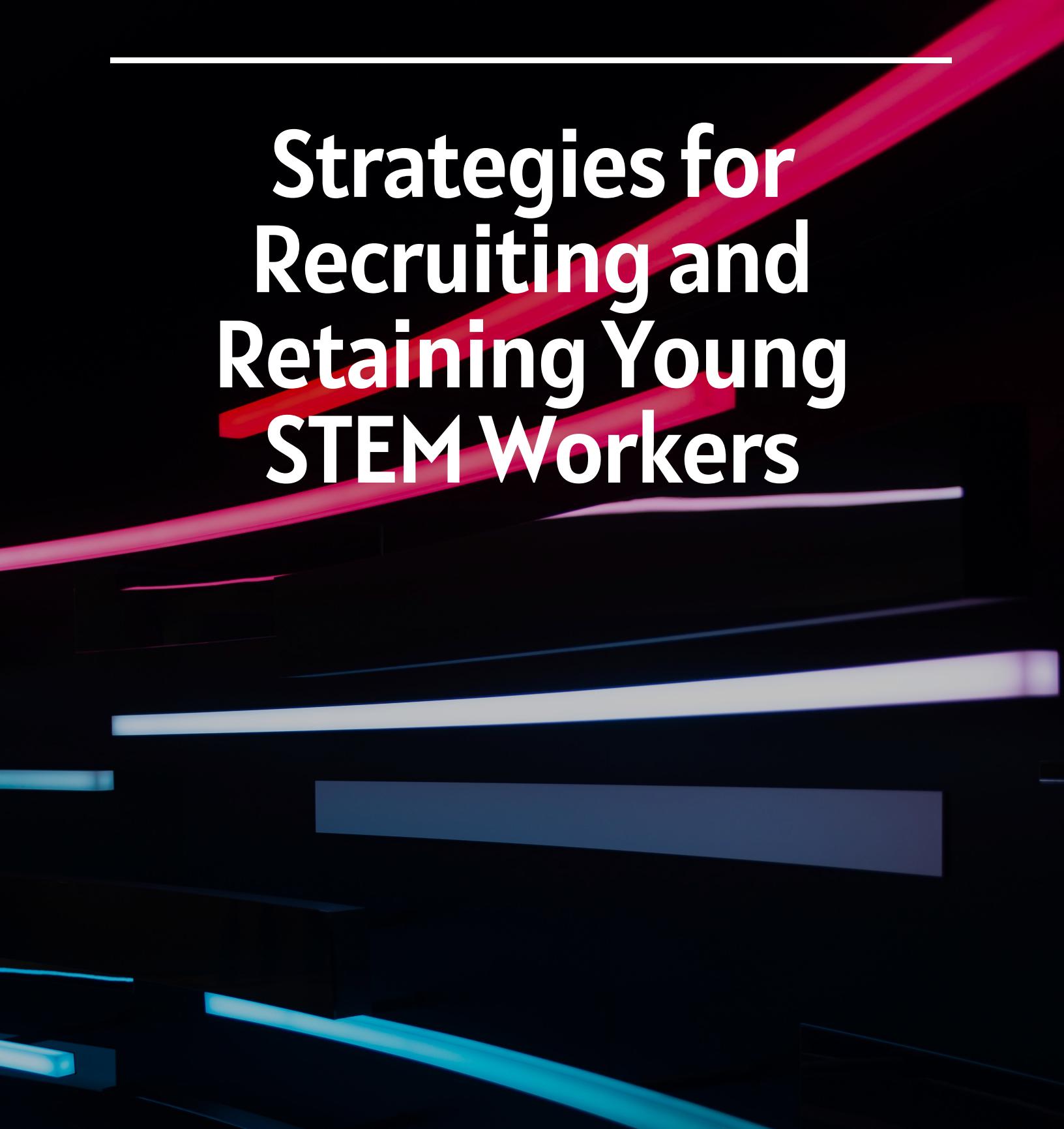

Strategies for Recruiting and Retaining Young STEM Workers



*An Analysis of Policy Options for the Innovation
Steering Group of the Department of Defense*

Daniel Nakasone
MPP Candidate at the Frank Batten School of Leadership and Public Policy
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I have been truly blessed in my entire life but—as I worry my APP might near 100 pages—I must keep my acknowledgements short. To the countless people not named here, know I am eternally grateful for all you have done for me.

Disclaimer

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, by the Department of Defense, by the Innovation Steering Group, or by any other agency.

Honor Statement

On my Honor, I have neither given nor received unauthorized aid on this assignment.

A handwritten signature in black ink, appearing to read "Daniel Nakasone".

Introduction

For my entire life I have grown up with a parent in the military. While this has shaped me in many ways, one that is salient in my mind is my desire to do work that is meaningful: work that makes the world a better place. That is why my first internship was in the public sector. One thing I noticed while working there was that a lot of my fellow interns would work one or two summers in the public sector then take an internship and full time job in the private sector—especially those who were pursuing STEM degrees.

That is the impetus for this report: I wanted to investigate why the public sector (specifically the Department of Defense) had trouble recruiting and retaining young workers. Not only that, I wanted to lend my hand at providing a potential solution for this. This report details the background behind this problem and then looks at potential solutions.

Executive Summary

This report begins by defining the problem it seeks to address: how can the Department of Defense do a better job recruiting and retaining young STEM workers. This report is written for the Department of Defense's Innovation Steering Group and has a focus on the Intelligence portions of the Department of Defense also and outlines those sponsors.

This report then goes on to detail background information broken into two sections: Problem Background and Evidence on Potential Solutions. In the Problem Background section, I examine questions such as what is innovation, how is it present in both the public and private sectors, the importance of the workforce to the Department of Defense, and an overview of workforce trends both in general and for the Department of Defense specifically. In the Evidence on Potential Solutions, I detail things such as the Department of Defense's SMART Scholarship Program, different types of project management techniques, and specific examples of innovation in both the public and private sectors.

I then offer three potential solutions to help solve the problem: 1) Establish a Rotational Job Program with Private Companies; 2) Train Leaders on Innovative Project Management Techniques; and 3) Expand the SMART Scholarship Program. These alternatives are evaluated on the four following criteria: effectiveness, cost, feasibility, and diversity. After comparing the three alternatives on those criteria, I found that the third alternative of expanding the SMART scholarship program would be the most effective. I then detail an implementation plan for this including an analysis of key stakeholders and the "worst-case scenario" of implementation for this chosen alternative.

Exordium

Problem Statement

Innovation: this is a key phrase heard often today. While this is often talked about technical advancements, another important facet of innovation is workforce innovation. The public sector is at a disadvantage in recruiting top talent as the private sector can pay much more—especially for workers with specialized technical degrees. The labor force participation rate is struggling in the wake of the COVID-19 pandemic; millions of people have left the workforce (Tappe & Morrow, 2021). *As more employers begin competing over a scarcity of workers, Intelligence Community members of the Department of Defense (DoD)—such as the Defense Intelligence Agency—must think of new and innovative ways to recruit and retain young science, technology, engineering, and mathematics (STEM) workers.* Effects of workforce concerns are especially key for the intelligence side of the DoD where greater technical knowledge and experience is often needed. For example, in 2018, the National Security Agency (NSA)—which falls under the purview of the DoD—was reported of “losing its top talent at a worrisome rate.” Current Deputy Director of the NSA, George Barnes, has said that “The big change these days is there’s a supply-demand imbalance between the outside and the inside [of the government].” (Nakashima & Gregg, 2018)

Without proper talent, the United States risks falling behind near peer adversaries in the national security space. The United States spends \$778 billion on the military—the most of any country (Figure 1). China, who spends the second most, only spends roughly \$250 billion. The median of the 15 largest spending countries is only \$52 billion (SIPRI, 4/21). Despite this wide disparity in spending, the United States still faces competition from countries such as China, Russia, Iran, and North Korea. Without the proper talent, the United States risks losing its position as a dominant global power and—in dire circumstances—not being positioned well for an international conflict.

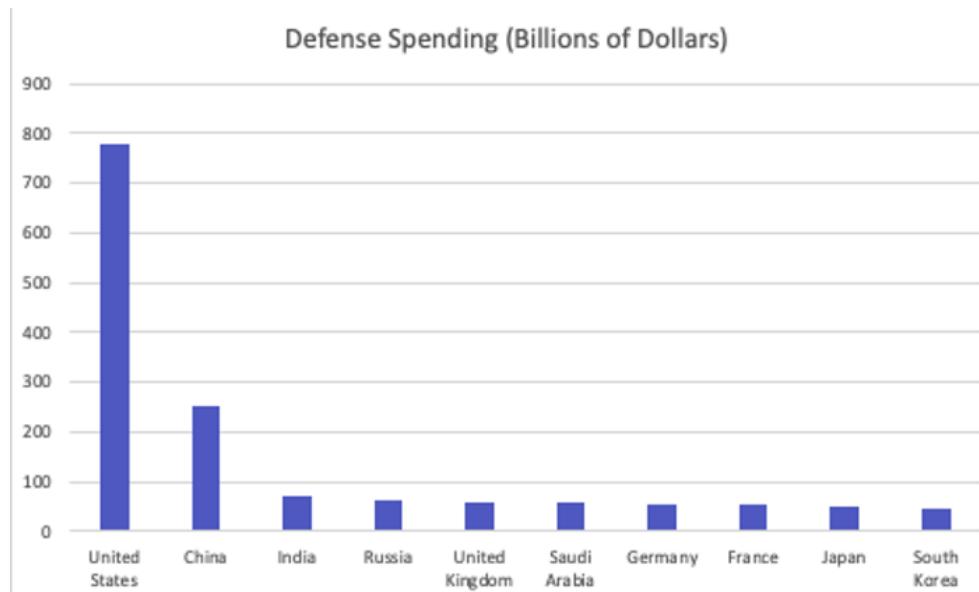


Figure 1
(SIPRI, 4/21)

Client Overview

Under Secretary of Defense for Intelligence and Security

In general, the Under Secretary of Defense for Intelligence and Security (USD(I&S)) is responsible for advising the Secretary of Defense and the Deputy Secretary of Defense on all matters relating to intelligence, counterintelligence, and other related matters. They are in charge of agencies such as the National Security Agency, the Defense Intelligence Agency, and the different intelligence operations the branches of the military have established (Department of Defense, 2014).

The Innovation Steering Group

Back in mid-April of 2021, then acting Under Secretary of Defense for Research and Engineering Barbara McQuiston announced that the DoD was standing up the Innovation Steering Group (ISG) (Jasper, 2021). The ISG—very broadly—is tasked with assessing the current innovation in the DoD and what value it provides. It is then supposed work to consolidate this across the DoD. Specifically with the USD(I&S), their mission is two fold: 1) Identify the problems that will arise in the next five to ten years 2) Ensure they have the right pathways to acquire the necessary solutions (J. Bird, personal communication, September 10, 2021).

Background

Problem Background

What is Innovation?

Innovation nowadays is an often used and often misunderstood term. Generally, innovation can be considered in three ways: 1) Innovation as an outcome; 2) Innovation as a process; 3) Innovation as a mindset (Kahn, 2018). Innovation as an outcome puts the focus on the end product of something. While there are aspects of the DoD that operate similar to a business, it is not wholly similar. When looking at innovation as an outcome, things such as marketing innovation, product innovation, and business model innovation do not apply. When considering innovation as an outcome, the models that apply to the DoD are: process innovation (which is different from innovation as a process), supply chain innovation, and organizational innovation (Kahn, 2018). Process innovation looks for ways to change processes; for the DoD this could be the hiring process, the process of assigning people to jobs, etc. The DoD must also worry about supply chain innovations as they must buy a lot of things: boats, submarines, tanks, etc. Finally, organizational innovation is applicable to the DoD as they consider things such as how they promote civilians and soldiers.

Looking at innovation as a process involves looking at the process of how things come about (this is opposed to innovation as an outcome which examines the outcome of these processes). One popular innovation process is the three step method of discover, develop, and deliver (this can be known as the innovation cycle). Discover is about examining what is currently happening and looking for what can be changed, what can be improved. Develop is the step in which evaluation criteria are created and the innovation is made. Finally, deliver is when the innovation is implemented within an organization (Kahn, 2018).

Kahn describes innovation as a mindset as, "...the internalization of innovation by individual members of the organization and advancement of a supportive culture throughout the organization." (Kahn, 2018) In the article, Kahn identifies five skills that are integral to innovation as a mindset: associating, questioning, observing, experimenting, networking. These are applicable both to individuals and groups as a whole (Kahn, 2018).

Public Sector vs. Private Sector Innovation

There are many differences between innovation in the public and private sectors: the purpose and goals, which groups/what receive(s) funding, the connection with the end-user, etc. But the main difference between the public and private sector is time frame and risk tolerance. In the private sector, because companies are usually profit driven, there is usually a shorter window of time to see innovation to the end. This leads there to being a lower tolerance of risk. Whereas in the public sector, they are able to take on riskier endeavors because they have a much longer window of time with which to work (Orazem & Biljon, 2020).

There has been little empirical literature written comparing innovation in the public and private spheres—especially in the United States. But, there has been a study of this kind conducted and published in Australia. When looking at the differences between public sector innovation and private sector innovation, it is important to remember that these differences are mostly likely driven by the different contexts that come with working in the public sector versus working in the private sector. In their article, Kay and

Goldspink published this graph (Figure 2) detailing innovations that had both succeeded and failed:

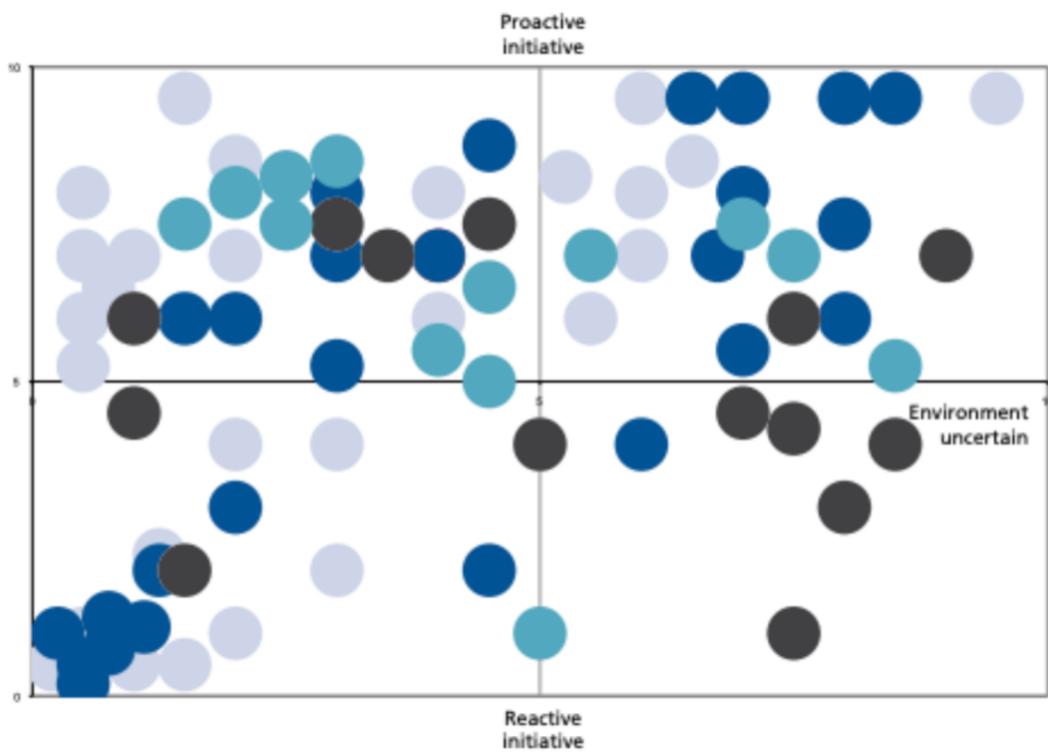


Figure 2
(Kay & Goldspink, 2013)

The horizontal axis measures the uncertainty the private or public sector leader had related to the problem the innovation was trying to solve, the idea of the innovation itself, the context of the innovation, etc. The vertical axis measures how proactive the innovation; a highly proactive innovation would have been one part of a strategic plan well planned out ahead while a more reactive one would have been in response to an event outside their control. One thing to note is that the lower right hand quadrant is almost entirely compiled by those innovation opportunities in the public sector (there is only one private sector one there). The public sector innovation instances are more tightly clustered on the left side of the graph compared to the private sector instances (there is a more even distribution of these). These patterns, among others, make sense. CEOs face different incentives and time pressures than a leader of a governmental group. These differences, among things such as differences in culture, differences in outside perception, and differences in the type of people drawn to each lead to these differences between the public sector and private sector vis a vis innovation (Kay & Goldspink, 2013).

It is important to remember that these findings were from Australia: this raises an important question of external validity. With both the United States and Australia being very similar countries culturally and the two countries having close military relations (they are both members of the FVEYE partnership), these findings do carry some weight as their defense structures are more similar than different.

Importance of the Workforce

In November of 2015, then Secretary of Defense Ash Carter sent out a memo to top DoD officials with the subject “Force of the Future: Maintaining our Competitive Edge in Human Capital.” Secretary Carter hailed the DoD workforce as the United States’ “most important competitive edge.” (Department of Defense, 2015) In it, he details work done by then Acting Under Secretary of Defense for Personnel and Readiness (A/USD(P&R))–Brad Carson–to ensure that the DoD workforce is evolving in a trajectory similar to that of the rest of the world. Secretary Carter tasked A/USD(P&R) Carson to evaluate the DoD’s permeability to people and ideas. Secretary Carter was concerned that the DoD was getting “stuck in its ways” and was approaching problems the same ways that they had been done before. He wanted A/USD(P&R) Carson to consider the recruitment process, retention ability, and talent management systems within the DoD (Department of Defense, 2015).

Workforce Trends

No longer do people work for a company most of their lives: the current job market is characterized by people switching not only jobs—but companies—every so often. For both millennials and those in Generation Z, the average time spent at a job is less than three years; for millennials, the average is two years and nine months while for Gen-Zers, the average is two years and six months. This is in stark contrast to the baby boomers—eight years and three months—and Gen-Xers—a little more than five years and two months (Paulise, 2021).

In addition to the changing sentiments in how long one stays at a job, another challenge the DoD faces in recruiting young STEM workers is that the country is currently experiencing a shortage of STEM workers. In a study conducted by the technology and engineering firm Emerson shows that 40% of Americans classify the STEM worker shortage as a “crisis.” By the year 2025, the manufacturing industry alone is predicted to be unable to fill 2 million STEM related positions (Radu, 2018). Additionally, in 2018, the average salary for private sector stem workers was about 7% higher than that of federal STEM workers (\$95,100 vs. \$89,000). This is despite the fact that most federal STEM workers are farther along in their career: thus should expect higher pay (Edwards et al., 2021). According to a study by the Partnership for Public Service, only 7% of government employees are millennials; in the private sector, 23% of their employees are millennials (Bates, 2016).

Equity Implications

When considering the equity implications of this, most workforce innovation will center around jobs in the STEM fields within the DoD. The STEM field is vastly white (69%). This is followed by Asians (13%), African Americans (9%), and Hispanics (7%) (Funk & Parker, 2018). There are also implications on the basis of gender. While women earn about 53% of STEM degrees, this is below the baseline that 58% of college degrees are earned by women. In addition, in the workforce, women are underrepresented in most STEM fields—besides that of healthcare (Fry et al., 2021). When examining the rates of the DoD, 29% of the STEM workforce is female, 7% of the STEM workforce is Asian, 10% of the STEM workforce is African American, and 5% of the STEM workforce is Hispanic (Lim et al., 2013).

While a portion of innovation will certainly center around being more diverse, that will not be able to happen until further down the road. This is shown by recommendations provided by RAND for the DoD to increase diversity in the STEM fields. Most of their short term suggestions (1 - 12 month time period) are focused around establishing groups to help coordinate diversity efforts within the DoD (efforts that have not been successful so far). In the mid term goals (1 - 4 years) though, they suggest things such as working outside of the DoD with different industries and educational institutions to increase diversity in STEM itself (Lim et al., 2013). The problem the DoD faces with increasing diversity is the same problem they face with innovation: the DoD is the world's largest employer—it is hard to enact meaningful, institutional change. Differing cultures and attitudes among the vast workforce make change slow and tough.

How Lack of Innovation Can Impact the Workforce

One of the biggest consequences of not modernizing our workforce is that we are no longer able to recruit the top talent. This is really important especially in the science, technology, engineering, and mathematics (STEM) fields within the DoD. Take for example the responsibility of ARMYCYBER. In 2016, they were tasked with disrupting ISIS's online communications: both externally and internally. This was no easy task as ISIS had a "sophisticated, multifaceted global media campaign." (Graff, 2020) If the DoD is not able to attract the best talent, the work might still get done, but it might not get done in time or be done well. With military operations, being able to deliver information, cyber disruptions, etc. is extremely time sensitive. As mentioned above, the best asset the DoD has is its workforce—without a top tier workforce, other countries will begin to gain a competitive edge over us and be able to outmaneuver us on the battlefield, no matter what the domain may be.

Morale is a key metric tracked by many companies; there is a reason for this. Higher workforce morale has been linked to many positive benefits. First, employees are more productive. In a study comparing people who worked 42 hour weeks versus 28 hour weeks, it was found that those who worked shorter weeks (and had higher morale) were 70% more productive (*The Importance of Morale on Your Team*, 2019). In terms of productivity, it is believed that there are three pathways which morale improves productivity: 1) people who are happier are more willing to work harder; 2) higher morale makes people more efficient; and 3) higher morale means there is a better relationship between managers and their employees (Weakliem & Frenkel, 2006). Also higher morale has been linked to higher retention rates (*The Importance of Morale on Your Team*, 2019). Retention is very important in the government as replacing employees is costly. Hiring timelines are much longer for the DoD as many people must have proper clearances to work there. Plus, there is a steeper learning curve in the government as they have systems and technology that are not used in the private sector because of their classified nature.

Evidence on Potential Solutions

This section looks to deal with potential solutions to how the DoD can work to attract and keep the best workplace talent. These things range from different programs already implemented, specific ways to manage teams already in the DoD. The base question these are trying to answer is “How can the public sector be competitive with the private sector on hiring?”

DoD SMART Scholarship

In 2005, the DoD launched a pilot program of the Science, Mathematics, and Research for Transformation (SMART) Scholarship for Service; in 2006, this program was made permanent (Balakrishnan et al., 2018). A SMART scholarship is awarded to people pursuing either a bachelors, masters, or PhD in one of 21 different science, technology, engineering, or math (STEM) related fields. Financially, the SMART program provides its recipients full tuition, an annual stipend, and health insurance. On the professional side, SMART Scholars are guaranteed summer internships within the DoD and employment after their graduation (Knowledge Base - SMART Scholarship, n.d.). For every year of college paid for by the SMART program, the recipient is expected to work one year in the DoD (Balakrishnan et al., 2018).

Between 2006 and 2016, the SMART program had more than 2,000 different scholars across more than 300 universities; these scholars then went on to work in almost 170 different DoD offices. After 2016, the DoD tasked the Institute for Defense Analyses to evaluate how successful the program was at reaching the goal of recruiting and retaining workers with STEM backgrounds. They conducted this study based on a plethora of methods: they reviewed applications to the program, conducted interviews of those in the DoD involved in the programs and SMART scholarship recipients, compared this data to that of the current DoD workforce. They first found that SMART scholars were of higher quality than the average DoD science and engineering (S&E) employee. This was found not only through job performance metrics (e.g. faster increases in salaries, faster promotions) but also through background metrics: based off of the Carnegie Classification of institutions, 83% of SMART scholars went to top research universities while only 70% of DoD S&E workers did (Balakrishnan et al., 2018).

In addition, the SMART program also served as a recruiting tool for DoD S&E jobs. 30% of SMART scholars did not know about S&E career opportunities in the DoD until they applied to the SMART Scholarship. In terms of diversity, SMART scholars were more diverse than the current DoD S&E workforce on the bases of gender (26% vs. 21%) but had less racial diversity than the current workforce (Balakrishnan et al., 2018).

Perhaps the most important finding from the study was the effect of the SMART program on retention of these workers; SMART scholars actually left the DoD at higher rates than their counterparts from the DoD S&E workforce. After 3 years, 27% of SMART scholars had left the DoD while that number increased to 45% percent after 5 years. In contrast, the general S&E workforce's numbers were 14% and 22% respectively. Only 12% of SMART scholars were still working for companies that served the DoD mission (e.g. defense contractors) after they left. The biggest reason behind scholars leaving the DoD was “for career growth and for more interesting jobs.” (Balakrishnan et al., 2018)

Different Types of Project Management

One popular topic when looking at innovation is that of project management. Defined by Northeastern University, “Simply put, project management is the art and discipline of managing a project and all of its components from start to finish.” (“How to Become a Project Manager,” n.d.) Below, some of the different project management styles are outlined. In addition, visual representations of these project management styles can be found in the Appendix.

Agile Project Management

Agile project management attempts to break a project up into many different parts. The purpose of this is to allow for a project to be iterative. These iterative segments should also each include a way to measure the return on investment (ROI). Thus, having many defined segments allows for earlier evaluation via the ROI. Agile is seen more as a philosophy and is applied in other project management styles such as Scrum and Kanban. The main thing that makes a project Agile is the iterative nature (Stobierski, 2021).

Scrum Project Management

Scrum project management is one of the types of methodologies of Agile. With Scrum project management, there are two distinct roles: 1) the product owner and 2) the Scrum master. The product owner is responsible for ensuring that the end product is as developed/valuable/etc. as possible. The goal of the Scrum master is to ensure that the team as a whole is following the different segments (as characteristic of Agile Project Management) and completing them in a timely manner. The key difference between Scrum and normal work styles is that there are “shippable portions” of the project along the way—the final product is delivered in parts (Stobierski, 2021).

Kanban Project Management

Similar to Scrum, Kanban project management is another type of Agile methodology. Kanban alters workflow through one major way: the Kanban board. This is a board divided up into sections—each representing a different work segment of the project—with cards on each representing a different task to be completed in that segment. These cards are then moved along the board as tasks are accomplished (Stobierski, 2021).

Waterfall Project Management

Waterfall project management is almost the exact opposite of Agile. The big emphasis in Waterfall Project Management is the linear nature: once you have finished a segment, you should not go back and rework it later in the project. Waterfall has been found to work best with smaller projects where the end goal is clearly defined (Stobierski, 2021).

Innovation in the Private Sector

Google and their Drivers of Innovation

In the private sector, when someone thinks of innovation, usually they are also thinking of large technology companies. There is no better example than that of Google. In drawing on previous research and interview questions asked to Google employees, Annika Steiber and Sverker Alänge attempted to come up with an

explanation behind Google's success in innovation. The interviews ended with the researchers asking the Google employees to "... rank and then describe seven pre-defined organizational elements (characteristics areas) according to their relative importance for Google's innovativeness. The interviewees were also given the opportunity to add new factors to the list, although none of the interviewees chose to do so." (Steiber & Sverker Alänge, 2013)

After the interview, these seven organizational elements were ranked as follows. Culture and individuals were ranked the highest (tied for first). Then, a leader who facilitated innovation was third. Fourth was the organization at Google; this includes things such as the policies Google institutes, the structure, etc. Fifth was the system used to measure performance indicators and evaluate employees and their processes. Sixth were the systems Google put in place to ensure that people were able to learn from previous work—whether success or failures. Finally seventh was the external interaction Google employees had with others (Steiber & Sverker Alänge, 2013).

At Google, there is a culture of continuous innovation. Innovation is not simply a goal one committee works towards once, but something that happens in every project, on every team, from every worker (at least that is the ideal of it). Because the two highest ranked organizational elements are the people and the culture (which is built by people), it is important to realize that in many ways, innovation is endogenous. This is helpful to consider when looking at how an organization as big as the DoD can work to change to make their culture more innovative (Steiber & Sverker Alänge, 2013).

Amazon and Open Innovation

Open innovation is "... the ability of firms to open themselves up to external networks and relationships in order to gain the full potential of their investments in innovation." (Thierry & Lescop, 2009) In plain terms, this means that companies are looking more and more outside themselves (and sharing their innovations more and more) for new innovative ideas. There has been arguably no better company to embrace this than Amazon. Starting in 1994 as a bookshop, Amazon has grown into one the world's largest retailers and richest companies. Services such as Amazon Web Services have not only helped make Amazon so profitable but also serve as a key information and communication technology (ICT) that opens up new avenues of open innovation for Amazon (Thierry & Lescop, 2009).

With the introduction of Amazon Web Services in 2002, they started to share with their business partners the innovation they used in building out their "E-retail" business. As outlined in the journal article from Thierry and Lescop: "Three layers appear in the open innovation strategy of Amazon. First, Amazon opened up its platform and ICT infrastructure through Web services. Secondly, it acts as an incubator for e-business. Thirdly, the company expands the use and finally the reputation of its platform thanks to Amazon certified integrators. This enhances the attractiveness of the whole platform and hence value creation opportunities." (Thierry & Lescop, 2009)

Innovation in the Public Sector

The United States Air Force

The RAND corporation did a research report looking at innovation in the Air Force and in it they identified six cases: 1) Peacetime strategic reconnaissance, 2) Close air support, 3) Nuclear deterrent survivability, 4) Suppression of enemy air defenses, 5) Precision strategic attacks, and 6) Airborne high-value targeting. After examining these cases, there were a couple key findings. First, innovation within the Air Force began with strategically framing a problem, not technological change. Second, the innovation process in the Air Force was found to be different than that of other military organizations. Whereas innovation is usually driven by centralized forces in other branches, the Air Force innovations were more driven by decentralized forces. This practice has also allowed for the Air Force to have shorter innovation cycles compared to other branches (Grissom et al., 2016).

While this information does not relate directly to workforce innovation, it does show how change was brought about in the DoD; this is not an easy achievement. This can allow for examination of why this was possible and then be applied to workforce innovations.

Public Private Talent Exchange Program

The Office of the Under Secretary of Defense for Acquisition and Sustainment (A&S) currently has a program—authorized under Section 1599g of title 10, U.S.C.—called the Public Private Talent Exchange (PPTE) Program. In the PPTE program, mid level employees in the federal government have the opportunity to work six months with a private company in industry; industry employees also have an opportunity to work a six month stint in the DoD. To be eligible, one must have 10-15 years of experience (industry) or be a GS 13-15 (DoD) and make no more than \$176,300—among other miscellaneous requirements. Private sector partners have included Amazon, Ball Aerospace, Boeing, Booz Allen Hamilton, Deloitte, General Dynamics, Guidehouse, Lockheed Martin, National Industries for the Blind, Northrop Grumman, Raytheon, SAIC, and Virgin Orbit (Office of the Under Secretary of Defense & for Acquisition and Sustainment (A&S), n.d.). This is also a popular practice in the private sector as consulting companies such as Bain and Boston Consulting Group offer their employees a similar program (but with other private sector companies instead of the government).

Alternatives

Alternative 1: Establish a Rotational Job Program with the Private Sector

As mentioned in the backgrounds section, people are staying at jobs for less time. These job trends are almost diametrically opposed to work within the DoD—especially intelligence aspects. One common requirement for intelligence work in the DoD is that of a top secret security clearance. In order to get one of those—the average processing time is over five months (Kyzer, 2021). This large upfront cost—both for the potential employee and the government—makes it difficult for people to go into and out of government work. This can be for a number of reasons: private companies not being able or willing to keep clearances active, needing to redo the clearance process when coming back, etc. A security clearance is highly sought after as many private companies want cleared workers and are willing to pay for them. According to job blogging websites, Amazon Web Services (AWS) is willing to give people up to a \$45,000 bonus if they are already cleared and use it in their work (AWS TS/SCI/CI Poly Bonus, 2021).

One solution that could help with attracting talent is establishing a program with private companies (AWS, Microsoft, etc.) where you could work rotationally between the DIA and them. This could be something such as two years working at the DIA, then a year at a private company, then an additional year for the DIA. Not only would this help attract top talent to government work, but it—on face value—seems like something that would also benefit private companies as they would have an easier time finding cleared workers.

The biggest challenge with implementing this would be getting the approval to allow people to move back and forth between the government. Any changes to security clearances would be tough as there is a worry—rightfully so—about making sure that top secret information is kept just that: top secret. In addition, deciding which companies would be allowed to participate in this could lead to corrupt practices in who would get access to these workers.

As highlighted already in this report, a program like this is already in place: the PPTE. The existence of the PPTE Program shows that despite the implementation challenges, a program like this is more than possible. This alternative would differ from the PPTE in two main respects. First, it would target entry level employees—not those in the middle of their career. Secondly, it would be focused on STEM related jobs and not specifically just those in acquisitions.

Alternative 2: Train Leaders on Innovative Project Management Techniques

As discussed in my previous work, many teams in the private sector have changed their work by changing how they manage work within teams. This can be anything from agile project management to scrum project management, to waterfall project management. While the DoD cannot—and should not—force people to adopt a uniform management style of their teams, exposing leaders to different project management techniques broadens their horizons and leads to more opportunities for innovative work. As mentioned previously, some of the highest determinants of innovation in private sector organizations was the culture: this attempts to help create a better culture for innovation.

The way this would be implemented would be that once someone assumed a leadership role (say GS-13 and up for civilians and O-6 and up for the military) would be briefed and/or trained on key and successful project management techniques used in the private sector. The DIA could partner either with private companies themselves or with firms who specialize in teaching and training project management techniques.

Obviously, one of the biggest implementation challenges will be getting leaders within the DIA to buy into these new project management styles and keep an open mind regarding them. Not only can it be difficult to change the minds of people who have progressed far into their careers and done well, but in addition there will be an added difficulty as this would be attempting to change how the military operates: which is notorious for being resistant to change. Also, there may be a perception among people within the DIA that they are trying to make the military operate more like a startup or technology company. This may be seen as pretentious and turn people off to the idea.

Alternative 3: Expand the SMART Scholarship Program

As mentioned in previous works, the SMART program has been widely successful on a number of levels. It has brought in a working class to the DoD—particularly the DoD’s science and engineering (S&E) sector—that are of a higher caliber than the average person outside the program. It has also worked as a tool for spreading awareness of DoD jobs to not only those who receive a SMART scholarship, but also to those who simply hear about it. It also has helped diversify the DoD S&E workforce when it comes to gender diversity; the strengths of this program are undeniable.

There are a couple ways in which this program could be expanded. When looking at ways to expand the program, one must first understand where the program is lacking. Currently, most ways people are aware of SMART is through word of mouth (63%). In addition, SMART does not have as many direct contacts within Universities as other scholarship for service (SFS) programs such as the Reserved Officers Training Corps (ROTC) (Balakrishnan et al., 2018).

First, the DoD should devote more resources to the campuses in which it publicizes. One of the strengths of the program is that it makes people aware of career opportunities within the DoD. They should target not only a greater number of schools, but also a wider diversity of schools. One example would be establishing a subprogram which specifically recruits from Historically Black Colleges and Universities (HBCUs). Second, they could work to award more SMART scholarships, thus giving more opportunities to talented people to get exposed to what work in the DoD is like. In addition, they could look to find ways to further fast track SMART scholarship recipients towards careers in the DoD. This could be anything from the jobs they receive to looking if they could be hired at higher steps within the GS scale so as to give them more of an incentive to build a career within the DoD.

When looking at implementation challenges with this alternative, the biggest limiting factors will be that of the need for increased manpower and funding. To sustain larger recruitment efforts, the DoD will need more people to travel to campuses, talk to students, etc. In addition to having to pay for this, if more SMART scholarships are awarded, then that will also require more funding from Congress. Already, there are members of Congress who are hesitant to give the DoD more funds. In addition, increasing the number of SMART scholars and devoting more importance to the program might make others who work in the DoD feel left out—part of an outgroup.

Criteria

As stated in November of 2021 by Heidi Shyu, the Undersecretary of Defense for Research and Engineering, “It’s [the Innovation Steering Group] the principal form for us to drive systemic strategy, policy, programmatic, cultural and budgetary changes.” (Eversden, 2021) Keeping this in mind, this leads to certain goals of recommendations presented by this committee. First is effectiveness; it is important that whatever is proposed is able to create a substantive change as—if it didn’t—there would be no point in proposing it. In addition to this—decisions cannot be made within the vacuum of effectiveness; there must also be a measure of the cost of each alternative. It is also important to assess all alternatives on the basis of feasibility: no matter how cost effective an option is, it does not matter if it will not be implemented. When assessing feasibility, it is important to look at it from two perspectives: that of political feasibility (will entities such as Congress and the Executive Branch allow for these changes to be implemented) and cultural feasibility (will those who work in the DoD buy into a proposed alternative and give it life). Finally, another useful criteria is that of diversity. Diversity in teams has been proven to increase the functioning and produce better results—an innovative solution should look to increase diversity.

Effectiveness

When looking at operationalizing effectiveness, this will be measured on whether it helps the DoD recruit and retain young STEM workers. This will be measured in a combination of both the absolute number of new young STEM workers, but not solely on that. Quantity is not always better than quality: an effective program will also attract higher quality people to the DoD. There are a couple of ways to measure the “quality” of an employee. One way that can be done before they begin at the DoD is by looking at the rank of their graduating university by a company such as US News and World Report. You could also rate colleges and universities by their Carnegie Classification (a popular grouping method used in the education sphere).

Costs

When considering the costs associated with each alternative, it is important that both explicit and implicit costs are considered. Explicit costs are simple: any increase in spending/the budget needed to fund these initiatives. In terms of implicit costs, there must be consideration of whether implementing new programs would affect operations: if we having to pull more people into recruiting, from where are they leaving (and what holes does that create); if we are having to teach people new project management techniques, will there be a learning curve where output is less efficient in the short run; etc. Costs will be measured on a per employee cost differential. When discussing Alternative 3, employees will often be referred to as “scholarship recipients” as they start out as that and then transition to employees. Costs are calculated on a per employee basis so as to allow for scalability.

Feasibility

When considering feasibility, one first must look at the political feasibility of an option. Would members of Congress be willing to allocate more funds for this initiative? Would the higher ups in the affected organizations (e.g. the DoD, the DIA, etc.) be willing to throw their support behind these initiatives, etc. In addition to this, there is a cultural feasibility aspect: would those working in the DoD buy into these programs. If the people who will be working in these environments every day do not support these programs, their feasibility is effectively zero.

Diversity

Finally when looking at diversity, it will be important to measure how these programs work at increasing diversity among the DoD workforce. This can be measured first off on observable characteristics: are more people from underrepresented groups being given the chance to contribute to the mission of the DoD. But, it also must be measured on unobservable characteristics: are we increasing the thought diversity of our teams. The latter will be harder to measure as that type of information is usually only able to be gathered through surveying people on the unobservable characteristics and that introduces information gathering error possibilities.

Findings

Alternative 1: Establish a Rotational Job Program with the Private Sector

Effectiveness: 5/5

As previously mentioned, when evaluating the effectiveness of this first alternative, it will be looked at in a two fold approach: the number of private companies partnered with the DoD and the number of people enrolled in the rotational program. On July 7, 2020, Tech Inquiry published a report titled “Reports of a Silicon Valley/Military Divide Have Been Greatly Exaggerated.” They pored through almost five years worth of publicly available DoD and federal law enforcement contracts to see how many different technology companies held. This report showed that when looking at both direct contracts and subcontracts with the DoD, many companies such as HP, IBM, AT&T, Microsoft, Verizon, Dell, Amazon, Cisco had heavy involvement with one portion of the DoD (Poulson, 2020). In terms of attracting younger workers, this program would reach out to millennials’ desire to not work at one place too long: this program would give them the opportunity to work for different organizations. When looking at the difficulty of recruiting millennials, Office of Personnel Management Director Katherine Archuleta said, “We need to recruit and retain them in ways that are different from Gen-Xers or baby boomers... When I talk to them I say, ‘You can come into government and we’ll offer you a great opportunity to build your resume.’”(Rein, 2014)

Establishing a rotational job program would be very effective in its main goal: recruiting and retaining young STEM workers. As evidenced by how engaged major technology companies are with the DoD already, it is safe to assume many would love for the opportunity to host rotational employees. In terms of attracting people to the DoD, this hits at a major factor for millennials who are looking for jobs: flexibility of position.

Cost: 2/5

When looking at the cost of this program, there are some calculations that must be made. This is operating under the assumption that when a person is on rotation to a private company, the DoD is still paying their salary—this makes sense as this is how the PPTE Program works. While many employees within the government are bound by the GS Pay Scale, this is not true for all government employees. There are many programs which can authorize governmental departments to pay people outside of the GS Pay Scale. For example, The Critical Position Pay Authority allows for federal agencies to pay employees with special skills needed to fill critical positions outside of this payscale. In a 2021 report from RAND, they found that the average income of STEM workers with just a bachelor’s degree in the federal government in 2018 was \$89,000 (Edwards et al., 2021). As the DoD would have to pay an additional person to fill one’s role after they go on rotation, the expected cost of this program would be **\$89,000** per new employee.

Feasibility: 4/5

When looking at the feasibility of this alternative, it seems as if Congress is willing to allocate money for STEM investment. In the most recent omnibus spending deal (which was approved by the Senate in March of 2022), there was language that requires OPM to start looking into improving the federal STEM workforce and producing a report. Expected in the report is an outline of “...existing hiring authorities,

recruitment and hiring practices and the ‘feasibility of streamlining of restructuring those authorities and pathways to improve recruitment and hiring of STEM talent.’”(Heckman, 2022) While this is not a direct appropriation of funds, it shows that Congress is willing to invest in it.

Diversity: 3/5

In terms of diversity, this plan on its own would do little to help the diversity of women and minorities in STEM; it doesn’t address it at all. This alternative looks to pull from the already existing pool of those with or currently pursuing STEM degrees—which mentioned in the background is predominantly white and predominantly male.

Alternative 2: Train Leaders on Innovative Project Management Techniques

Effectiveness: 2/5

When evaluating the effectiveness of implementing new project management techniques, we must first look at how effective are project management techniques truly. In 2012, Hany Wells ran an experiment testing just this idea. The findings did not bode well: almost 50% of those in the study said that they did not believe these techniques met the expectations they held for how effective they would be. Wells goes on to say "...the majority of project managers gain suboptimal advantage from the use of any PMM [project management methodologies]..." (Wells, 2012) In addition, effectiveness might be stymied as the government has a reputation for being resistant to change. Unwillingness from senior leaders would prevent any potential change to take place, thus hurting effectiveness. I would rank the effectiveness of this alternative on the lower end.

Costs: 5/5

When looking at the cost of this program, the major cost would be paying for the training program itself. Looking at the price of courses in the Washington D.C. area, in person classes cost about \$500 per person per day (*Best Project Management Certification Classes Washington, D.C.: Find Courses & Onsite Training*, n.d.). Assuming this training lasts for one work week (i.e. five days), the cost per employee would be about **\$2,500**. These costs are on the lower end of the alternatives because it is paying a one time fee and not having to pay another salary.

Feasibility: 3/5

When looking at the feasibility of this alternative, this rests mainly in buy-in from DIA employees. As previously mentioned, the DIA is a primarily military organization (but they do have civilian employees). While the higher ups might authorize this initiative, the problem would be buy-in. For project management to work well, not only do team leaders need to be committed to it, but also the different members of a team. Because of so many points where this could fail, the feasibility of this option is relatively low.

Diversity: 2/5

Diversity fits difficulty into this alternative. There are no direct diversity benefits to the workforce besides the increase in knowledge which might provide people with more intellectual diversity. But—directly—this program would not do anything to help. There could be indirect benefits as more people from underrepresented communities may be drawn to apply but that is unlikely. The private sector struggles with diversity in STEM jobs and they already have these programs implemented.

Alternative 3: Expand the SMART Scholarship Program

Effectiveness: 3.5/5

As discussed in the background section, the SMART Scholarship Program has been a great tool when it comes to recruitment for the DoD. Not only has it worked to publicize a career in the DoD, but it also brings in employees who (on average) have a better educational background. In addition, this alternative is specifically targeting STEM students so it is a targeted approach to solving the problem at hand. Although, simply expanding the program would do little to help with the retention issues the SMART program has been having. Simply expanding the program would not help address the higher attrition rates that were discussed in the background section. (Balakrishnan et al., 2018). This alternative would be highly effective in the recruitment aspect but not the retention aspect. As retention is one of the aspects for effectiveness, the score for this alternative is not scored too highly.

Cost: 3/5

In order to evaluate the prospective costs of this program, some assumptions must be made. This is because in order to have the greatest impact, the DoD would likely need to hire more recruiters. This position would likely be filled by someone as low as a GS-9 but as high as a GS-11. This means their salary would range from anywhere from \$61,947 to \$74,950 per year (this is assuming D.C. area base pay and the position being in Step 1 of the GS pay scale); and average of these two numbers is \$68,448.50. In 2021, the SMART Scholarship had a 17% acceptance rate (between 2,400-2,500 applicants with 416 scholarships awarded) (Program Stats - SMART Scholarship, 2021). Assuming that each recruiter can encourage 100 people every year to apply, this translates to needing a recruiter for every 17 SMART Scholarships awarded. This means that increasing the program by one scholar would have an associated cost of \$68,448.50/17 which is about \$4,026.38

In addition, this program would also increase cost because of the increased number of scholarships. To get an estimate of this cost, we will take the average of the average cost of attendance at a 4-year in-state public institution (\$25,487), a 4-year out-of-state public institution (\$43,161), and a 4-year nonprofit private institution (\$53,217) (Hanson, 2022). We are not considering for-profit private institutions because they make up a great minority of colleges. This gives us an average cost of about \$40,622 per year per new scholar.

When summing the two separate costs, this alternative would cost about **\$44,648.38** per new scholarship recipient.

Feasibility: 5/5

The feasibility of this alternative is very high. The program has already seen great success within the DoD so leadership within the DoD would be happy to support this. In addition (as I'll discuss in the next paragraph) expansion of the program allows for greater diversity based off of targeted recruitment. This is a concern of Congress. Recently, Senator Mazie K. Hirono proposed a bill titled Women and Minorities in STEM Booster Act. As evidenced by the bill's name, this would seek to increase the prevalence of women and minorities in STEM fields (Hirono, 2021). This shows that there is Congressional support for increase in diversity. That coupled with the success of the SMART Scholarship program already makes the feasibility for this program quite high.

Diversity: 5/5

Finally, when looking at diversity, this alternative ranks the highest. Through targeted recruiting, the DoD could make strides by holding specific recruiting events at places such as historically black colleges and universities (HBCUs), at school clubs focused on things such as women in STEM, etc. In addition, they can hold specific recruiting events with clubs at a school that are specifically for underrepresented groups. The beauty of this alternative is that it allows for much more targeted recruitment.

Outcomes Matrix and Recommendation

Outcomes Matrix

When evaluating these alternatives, I assigned a point value for each criteria for each alternative based on a scale of 1-5 (1 being the worst, 5 being the best). For costs, a higher cost corresponds to a lower rating (and a lower cost corresponds to a higher rating). The point values assigned to each are scores relative to how well each alternative does for the four given criteria between the three alternatives. In addition, I have weighted effectiveness as the most important criterion, then feasibility, then cost, and then diversity. I have chosen the weightings because if a program is not effective, then it is useless. If a program is not feasible then it is not worth considering. Finally, the DoD has such a large budget that any of these programs would not make a significant dent so cost is not a primary concern—but one that should still be considered. Finally, the focus of these programs is not inherently on diversity: other programs should be looking to address diversity in a great way. While these programs should think about how they help to increase diversity, it should not be the main goal.

In the outcomes matrix below, I added two stylistic choices to help represent the data. First, in the "Effectiveness," "Cost," "Feasibility," and "Diversity" columns, the cells are shaded based upon how high of a score that alternative received for the given criterion; the lighter the shade, the lower the score. Finally, in the "Final Score" column, there is a bar filling each cell that represents how high the final score is compared to others; the more of the cell the bar takes up, the higher the final score.

	Effectiveness (35%)	Cost (20%)	Feasibility (30%)	Diversity (15%)	Final Score
Alternative 1	5	2	4	3	3.8
Alternative 2	2	5	3	2	2.9
Alternative 3	3.5	3	5	5	4.075

Recommendation

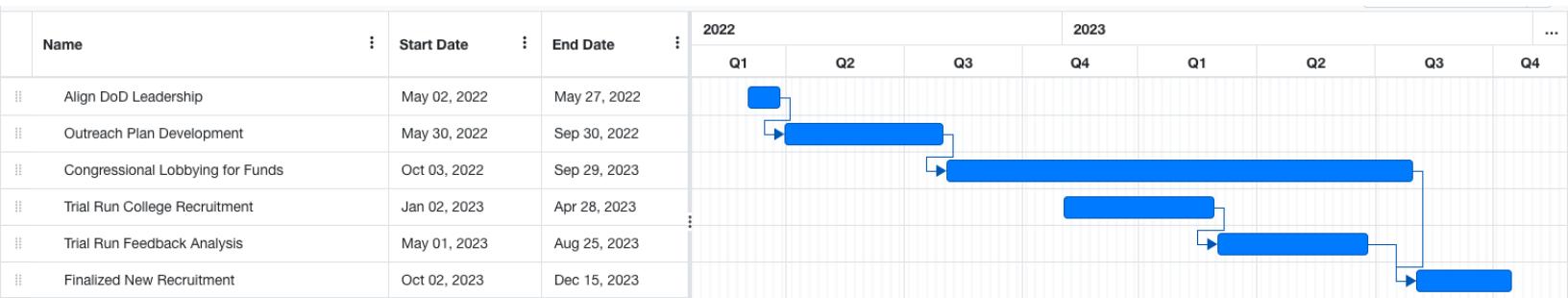
I recommend the expansion of the SMART Scholarship Program (Alternative 3). This program excels in its diversity and feasibility. It has a higher feasibility than alternative 1 because, with that one, they must coordinate things between both the government and private companies. This alternative though does face tradeoffs. It is not as effective as alternative 1 because it does not address the problem of retention as well as alternative 1 does. It is also more costly than alternative 2 because of the potential of having to pay more people (both recruiters and SMART scholars).

Final Considerations

Implementation

Implementing an expansion of the SMART Scholarship Program might sound relatively straight-forward, but error in implementation can destroy any of the gains made by the benefits an expansion of the program might reap. The first step in implementing this alternative is aligning DoD leadership on this objective. This should solidify the answers to big picture questions such as “What are our overarching goals?” This process should take about a month. After that, the Smart Program Office should be tasked with developing the specific outreach plan, the planned increase in allotment of SMART Scholarships, and final cost estimates. This process should be allotted about four months. After that, the next step is lobbying Congress for increased funding. This is a tedious process and should be done via budget requests. This process will likely take a year and should start at the beginning of the fiscal year (which runs from October 1 to September 30 for the federal government).

There will then be a phased launch of the increased recruitment. At the beginning of a new calendar year, there will be test run recruitments. This can be done via job fairs at Universities where the SMART is already well established. During these times, recruiters will also be administering surveys to get college student feedback. After that, the summer will be used to examine this feedback and figure out what worked. Then, at the beginning of the next fall semester, the increased recruitment process will begin: targeting new colleges, new student groups, etc. All of these steps are summarized in a Gantt Chart below.



In relation to the SMART Scholarship Program Balakrishnan et al. identified nine major stakeholders in their report on the program: Applicants, Scholars, SMART Program Office, Assistant Secretary of Defense for Research and Engineering (ASD(R&E)), Execution Leads and Component Heads, Sponsoring Facility Point of Contact (POC), Sponsoring Facility S&E Manager, SMART Program Support, and SMART Service Liaisons. Applicants and scholars represent the faction of students. The ASD(R&E) and SMART Program Office are the two groups within the DoD directly responsible for running/administering the program. The sponsoring facility POCs and S&E managers are the members within the different DoD groups (e.g. the DIA) who coordinate with those running the program. The execution leads and component heads are representatives from each service who oversees the program in their respective branch. Finally, the SMART program support and SMART service liaisons are contractors who help on either the DoD side or the service side (Balakrishnan et al., 2018).

In short, I am fairly confident that all of the stakeholders listed above would be very supportive of this recommendation. On the student side, they would support this as it means increased visibility and knowledge about the problem. Those directly responsible for running the program would be supportive as

it would grow the program. The different sponsoring facilities and services would likewise be in favor as this would mean that they receive more, high quality workers. Finally, contractors would be in support of an expansion of the SMART Scholarship Program because that means that there will be more applications to help process, people to place, etc. so that means more contracts will need to be awarded.

When examining the worst-case scenario for implementation of this alternative, this would be increased spending on the program with no improvement in the quality and/or quantity of applicants. At the end of the day, this would be a loss of money. In 2018, the funding for the program was a little under \$60 million (Balakrishnan et al., 2018). In the grand scheme of the government and DoD budgets, this is a drop in the bucket. While it is never good to waste money, this is a relatively safe way to try to improve a current problem.

When looking at the implementation for this alternative, it is relatively straightforward; this was one of the main reasons this alternative is so attractive. For areas in which there might be uncertainty, those responsible for the implementation have many others to which they can reach out. One good program to look into would be the Reserve Officers Training Corps (ROTC). They run a very similar scholarship for service (SFS) program at a much larger scale.

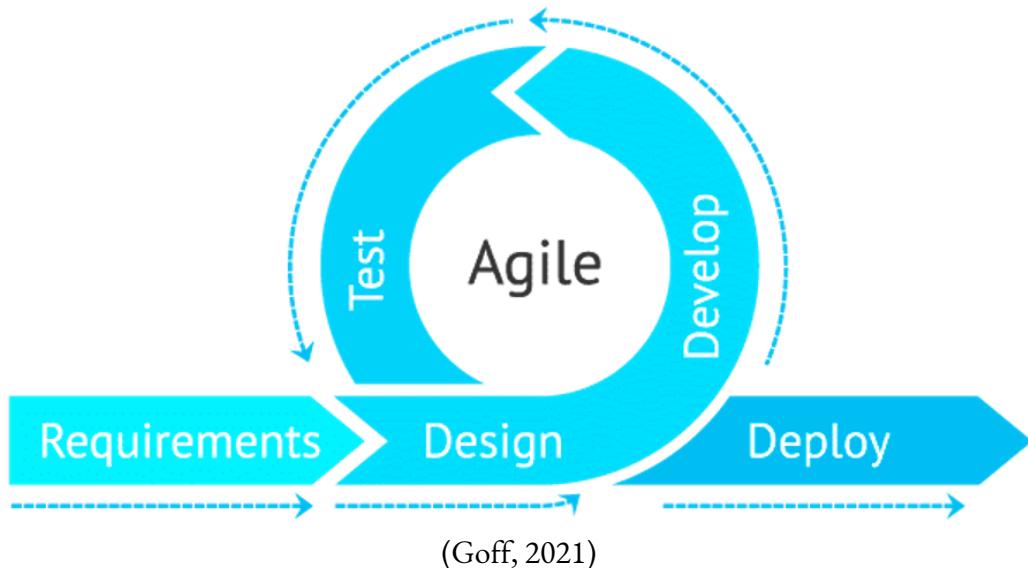
Conclusion

The recruitment and retention of young, STEM employees is one of the most important issues facing the public sector workforce. As work becomes more and more technical, it requires more people with those degrees to help protect the nation and keep our country safe. This report is not exhaustive of course and further research and thought should be devoted to this topic.

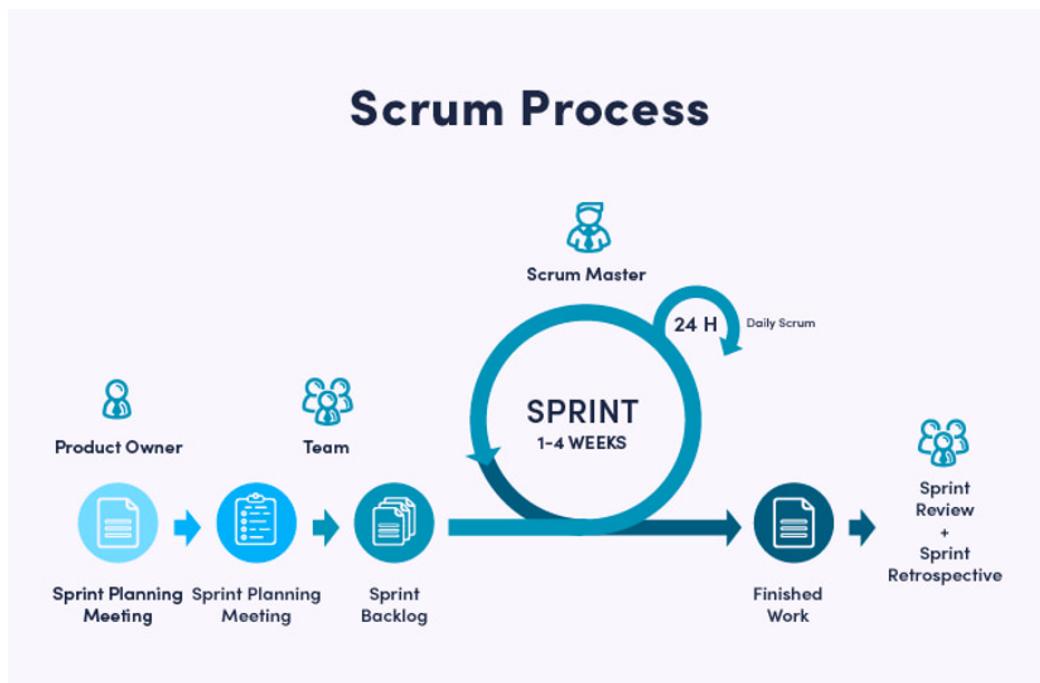
Appendix

Project Management Visual Representations

Agile

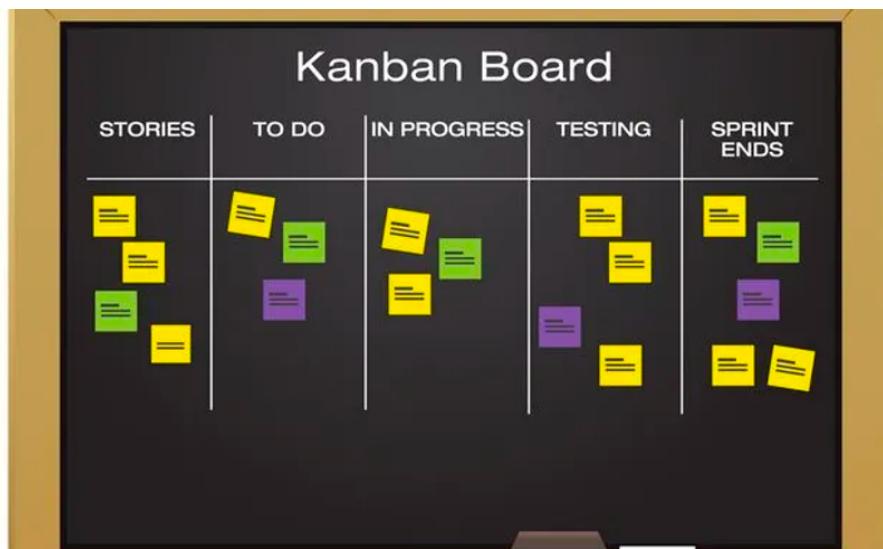


Scrum



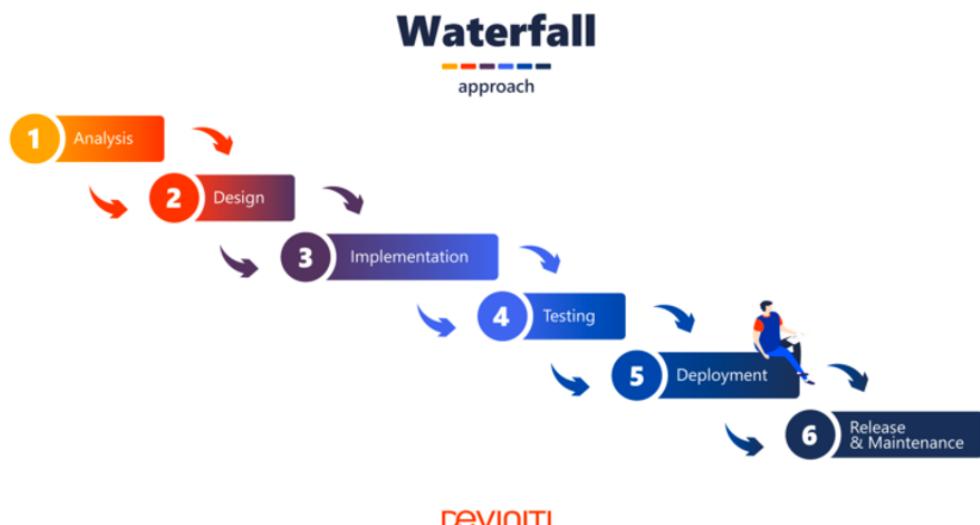
(Froggy Ads Support Staff, 2021)

Kanban



(Villanova University, 2021)

Waterfall



(Kornaga, 2019)

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