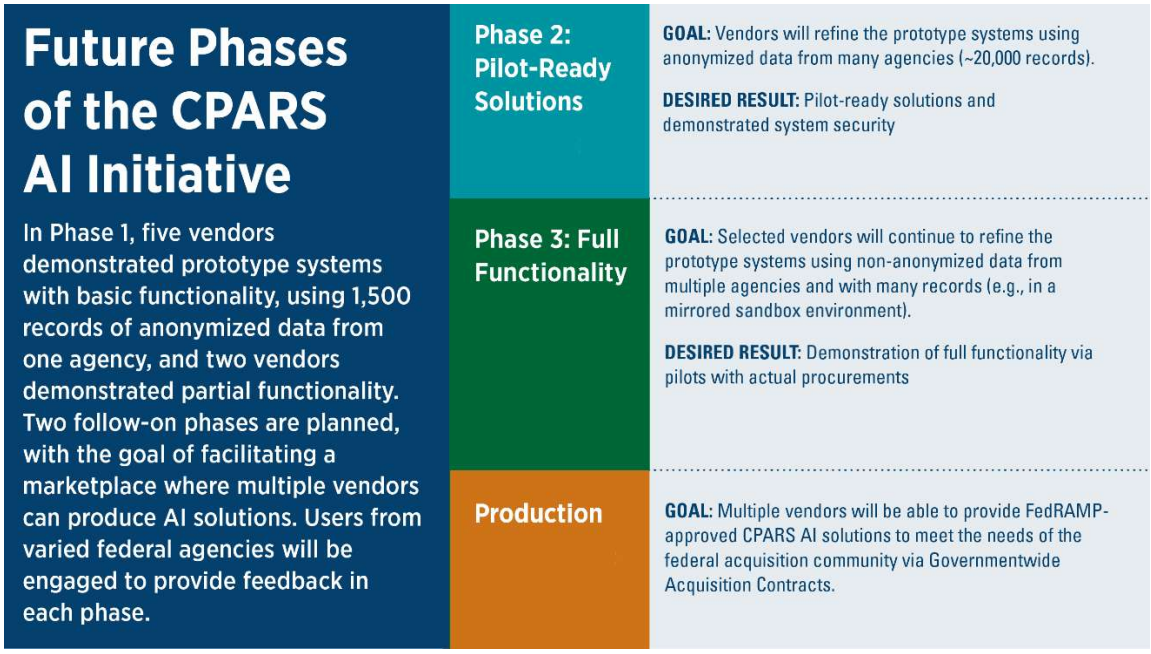

Figure 2: *CPARS AI Initiative Project Timelines*

Constraints

From the outset, DHS realized it did not want to develop its own IT systems/solutions. CPARS would remain the system of record for contractor past performance assessments, given the significant resources committed to the system and its modernization. Further, the intent was not to replace CPARS. Rather, DHS wanted to support the development of third-party solutions that connect to CPARS so that DHS can gain additional value from the data contained in the CPARS system.

DHS maintains rights to the data in the system but did not want to own the AI solutions that ingest the data and derive outputs from the data. DHS wanted to contract for the output from these AI solutions – in the form of CPARS AI Reports or Subscription Services with dashboards or similar visualization interfaces. If successful, the end state of this AI effort for CPARS for DHS will be a self-sustaining, multi-contractor commercial marketplace.

Currently, this marketplace does not exist. DHS views the government's role to be an incubator fueling the development of this new commercial marketplace, and DHS has an active stake in the success of these solutions. DHS also does not intend to contract for one solution. Multiple vendors in a production phase helps DHS keep costs down and improve quality through competition and diversity in solution offerings, which ensures DHS is not faced with vendor lock-in and helps incentivize industry be attentive to model degradation and consistently correct model drift.

DHS is leading and building these solutions for the entire federal acquisition community. It took both the government and industry partners extended time to understand this, but these solutions will be available to every federal agency once they are production ready – likely through

Government-Wide Acquisition Contracts (GWACs). Finally, yet most importantly, DHS is steadfast in their commitment to develop user-driven solutions. Through a user-centered design approach, the DHS initiative will ensure their operational contracting community to be intimately involved in the development and design of these solutions.

Transformation Enablers

DHS followed several goals in the development of the project:

1. Start with the end in mind – knowing the desired end state, recognizing constraints, and building backwards from this starting point enabled DHS to understand what was ahead and allowed them to scope, resource, and build the right coalition of stakeholders to support that journey.
2. Make time for the data – recognizing and planning for the time needed to prepare the data that digital transformation technology solutions such as these need for training and testing helped DHS ensure that vendors had what they needed. This required support from subject matter experts was critical to have those stakeholders on board from the start. It also required strong collaboration with industry who needed that data to be successful.
3. DHS supported the development of commercial solutions that did not currently exist, rather than asking industry to build solutions for DHS that the government would own and maintain.. First, it helped DHS identify the appropriate procurement authority – the Commercial Solutions Opening Pilot Program (CSOP) authority provided to DHS under the FY19 National Defense Authorization Act (NDAA). [20] It also helped DHS adopt the principle of minimal restriction on the commercial marketplace – DHS structured intellectual property rights to protect its rights to the CPARS data, not to own the rights to the commercial solutions the contractors were developing to meet DHS needs. This approach enabled the contractors to secure additional, private funding to support their ability to design and develop these commercial CPARS AI solutions, which the government would buy later – in the form of subscriptions or reports.
4. Building incrementally has been critical to ensuring the users and policy stakeholders understand the purpose and value of the CPARS AI solutions, as well as how the AI interacts with the CPARS data and supports user decision-making. Building incrementally has also ensured the government and industry are investing time in solutions that are meeting the government's objectives and helps ensure that each contractor has appropriate access to users, decision-makers, and feedback throughout the development of these commercial solutions. This model supports private sector investment in these solutions. This model also supports appropriate, necessary federal data governance and policy changes.

Stakeholders

1. Industry – Contractors that do business with the federal government and have data in CPARS.

2. Industry – The contractors that are developing the commercial CPARS AI solutions.
3. OMB and OFPP.
4. Chief Acquisition Officer's Council (Agency Senior Procurement Executives serving as executive sponsors).
5. Procurement Council on E-Government.
6. The GSA's Integrated Award Environment (IAE).
7. Federal CPARS Users (Operational and Policy).
8. Federal Information Technology Subject Matter Experts (DHS OCIO partnership support through SME technical assistance for data preparation, technology assessment, and security accreditation).
9. Third-Party Partners (Technology Assessment & Validation).
10. Federal Innovation Stakeholders (including executive sponsors, champions).
11. Federal Information Technology Stakeholders (including executive sponsors, champions).
12. DHS Center of Academic Excellence – Center for Accelerating Operational Efficiencies (CAOE), Arizona State University (providing technology assessment and SME support).

Business Process Model

In order for industry to address the challenge question, on behalf of the federal acquisition community, DHS issued a general solicitation using the CSOP authority derived from the Fiscal Year 2017 NDAA. They used that authority to obtain demonstrations of a proof of concept to determine the extent to which AI can assist Contracting Officers conducting past performance evaluations in making efficient and effective use of CPARS information. The government hoped, as a threshold, that the demonstrations would show that AI can help the Contracting Officer identify which records in CPARS contain the most relevant information to the source selection in question. The government also desired data-driven and evidence-based recommendations about opportunities to improve the data quality of the past performance information inputted by Contracting Officers into the CPARS, based on the provided test data set and informed by the development of the prototype.

The solicitation was posted in August 2019 and 40 proposals were received. Peer review identified nine that demonstrated technical merit and awards were negotiated with those nine contractors. The following constraints were incorporated into the initial CPARS AI prototype awards:

- The government does not require delivery of any intellectual property.
- The government will provide test data for use in the prototype design and development. This test data will be sanitized to safeguard the integrity of the CPARS system. The test data will be provided as a data table developed using a parsing script from PDF CPARS reports generated from the CPARS system. The data table will be comprised of approximately 1,000 records representing approximately eight contractors. Additionally, a sample solicitation will be provided as part of the test data for purposes of developing the proof of concept or viable prototype.
- To the extent that FAR 42.1503 or any other FAR provision limits use of information

from CPARS to supporting specific source selection decisions, from a policy perspective, OFPP does not view this AI initiative as an inappropriate or misuse of the data, as the purpose of the proof of concept is to explore how to maximize the value of the CPARS data specifically for purposes of source selection. Further, DHS will take appropriate safeguards to protect the data and intends to limit the use of the data to only the number of reports sufficient to enable DHS to obtain meaningful proof of concepts or viable prototypes.

- The government will provide regular, scheduled access to SMEs during the performance of resultant contracts, including operational contract specialists who use CPARS to perform past performance evaluations, for purposes of user feedback during the development of the proof of concept / working prototype.
- The government may engage academic researchers through a DHS Academic Center of Excellence partnership agreement for purposes of supporting the government's assessment of the validity and reliability of the proof-of-concept prototypes.
- The government prefers solutions that will ultimately be able to comply with Federal Information Security Management Act (FISMA) of 2002 and 2014 (as amended) and IAE design standards which may mean a solution capable of obtaining a Federal Risk and Authorization Management Program (FedRAMP) certification or ATO. Phase 2 contracts will require the final delivered CPARS AI solution to obtain the FedRAMP certification and DHS ATO. CPARS AI solutions unable to achieve those accreditations will not be eligible for piloting contracts (Phase 2).
- The government requires that the solution be "explainable" – meaning that the solution shall describe the methodology that was applied to the data to obtain the results and outcomes from the use of the AI methodology

Government stakeholders attended each of the demonstrations, including the final viable prototype demonstration, and these stakeholders included users, as well as decision-makers. Commercial companies were awarded $50,000 in seed funding, provided test data, and consistent access to a product owner and users to iteratively develop the prototypes with scheduled demonstrations along the four-month period. In January 2020, the initial prototypes were delivered. Most of the vendors' prototypes effectively demonstrated the capabilities of these cognitive solutions to the use case and warranted further prototyping.

DHS continues the building out the next phase of prototyping by validating user stories, developing the baseline security control requirements for the cloud-based SaaS solutions, coordinating the cross-agency data preparation of a larger test data set, and lining up additional agencies to support this journey, including expanding the user group that engages with the vendors throughout the prototyping process. Ultimately, if the prototyping and piloting phases prove as intended, DHS will have multiple FedRAMP accredited cloud-based commercial SaaS solutions for federal agencies to procure and utilize to improve the work life of our federal acquisition workforce, and to support more meaningful outcomes of source selection past performance evaluation.

Department of Health and Human Services (HHS) and the BUYSMARTER Initiative

The intent of ***BUYSMARTER*** is to maximize HHS' enterprise purchasing power to establish a cohesive acquisition structure across the department in order to drive better pricing and achieve better terms and conditions, while consolidating the total number of contracts. This technical solution leverages AI technology to assist in spend data and identifying opportunities that support enterprise acquisitions. A solution includes the Full Contract Scan (FCS) AI Tool. The purpose of BUYSMARTER is to enable the 26 operating and staff divisions within HHS to operate as a singular buying entity by bringing all HHS contracting data together and then deploy AI to empower the HHS acquisition community with powerful analytical, collaboration, and negotiation capabilities.

Current State

HHS has five acquisition management systems across HHS's 11 operating divisions and 15 staff divisions (OpDivs/StaffDivs). If HHS wanted to buy as an enterprise, it would have to search through and read thousands of contracts across the OpDivs/StaffDivs to determine who buys the same things, at what prices, and with what terms and conditions. HHS did not have the ability to "scan" full contracts and compare "like to like" requirements and items to increase bargaining power. This is where AI was the logical solution to solve this age-old problem.

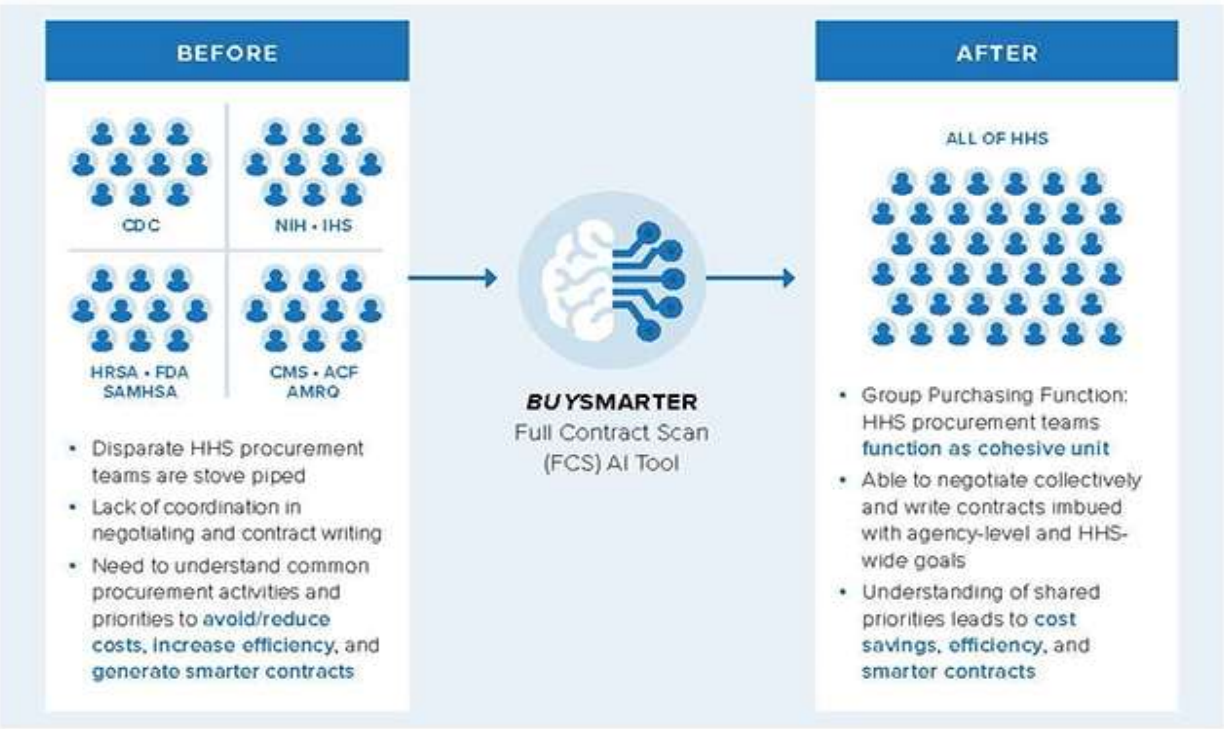

Figure 3: *BUYSMARTER Before and After State*

Future State

With the FCS AI tool, HHS can quickly scan existing contracts, negotiate collectively, and write future contracts with agency wide goals. The *BUY*SMARTER AI FCS Microservice's purpose is to enable the 26 OpDivs and StaffDivs within HHS to operate as a singular buying entity by leveraging the full suite of HHS contracting data and AI capabilities to empower the HHS acquisition community with powerful analytical, collaboration, and negotiation capabilities.

In short, the *BUY*SMARTER philosophy is, fundamentally, a human experience where a group of individuals from different agencies acquiring together as one, as

> "…this tool is designed to AI-enable that human experience. BUYSMARTER is a human experience of working together to achieve cost savings and improvements to mission capabilities." [21]

The key word is 'Together', as shown in the following graphic.

Figure 4: *BUYSMARTER Business Philosophy*

*BUY*SMARTER's approach empowers collaborative requirements gathering and all historical data that leverages AI technology to assist in understanding spend data and identifying opportunities that harness collective purchasing power while consolidating contract vehicles. The goal of the FCS AI tool is to give the Category Collaborative teams an entirely new capability to understand where the most spend is happening, where operating and divisions are contracting for the same things, and where the differences in prices paid are the most pronounced. Building the tool to meet the defined mission, the BUYSMARTER team had to leverage many types of AI tools, such as NLP, ML, Nearest Neighbor Inference Models, Predictive Search Engines, and dozens of AI open source code tools.

Having the ability to review the entire department's spend within a category, its sub-categories and down to the specific products/services will allow the agencies to make sound, logical decisions as to whether to pursue an enterprise acquisition for that product/service. The tool was designed to be very simple to use based on familiar tools that we use regularly:

Figure 5: *BUYSMARTER UI/UX*

- The search function looks like a regular **Google** Search
- The process follows a simple **TurboTax** style step-by-step process
- And the output looks and works just like **Excel**

The AI is designed to 'look' for information the same way you and I would – by making associations within and between the things we are searching for that make sense in what is known as an 'inferential model'. Given the learning nature of AI, the tool will get better and smarter every time it is used. The tool currently processes 1.37 million contract attachments in under eight seconds. The navigation tool seen below allows the user to start a new search or to jump back into any of their historical searches.

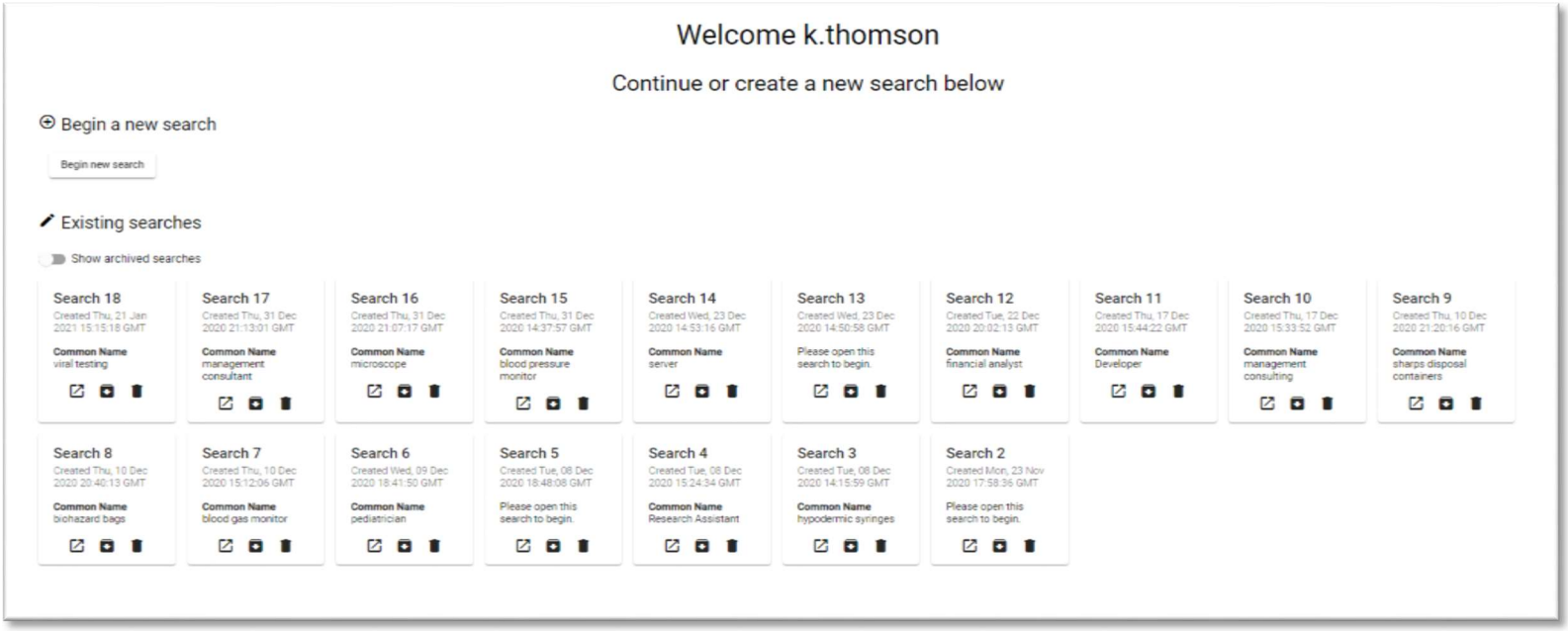

Figure 6: *BUYSMARTER UI Example 1*

The FCS process flow, highlighted in the following graphic, walks users through each step to 'narrow the search funnel' to direct the AI engine on where to look and what it should find.

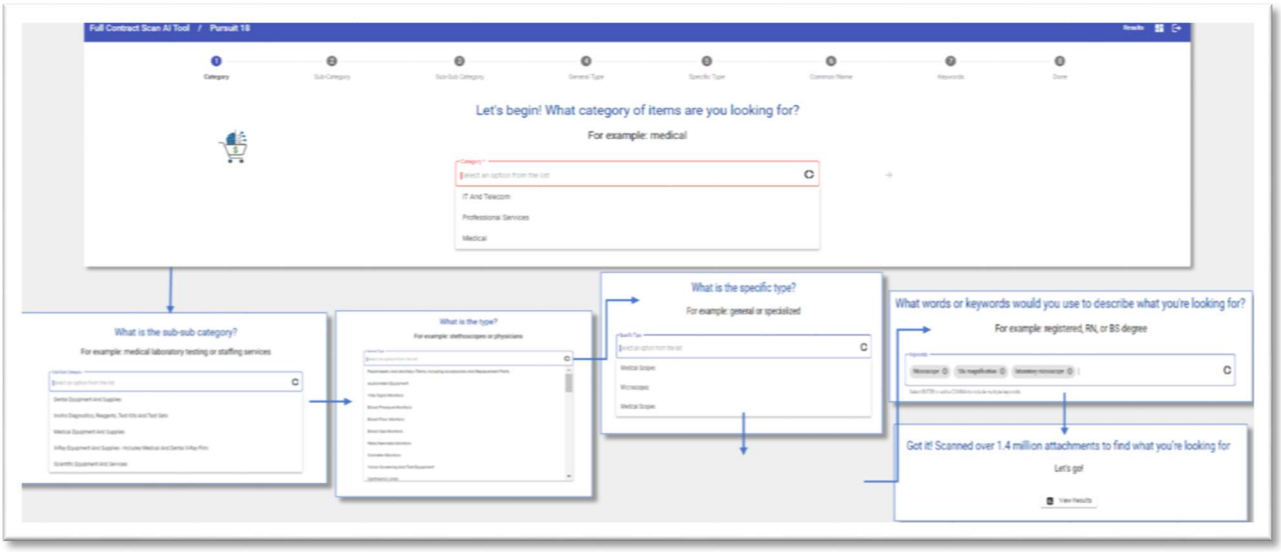

Figure 7: *BUYSMARTER UI Example 2*

The search screens have been designed with a simple look and feel where the user is led through each step with plain English questions and examples. As the user moves through each step of the sequence, the tool begins to pre-populate what fits within that search parameter. The more search parameters the user inputs into each step will help the AI tool to 'hone-in' on exactly what is being sought. The Output tool, shown in this Figure 8, displays all the key variables that the teams will need to master throughout the acquisition process.

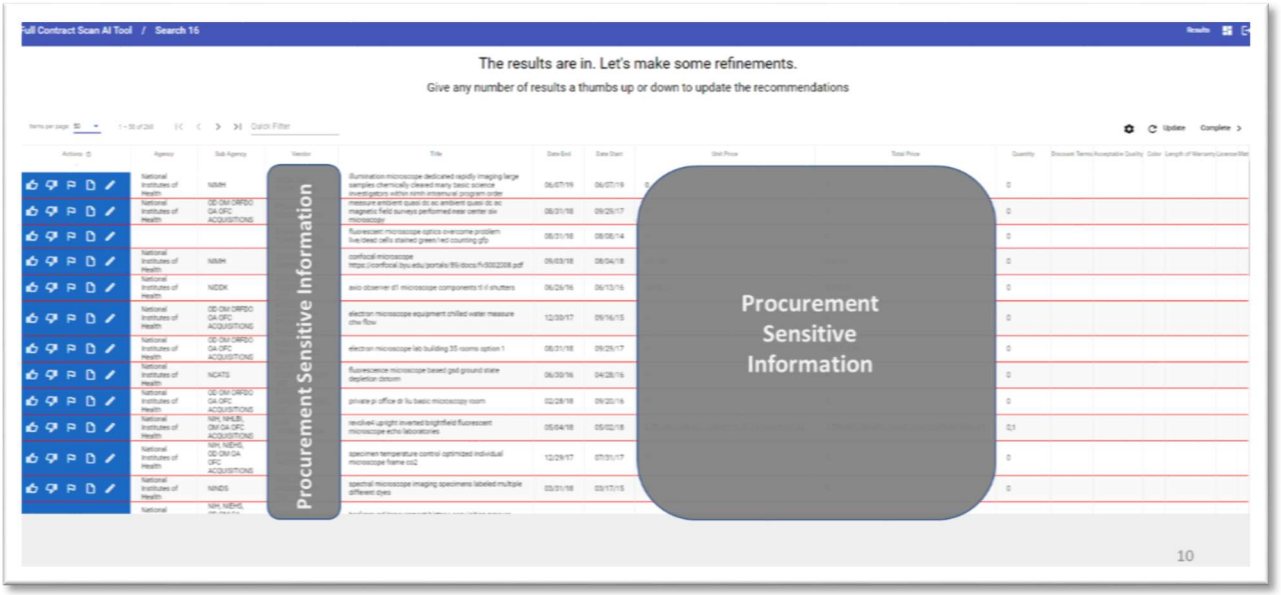

Figure 8: *BUYSMARTER UI Example 3*

The number and type of variables is based on the category and type of product, equipment, or service being targeted. The actual contract language can be viewed, as well. Users can Sort, Hide, and Filter any column just like in Excel to target the data of interest. Each time the 'Thumbs-Up/Thumb's-Down' flagging is complete, the AI tool re-runs and updates the results as it further 'learns'.

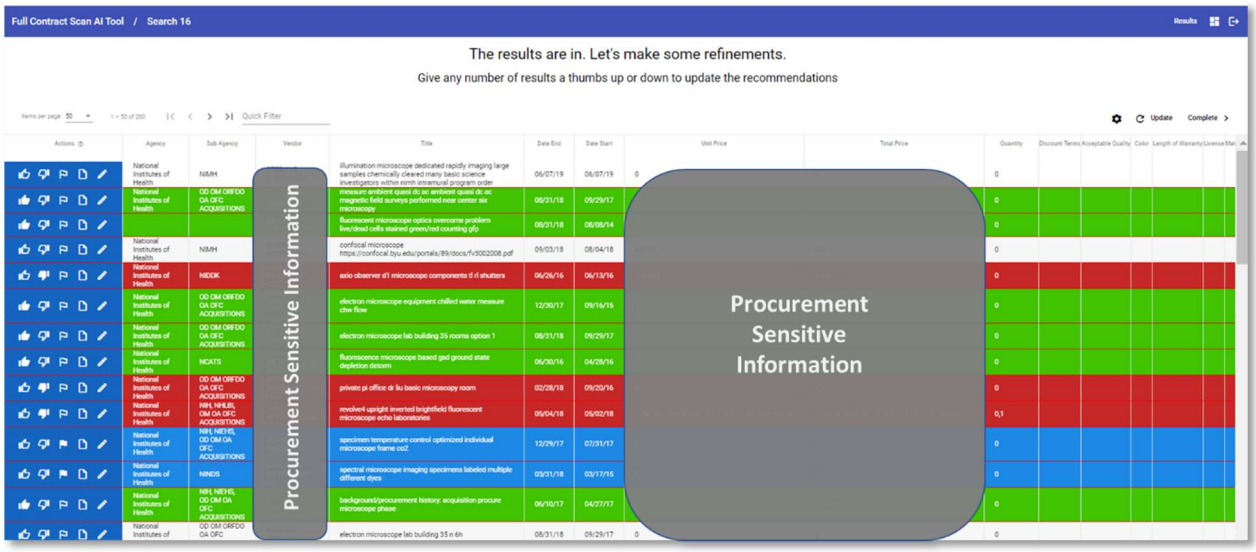

Figure 9: *BUYSMARTER UI Example 4*

Finally, the AI tool calculates the metrics that would be key for making enterprise buying decisions as shown below:

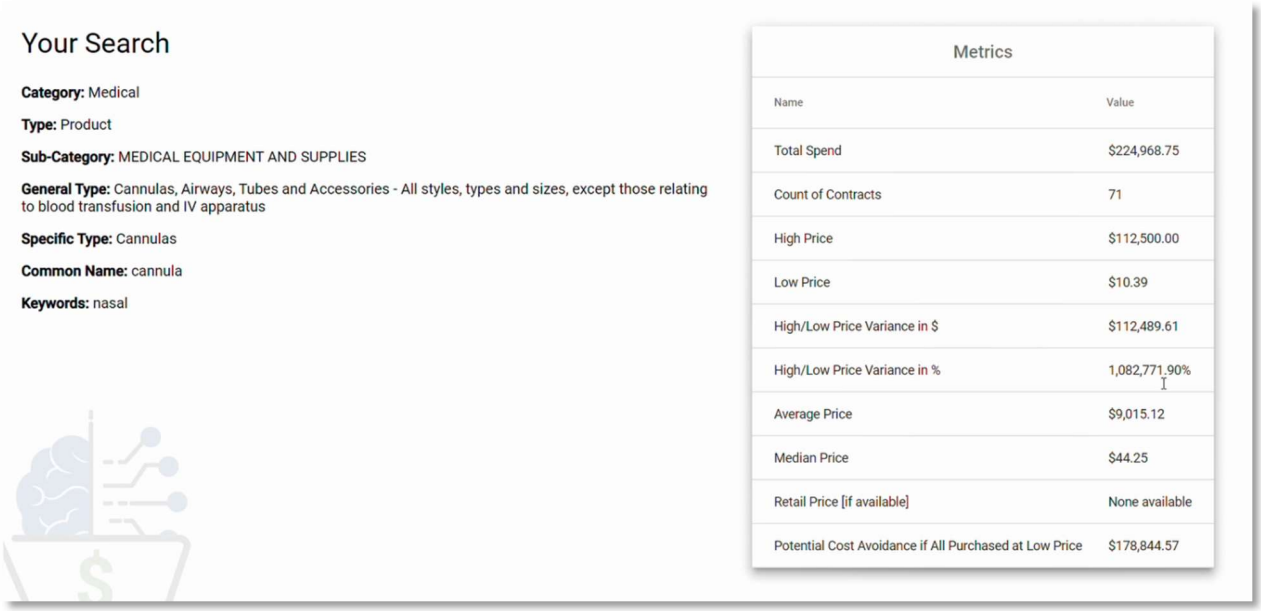

Figure 10: *BUYSMARTER UI Example 5*

Constraints

This AI based solution was designed and built from the ground-up by piecing together multiple AI tools that all had to work together to produce the desired results. HHS leaders had to be willing to the 'develop fast, fail fast, and learn' model with daily interactions with the AI vendors to mold the tool into what HHS needed. By being the 'first in kind' AI tool, HHS had no rulebook or recipe to follow, so the development of the tool took longer than desired. Also, developing a simplified and automated process for ingesting the data from the five contract writing systems would greatly improve the challenges of data loading and structuring.

Transformation Enablers

The most key enabler has been unwavering leadership support, including the visionary leadership of the Office of Acquisition, the Heads of Contracting Activity from the OpDivs/StaffDivs, and the Re-Imagine HHS Transformation Management Office. Going forward, BUYSMARTER must really focus on the value delivered, in terms of "cost savings" in addition to clearly articulating the "why" behind continued investment will prove to be critical.

Stakeholders

Stakeholders vary significantly across the HHS Operating Divisions and Agencies. However, primary stakeholders include the Heads of Contracting Activity, acquisition workforce, and acquisition systems developers and maintainers (to include the maintainers of legacy systems). Also, the cost avoidances that these large enterprise acquisitions will realize will help the OpDivs and StaffDivs better deliver their mission by keeping more of their funds focused on mission delivery.

Business Process Model

The entire enterprise acquisition process follows the HHS *BUY*SMARTER Operating Model, which mirrors the Healthcare Industry's Group Purchasing Organization model for leveraging the buying power of member groups of hospitals and non-acute care sites.

Organizational Readiness

HHS Deputy Secretary Eric Hargan signed the *BUY*SMARTER Program Proclamation on January 14, 2020, formally establishing *BUY*SMARTER as an official program with the Office of Acquisitions.

Technology Selection

Full suite of 40+ AI Open Source Code Tools brought together to achieve the mission.

Lessons Learned

AI, by its very nature, is a new and customized capability when applied to any new use case. The best lesson was constant developer/customer interactions. Developing in a model that is 'more agile than Agile', in that, the full team meets every day to review progress on development, data, and testing. It has become affectionately known as 'Full Contact Development' and is the key to our success.

Conclusion

People produce permanent processes

No matter what modernization effort is being undertaken, the adoption of emerging technologies is often a difficult task beyond the technical aspects of the initiative. Technical issues aside, buy-in is critical for emerging technologies to be successful as the workforce needs to be able to lead this change and leverage the capabilities of these technologies to transform government.

For example, the Defense Logistics Agency (DLA) was able to successfully leverage the use of RPA by overcoming workforce reluctance about how these technologies affected their positions. The DLA RPA team undertook a comprehensive strategy to communicate with workers that not only were there not going to be reductions in jobs, but they were also going to be able to do more interesting work — and that the bots would be able to be a force multiplier against empty positions that were never going to be filled due to budgetary reasons. These efforts would enable the department to get more strategic work done, the epitome of the "Shifting from Low-Value to High-Value Work" CAP goal. [22]

However, with the possibilities that these emerging technologies bring especially the promise of AI, the federal workforce is not ready to execute these solutions. According to a 2019 Accenture survey: [23]

> 61 percent of federal workers said they haven't been adequately trained to work alongside AI technologies. According to the new research, while 85% of federal executives believe that 'collaboration between humans and machines will be critical to innovation in the future,' only 18% said they were currently preparing their workforce to interact with collaborative, interactive and explainable AI-based systems.

Reskilling the workforce to implement emerging technology solutions is required. Achieving this training goal begins with federal leaders engaging their workforces early to provide a vision on the outcomes to be achieved by the technology and the requirements of the workforce to successfully achieve these objectives. Ultimately, federal leaders need to remove barriers to make it easier for the workforce to obtain the skills they need to be successful. Several areas include:

- Designing a more user-friendly learning environment to increase convenience and opportunities for the federal workforce that accelerates training. This area focuses on time and easing the overburdened workforce to prioritize training and incentives life-learning beyond the heavy compliance of daily operations.
- Creating organizational cultures that make employee engagement and knowledge transfer easier, empower communications, and improve collaboration to create positive changes that people both feel and grow.

- Reevaluating the way training programs are developed and delivered, as well as understanding how agencies need to train adult learners to grasp new topics and skills. For example, Beth Killoran, GSA's Deputy Chief Information Officer, is considering how short, YouTube-style videos and podcasts could be used as training tools for employees to learn at their own pace in digestible chunks. [24] In addition, agencies can leverage online educational platforms like LinkedIn Learning. [25]

Through a concerted effort by federal leaders to focus on the workforce versus the technology, the implementation of these capabilities will be successful across the federal government.

A starting point for today's practitioners

One of the advantages of these technologies is the relative ease of getting started with their use. Today's practitioners have numerous opportunities to begin understanding these tools through product demonstrations, either through verifying general capabilities, or better yet, pre-coordinated demonstration that allows a specific issue to be addressed through a more targeted demonstration. Nonetheless, the goal of using these technologies should be to integrate emerging technologies into a larger digital transformation and modernization strategy rather than approaching these projects piecemeal. While using them this way may be an effective strategy in the short term, these technologies are not suitable in all situations.

One of the most important planning steps needed before undertaking any emerging technology initiative is to understand the outcomes of using the technology and the problem needing to be solved. The technology is not a be-all-end-all and this planning and understanding helps organizations ensure they are using these tools effectively and not misapplying it to processes when another solution would be a better fit. Considerations for practitioners to get started with emerging technologies: [26]

- One of the most important starting points for emerging technology initiatives is to avoid focusing on large scale projects. By looking for "quick wins" through smaller projects and lower risk opportunities, measurable return on investment is possible to allow for momentum to grow towards larger implementations.
- Fit the problem to the solution to increase opportunities for successful projects. For example, processes that would be suitable for RPA implementations are rules-based and repetitious. Work with stakeholders on process automation workshops to assess processes and choose your starting point.
- Develop business cases to prioritize which processes to automate and analyze the best opportunities for value and return on investment. Focus on the value of increasing efficiency and accuracy of the tasks looking to be automated, and cost savings as a result
- Determine the right operating model for hosting the technology, since the technologies can be executed in the same ways as any other software. This analysis would be look at models such as internally hosted data centers, or via cloud, for example.

- Having the right partners, or mentors, can be the difference between success and failure. As stated by Prem Jadhwani, Chief Technology Officer, of Government Acquisitions, Inc.: [27]

> "Mentors should be more than a sounding board or advisor – they can also be valuable partners, guiding and helping you throughout the AI solution lifecycle – from inception to mission outcome. Think of that when choosing an integrator or solutions provider; getting into AI is not like buying a computer, but more like adopting a new way of doing business. You'll get further faster if your partner has done that before. "

Next steps for a team new to these technologies

An important factor for federal agencies is to focus on understanding how these technology solutions impact the priorities of the agency. Agencies should research how others in the public sector have implemented these solutions under consideration, since these initiatives have broad exposure across the federal government. Research should also be conducted with vendors and other industry experts to see what capabilities exist that can be implemented. It can be tempting to jump in headfirst when a solution promises to push the agency toward meeting a certain goal. Adoption of new technology should be well-conceived and methodical for it to be successful.

In addition to a well-thought-out implementation process, make sure the team is supported and setup for success. This includes training so that the workforce can get the most value out of new technologies and can best leverage the capability. Training should be both ongoing and integrated into operations.

This training focus should be two-phased. Phase one would constitute more traditional platforms and mediums such as expert consultants, the technology vendor, etc. Phase two then pivots to focus on training-the-trainer and identifying employees who are comfortable using the new solution and encourage them to both train other employees and be coaches to others when questions arise.[28] Ultimately, practitioners will just have to dig in and try new things. Agencies can and should experiment with single-point solutions and not get locked into a technology that cannot be easily discontinued if it is not working or solving a problem. Getting real people using it as soon as possible is the best way to realize the potential of an emerging technology.

Authors

This paper was written by a consortium of government and industry representatives. The organizational affiliations of these contributors are included for information purposes only. The views expressed in this document do not necessarily represent the official views of the individuals and organizations that participated in its development.

Jaime Gracia	United States Government (Project Lead)
Mike Rice	CornerStone IT (Project Lead)
Polly Hall	United States Government
Janelle Billingslea	United States Government
Marisa Roinestad	United States Government
David Dastvar	Eagle Tech, Inc.
David Hernandez	Riva Solutions, Inc.
Ken Thomson	Unissant, Inc.
Ali Loveys	BT Block Health Group

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