15.   INFORMATION TECHNOLOGY

Federal Information Technology (IT) provides Americans with important services and information and is the foundation of how Government serves the public in the digital age. The President proposes spending over $92 billion on IT at agencies[1], which will be used to deliver critical citizen services, keep sensitive data and systems secure, and to further the vision of modern Government. The Budget also supports the IT Modernization (Modernize IT to Increase Productivity and Security) Cross Agency Priority (CAP) Goal of the President's Management Agenda (PMA)[2], Federal laws that enable agency technology planning, oversight, funding, and accountability practices, and Office of Management and Budget (OMB) guidance to agencies on the strategic use of IT to enable mission outcomes. It also supports the modernization of antiquated and often unsecured legacy systems; agency migration to secure, cost-effective commercial cloud solutions, and shared services; the recruitment, retention, and reskilling of the Federal technology and cybersecurity workforce to ensure higher value service delivery; and the reduction of cybersecurity risk across the Federal enterprise. These investments will, in alignment with the PMA, focus on addressing root cause structural issues, promoting stronger collaboration and coordination among Federal Agencies, and addressing capability challenges that have impeded the Government's technology vision. This analysis excludes information on classified IT investments by the Department of Defense.

Federal Spending on IT

As shown in Table 15-1, the Federal Government Budget for IT at agencies is estimated to be $92 billion in 2021. This figure is an increase from the estimate reported for 2020. Table 15-2 displays IT spending for civilian agencies. The Department of Homeland Security (DHS) is the largest civilian agency in IT spending, while the bottom five agencies represent 1.1 percent of Federal civilian IT spending. Chart 15-1 shows trending information for Federal civilian IT spending from 2011 forward.[3]

IT Investments Overview

The 2021 Budget includes funding for 8,645 investments at agencies. These investments support three main functions: mission delivery; IT infrastructure, IT security, and IT management; and administrative services and mission support (see Chart 15-2). As Chart 15-3 shows, IT investments can vary widely in size and scope. As a result, the largest 100 investments at civilian agencies account for 42 percent of Federal IT spending.

Of those 8,645 IT investments, 591 are considered major IT investments. As outlined in OMB Circular A-11 and FY 2021 Capital Planning and Investment Control (CPIC) Guidance, agencies determine if an IT investment is classified as major based on whether the associated investment has significant program or policy implications; has high executive visibility; has high development, operating, or maintenance costs; or requires special management attention because of its importance to the mission or function of the agency. For all major IT investments, agencies are required by CPIC Guidance to submit Business Cases, which provide additional transparency regarding the cost, schedule, risk, and performance data related to its spending.

OMB requires that agency Chief Information Officers (CIOs) provide risk ratings for all major IT investments on the IT Dashboard website on a continuous basis and assess how risks for major development efforts are being addressed and mitigated. The agency CIO rates each investment based on his or her best judgment, using a set of pre-established criteria. As a rule, the evaluation should reflect the CIO's assessment of the investment's ability to accomplish defined security, efficiency, mission, and/or service goals as of the time of the Budget release. Chart 15-4 summarizes the CIO risk ratings for all major civilian IT investments Government-wide. The IT Dashboard shows slight decreases in the general health of IT investments across Government, as denoted by the decreased proportion of CIO-rated "Green" ("Low Risk" to "Moderately Low Risk") investments. "Green" investments comprised 35 percent of all rated investments in 2020 compared to 41 percent in 2019, reflecting the increased complexity of initiatives (assessments based on total life cycle of investments).

The remainder of this chapter describes important aspects of the latest initiatives undertaken with respect to Federal IT policies and projects, addressing a variety of topics. In the important area of cybersecurity policy and spending, however, the reader is referred to Chapter 19 of this volume, entitled "Cybersecurity Funding." This chapter addresses the important area of the protection of Federal systems and data, including those which have personally identifiable information, and the Continuous Diagnostics and Mitigation (CDM) program -- a dynamic approach to fortifying the cybersecurity of Government networks and systems.

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[1] The scope of the analysis in this chapter refers to agencies represented on the IT Dashboard, located at *https://www.itdashboard.gov/*.

[2] See *https://www.perfomance.gov/*.

[3] Note that as of the 2020 CPIC guidance, IT related grants made to State and local governments are no longer included in agency IT investment submissions.

Table 15–1. FEDERAL IT SPENDING
(In millions of dollars)

	FY 2019	FY 2020	FY 2021
Civilian Agencies	51,877	52,925	53,358
Department of Defense	36,906	39,057	38,815
Total	**88,783**	**91,982**	**92,174**

Note: This analysis excludes Department of Defense classified spending.

Cloud Adoption

The Administration last year issued the Federal Cloud Computing Strategy, now commonly referred to as the "Cloud Smart" strategy. This is a significant update to the "Cloud First" strategy released in 2007. Cloud Smart emphasizes the need for application-specific business case analysis to determine the best solution and computing environment. The strategy describes three pillars for successful cloud adoption: a risk-based security approach, improved Federal procurement guidance, and the continued development of the Federal IT workforce. OMB, the CIO Council, GSA, and other agency partners have made significant progress in satisfying the 22 actions outlined in the strategy that will accelerate the adoption of cloud technologies.

The PMA set a goal that 95 percent of civilian Government employee email boxes will be serviced by a cloud-based service. At the end of 2019, 76 percent of email inboxes at Federal civilian CFO Act agencies are now hosted on cloud services, up 10 percent from 2018. This transition improves the efficiency of Government business and communication.

The Cloud Smart policy also directed that agencies complete an Application Rationalization to create an outlook for application disposition, transition to cloud and inform plans for data center closure and optimization. The Agency Application Rationalization plan provides a roadmap to prioritize, navigate and manage risk for ongoing modernization efforts.

As agencies plan their modernization, there are activities directed by OMB, the 21st Century Idea Act, and the CIO council that advance the use of and effectiveness of digital service delivery across all agencies. The activities specific to enhancement of digital service capabilities and user-center design have been a focus in previous years and continue to be a priority focus in the initiatives planned for 2021.

Data Center Optimization Initiative (DCOI)

In addition to the Cloud Smart strategy, OMB updated the companion Data Center Optimization Initiative (DCOI) policy in 2019. This update refocused data center optimization on the applications and data rather than just IT infrastructure. Agencies are to consider the applications' total cost of ownership, security requirements and mission mandates when determining future IT infrastructure optimization efforts. The updated DCOI policy also clarifies both the criteria by which a data center is reportable to OMB, and the criteria that may exempt some data centers from closure. This change in policy re-

Table 15–2. ESTIMATED FY 2021 CIVILIAN FEDERAL IT SPENDING AND PERCENTAGE BY AGENCY
(In millions of dollars)

Agency	FY 2021	Percent of Total
Department of Veterans Affairs	$7,761	14.5%
Department of Homeland Security	$7,298	13.7%
Department of Health and Human Services	$6,422	12.0%
Department of the Treasury	$5,107	9.6%
Department of Transportation	$3,392	6.4%
Department of Justice	$3,265	6.1%
Department of Energy	$2,847	5.3%
Department of Commerce	$2,634	4.9%
Department of State	$2,634	4.9%
Department of Agriculture	$2,372	4.4%
National Aeronautics and Space Administration ...	$2,154	4.0%
Social Security Administration	$1,940	3.6%
Department of the Interior	$1,390	2.6%
Department of Education	$887	1.7%
Department of Labor	$784	1.5%
General Services Administration	$638	1.2%
Department of Housing and Urban Development ..	$409	0.8%
Environmental Protection Agency	$353	0.7%
U.S. Army Corps of Engineers	$247	0.5%
U.S. Agency for International Development	$222	0.4%
Nuclear Regulatory Commission	$141	0.3%
Office of Personnel Management	$130	0.2%
National Science Foundation	$127	0.2%
Small Business Administration	$108	0.2%
National Archives and Records Administration	$99	0.2%
Total	**$53,358**	**100.0%**

Note: This analysis excludes the Department of Defense.

duced the number of Federal data centers reported on the Federal IT Dashboard (https://itdashboard.gov/). Using the adjusted criteria, Federal Agencies have closed 4,247 data centers for a cumulative cost savings or avoidance of $2.2 billion since 2010.

Enterprise Infrastructure Solutions

Federal cloud adoption is underpinned by the modernization of Government communications networks. OMB has designated the GSA Enterprise Infrastructure Solutions (EIS) contract as "Best-in-Class" or the preferred Government-wide solution to leverage the Government's buying power for telecommunications and IT infrastructure requirements. As Federal Agencies transition to the EIS contract they are taking the opportunity to develop a holistic approach toward cloud infrastructure, enhanced mobility, automation, satellite communications, and security. EIS is the only Federal network services contract to include both OMB policy directives and DHS cybersecurity requirements. Through aggregated Federal buying, EIS can deliver a monthly savings of 16-21 percent. Modern, secure, and cost-effective communications networks are enabling Federal Agencies to continue to adopt a modern IT infrastructure and improve citizen services.

Chart 15-1. Trends in Federal Civilian IT Spending

Billions of dollars

Federal IT Spending without Grants Category

Federal IT Spending with Grants Category
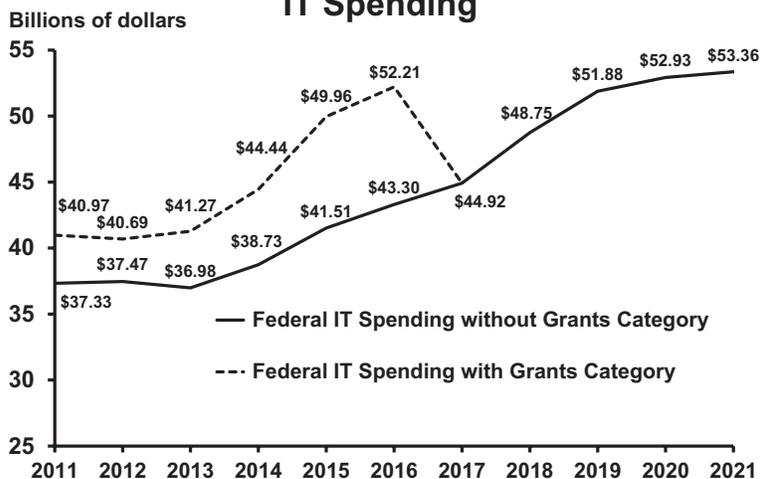
Notes: Investments labeled as "Part 06 – Grants to State and Local IT Investments" were excluded from 2011 – 2015 figures. Investments labeled "Part 04 - Grants and Other Transferred Funding" were excluded in 2016 figures. The 2017 – 2020 estimates did not include these types of investments.

Improving the IT Workforce

Maintaining and securing Federal IT requires a large, highly capable IT workforce. A current focus for policies guiding the strengthening of the Federal IT workforce, stemming from the President's Management Agenda, is the direction given to Federal Agencies to build a workforce able to leverage data as a strategic asset to grow the economy, increase the effectiveness of the Federal Government, facilitate oversight, and promote transparency.

To accomplish this goal, agencies need a workforce highly skilled in the technology, methodologies, and theory of data science. These individuals blend disciplines including mathematics, statistics, and computer science, and need to be able to adapt and develop their skills in a rapidly-changing field. To date, the Government has taken steps to expand the data science workforce, including efforts to establish a dedicated data scientist occupational series to reflect the unique qualifications and skills of the data science workforce. In addition, the Administration has provided training and other professional development opportunities for data scientists to build data literacy and capacity Government-wide.

The President's Budget continues to invest in the data science, data-skilled workforce, to make the Government an attractive employer for top-tier talent, improve our ability to oversee and administer Government-wide programs, and to better deliver services to the American people. A highly skilled data science workforce is essential for the Government's ability to innovate in artificial intelligence and machine learning. Agencies need staff who understand these technologies, both to generate the foundational data needed for them to operate, as well as to manage the automated services to ensure they are accu-

rate, fair, and aligned to the needs of the Government and the American people. Agencies also need cross-functional data scientists who can work in areas like financial management, acquisition, and privacy protections, to drive value across a range of Government domains. Ultimately, a strong cadre of data scientists will allow the Government to run more efficiently and effectively, and drive more user-centric services to the American people.

Shared Services

On April 26, 2019, OMB issued OMB M-19-16[4] establishing a new approach to shared services called Sharing Quality Services (SQS). The memo created a new governance structure leveraging the agencies leadership to help drive and champion these changes. During the summer of 2019, the Administration refreshed the Shared Services Governance Board (SSGB), now comprised of representatives from all the Government-wide councils, and created a new SQS Senior Accountable Point of Contact (SAPOC) group to coordinate actions across the agency to support adoption of the shared service strategies and to be the voice of the Government customer.

In the evolving Shared Service environment, Quality Service Management Offices (QSMOs) will manage the marketplace of solutions for a defined mission-support function. QSMO planning and formal designation of QSMOs already spans the 2019 and 2020 fiscal years. During the preparation for the 2021 Budget, three agencies prepared and presented plans for future services. In addition, exploration and analysis of standards for additional mission support areas will occur in 2020 and 2021. This multiyear journey of agency customer-led,

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[4] *M-19-16, Centralized Mission Support Capabilities for the Federal Government.*

Chart 15-2. 2021 Federal Civilian IT Investment Portfolio Summary

| Percent | 44.6 | 44 | 11.4 |

0   20   40   60   80   100

■ IT Infrastructure, Security, & Management
⊡ Mission Delivery
■ Administrative Services & Support Systems
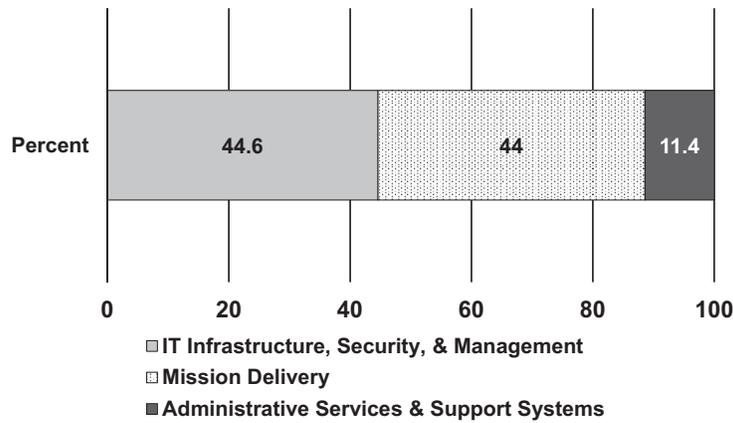
Government-wide identification of standards, alignment of modern services, and introduction of enhanced capabilities will lead the way to transform the Federal Government through improved mission support service quality, and decreased total cost of services, across the Federal enterprise.

United States Digital Service

Americans expect and deserve their interactions with the Federal Government to be simple, fast, and responsive. The United States Digital Service (USDS) is enhancing the Federal Government's most critical public-facing digital services through design and technology expertise. USDS recruits some of the country's top technical talent and partners directly with Federal Agencies to ensure that critical services reach the public. USDS projects not only provide the public with better digital services, but also help streamline agency processes and save taxpayer dollars.

To successfully modernize technical systems, USDS developed a new approach through the Digital Services Playbook.[5] A main element of USDS' approach is to understand what people need. Historically, the Government developed products without regard to how the American people would actually interact with those products. For instance, USDS supported the VA in developing and rolling out the new *VA.gov*, which consolidates the most important information for veterans and places it in one location. Veterans can now update their contact information in one place without having to worry about making the same change in disparate systems. Since the redesign and relaunch of *VA.gov*, 684,000 veterans updated their profiles in 2019, a 479 percent increase over a year prior. USDS continues to collaborate with the VA on

[5] See *https://playbook.cio.gov/*.

Chart 15-3. Percentage of 2021 Federal Civilian IT Spending by Number of Investments

Percent of Dollars*

100%
80%
60%
40%
20%
0%

0   1,000   2,000   3,000   4,000   5,000

Number of Civilian Agency Investments
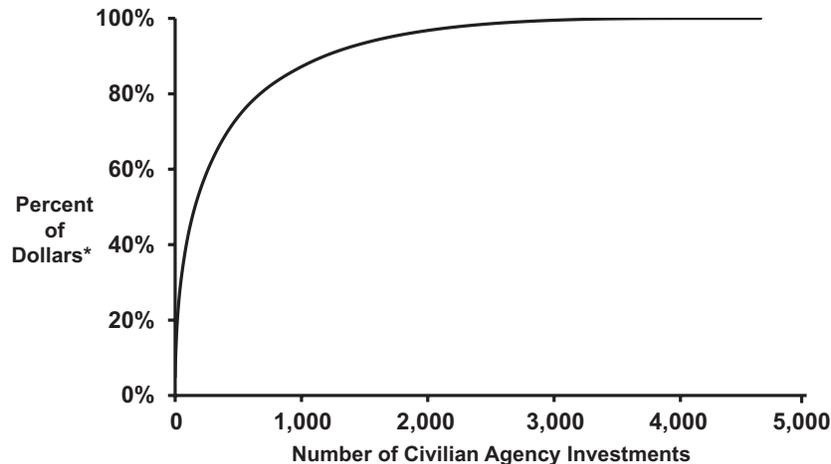
*Percent of Dollars Represented by Largest Investments, Progressing to Smallest Investments

Chart 15-4. CIO Risk Ratings for Federal Civilian Major IT Investments
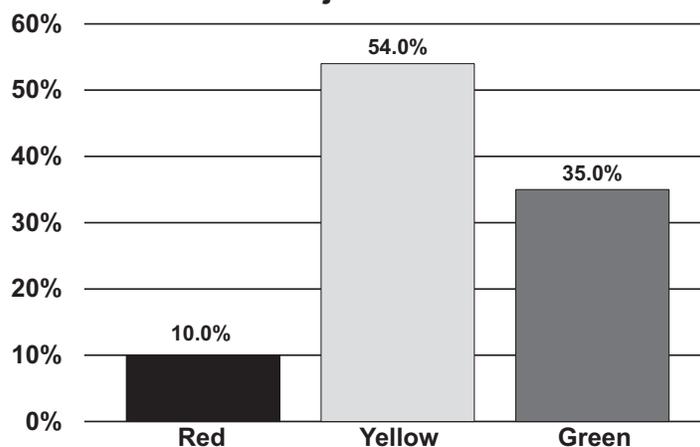
enhancing veterans' access to benefits and services, seeing significant increases in application submissions for healthcare, burials, and education benefits through the site. USDS has a number of similar projects across the Federal Government that not only help update and modernize legacy systems, but also change the culture of how the Government thinks about providing services to the American people.

USDS implements modern best practices that can be replicated across agencies. For instance, USDS is assisting the VA and Centers for Medicare and Medicaid Services (CMS) migrate to the cloud. Both of these agencies are also at the forefront of leveraging industry standard technology known as application programming interfaces (APIs) that allow software to interact with other software. At the 2019 Blue Button 2.l0 Developers Conference on July 30, the CMS USDS team launched Data at the Point of Care (DPC), a pilot API program. The DPC API gives some doctors and healthcare providers access to Medicare claims data, which may improve patient healthcare and overall customer experience. Under DPC, healthcare providers will have access to patient health histories, providing insight into other treatments they may be receiving. Medicare recipients may have more time with their doctors to address current health needs, and better, more coordinated healthcare.

In addition, USDS is working with OMB and OPM to pilot a new way to assess qualifications within the competitive service, with the goal of ensuring only qualified candidates make it to hiring managers for review. The two pilots conducted at DOI and HHS were highly successful, resulting in 20 selections to positions that had previously been advertised with no successful selections, and five additional agencies are moving toward piloting the process. USDS is working with OPM to prototype and test technology to help SMEs to engage in parts of this process.

USDS is also helping drive the adoption and implementation of information security best practices. In a combined project with GSA, USDS launched *Login.gov* that makes

managing Federal benefits, services, and applications easier and more secure through the use of modern identity management solutions such as two-factor authentication. *Login.gov* scaled to over 18 million users, and continues to grow as it is adopted by additional agencies.

Current Federal procurement practices largely do not provide the flexibility required to buy and deliver modern digital services. Meanwhile, the pace of technological change continues to accelerate, while citizen demand for Federal digital services increases. To meet this demand, the Office of Federal Procurement Policy (OFPP) and USDS developed a training program to enhance digital services acquisition expertise across agencies. Graduates of the training receive the Federal Acquisition Certification in Contracting Core-Plus Specialization in Digital Services (FAC-C-DS). As of December 2019, more than 300 people have graduated from the training program, and several agencies are running the training program internally, including the VA, DOE, and DHS. In addition, there are three companies now providing open enrollment courses for others interested in taking the training.

IPv6

The Federal Government is continuing its transition to the new version of Internet Protocol, called IPv6 -- the international standard enabling interoperability for all devices connected to the global internet. The protocol used for the last 30 years (IPv4) is at the point where its pool of available addresses is reaching virtual exhaustion. While stop-gap measures have served to extend IPv4's viability thus far, it is imperative that IPv6, with its vastly larger address space, sees widespread adoption in the near future. This will accommodate internet growth and innovation, giving better support to mobility, security, and virtualized network services. The Federal Government has been leading on policies to move the vendor community and Federal Agencies forward on the path to IPv6 adoption for the last 15 years, pushing network operators, software vendors, service providers, and other

private sector actors toward adoption of the latest IPv6 industry standards – mirroring the same transitions seen across the world. The Federal Government will continue to migrate its information services and networks until an IPV6-only environment is achieved.

IT Modernization

Due to the complexity of the IT landscape, agencies are often inefficient in acquiring, developing, and managing Federal IT investments. This is largely due to both legacy and internally developed, non-standards based systems designed to perform only one function rather than leveraging commercial off the shelf technologies that largely enable more efficient use of Federal technical resources. These legacy and high-customized systems are costly for the Federal Government to maintain and secure.

The Administration continues to pursue its IT Modernization CAP Goal, with its three-pronged approach focusing on enhancing Federal IT and digital services, reducing cybersecurity risks to the Federal mission, and building a modern IT and cybersecurity workforce. Federal Agencies are increasing efforts to modernize their IT in a way that will enhance mission effectiveness and reduce mission risks through a series of complementary initiatives that have and will continue to drive sustained change in Federal technology, deployment, security, and service delivery. Though a substantial amount of work is still required, below are several specific detailed efforts of the Administration's IT modernization strategy.

OMB continues to support the adoption and evolution of the Federal Information Technology Acquisition Reform Act (FITARA)[6] to provide agency CIOs with the authority, accountability, and support to deliver IT services across their agency enterprise. OMB continues to work with the Congress and the Government Accountability Office to improve the technology areas reflected in the FITARA Scorecard to ensure consistent, effective metrics-based evaluation of agency progress and outcomes. Through the Chief Information Officers Council (CIO Council), OMB and agency CIOs will direct discreet projects, coordination efforts, and focused problem solving initiatives to unleash the effectiveness of technical capabilities within agencies to deliver on missions and improve citizen services.

Leveraging Data as a Strategic Asset

On June 4, 2019, the Administration released the first comprehensive Federal Data Strategy[7] for managing and using Federal data. The Strategy is comprised of a mission statement, 10 guiding principles, and 40 best practices. The related first annual action plan includes 20 actions comprised of foundational steps and Administrative priorities to implement the Strategy. The Strategy and 2020 Action Plan are available on *https://strategy.data.gov*.

On July 10, 2019, the Administration released the first memorandum of guidance[8] related to implementing the Foundations for Evidence-based Policymaking Act, outlining the personnel and planning guidance needed to begin implementation of the Evidence Act's provisions. The guidance includes requiring all agencies to designate a Chief Data Officer and establish a Data Governance Body.

- The Budget supports the Foundations for Evidence-based Policymaking Act and the Federal Data Strategy by funding a U.S. Federal Data Service within the Department of Commerce. The Budget helps implement the OPEN Government Data Act by supporting the Federal Data Catalogue and related data services within the General Services Administration.

- The Budget supports the Federal Geographic Data Committee's work to improve management of geospatial data and implement the provisions of the Geospatial Data Act.

- The Budget includes technology investments that further enhance protection of data and foundational capabilities for management of data access and use.

Artificial Intelligence

The age of artificial intelligence (AI) is here, and has transformative potential for a wide spectrum of Federal missions ranging from healthcare to transportation to manufacturing. Recognizing the importance of American leadership in AI to maintaining the economic and National security of the United States, Federal Agencies have been directed by Executive Order 13859, "Maintaining American Leadership in Artificial Intelligence," issued on February 11, 2019, to support AI by prioritizing AI investments in their Research and Development (R&D) programs. To maintain America's AI advantage, Federal Agencies are to focus on two distinct areas. The first area of focus is internal—Federal use of AI to better achieve agency missions and serve citizens. The second focus area is external – including provision of data and related resources to support the private sector and academia in their efforts to harness AI. In both of the these areas, the Administration's policies and strategies aim to accelerate AI innovation to increase our prosperity, enhance our National/economic security, and improve our quality of life.

Agencies are now directed to include support to academia and the private sector via public-private partnerships for AI, to make Federal data, models, and computing resources available to researchers, to establish guidance for AI development and use across economic sectors, and to support programs to prepare our workforce with the skills needed to adapt and thrive in this new

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[6] National Defense Authorization Act for Fiscal Year 2015, Title VIII, Subtitle D, H.R. 3979.

[7] *M-19-18, Federal Data Strategy – A Framework for Consistency*

[8] *M-19-23, Phase 1 Implementation of the Foundations for Evidence-Based Policymaking Act of 2018: Learning Agendas, Personnel, and Planning Guidance*

age of AI. All of this should be aligned with promotion of an international environment that supports AI R&D, and opens markets for American AI industries, while also ensuring that the technology is developed in a manner consistent with America's values and interests. Internal to the Federal Government, agencies are encouraged to deploy AI to improve service delivery, realizing efficiencies allowing the redeployment of resources to further enhance agency performance.

Private sector companies with Federal support are leveraging AI today to improve outcomes. Two examples include financial and food security. In financial services, the Securities and Exchange Commission (SEC) is implementing machine learning algorithms to monitor and detect potential investment market misconduct. Additionally, in September 2019, the Consumer Financial Protection Bureau (CFPB) issued new policies that allow for an increased use of data and machine learning algorithms in financial products and services. This drives competition that lowers prices and provides consumers with more and better products and services. The U.S. Department of Agriculture (USDA) is conducting research and development to use machine learning and AI to create better crop yield models, based on weather data and analysis. These efforts will help rural America thrive, and promote more efficient and profitable agricultural production. Finally, the United States Postal Service (USPS) is deploying an AI capability in 192 mail processing and sorting centers to increase package data processing by a factor of 10. This improvement would not be possible without the machine learning capabilities this technology delivers.

Technology Modernization Fund

The Technology Modernization Fund (TMF) is an innovative funding vehicle that gives agencies additional ways to deliver services to the American public more quickly, to better secure sensitive systems and data, and to use taxpayer dollars more efficiently.[9] The mission of the TMF is to enable agencies to accelerate transformation of the way they use technology to deliver their mission and services to the American public in an effective, efficient, and secure manner. Agencies must apply to and compete for TMF funds. Effective evaluation, selection, and monitoring of approved projects by the TMF Board provides strong incentives for agencies to develop comprehensive, high quality modernization plans. Funds are distributed in an incremental manner, tied to milestones and objectives. Agencies that receive funds from the TMF work with GSA and OMB to ensure that projects make maximum use of commercial products and services in their planning and execution, and that TMF funds will be repaid over a period not to exceed five years. Payback is achieved through cost savings and cost avoidance generated by the initiative. In addition, funding transfer increments are tied to successful delivery of initiative products or achievement of milestones thus tying budget costs to the results delivered. Successful projects will operate as proofs of concept and will provide valuable insights to the Board, which may recommend prioritizing the selection of more comprehensive modernization projects that can serve the interests of the Executive Branch as a whole. This Budget includes additional TMF funding to meet the demand generated by agencies and to invest strategically in modernizing agency systems through commercial solutions and improving the adoption and delivery of shared services.

Since its start in March 2019, the Technology Modernization Fund (TMF) Board has awarded nine initiatives a total of approximately $90 Million. In 2020, two new modernization projects have been approved for funding. The Equal Employment Opportunity Commission received $4 million to accelerate the modernization of its core Charge and Case Management System and the U.S. Department of Agriculture received an award to overhaul its antiquated, mostly paper-based Specialty Crops inspection system. These two proposals both have key elements in common: they are each systems with thousands of customer touchpoints throughout the Nation, and both Agencies are leveraging innovative commercial capabilities to enable their respective digital transformations. In addition, both projects are using TMF funds to enhance the speed at which improved citizen services are delivered. The TMF awards and Agency use of working capital approaches, are levers to accelerate modernization across Government in a manner that demonstrates efficient management of taxpayer resources.

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[9] See *https://tmf.cio.gov/*.