Robotic Process Automation

Elvia Mercado

Defense Acquisition University
Senior Service College Fellowship 2020-2021

April 2, 2021

This research paper is presented to the Defense Acquisition University for partial fulfillment of the academic requirements for the Army's Senior Service College Fellowship (SSCF) under the direction of SSCF Director, Michael Chandler, and Research Advisor Jack Coyne.

Approval Page

Title: Robotic Process Automation

Author: Elvia Mercado

Organization: Defense Acquisition University (DAU) – South, Senior Service College Fellowship (SSCF)

Date of Paper: 03 May 2021

Informed Consent Forms: Not required

Research Advisor: Mr. Jack Coyne, Approval Date: 15 March 2021

Second Reviewer: Ms. Dana Stewart, Approval Date: 24 March 2021

SSCF Director: Mr. Michael Chandler, Approval Date: 20 April 2021

OPSEC Approval Date: 30 April 2021

Approval for Public Release Date: 03 May 2021, Distribution A

Defense Contract Management Agency

Disclaimer

The views and opinions expressed or implied in this research paper are those of the author; no agency or department of the United States Government has officially sanctioned any of these view and opinions.

Abstract

Robotic Process Automation (RPA) is a software solution used to perform mundane repetitive work previously done by people. RPAs emerged in the 2000s and grew as a subset of Business Process Management and the three technologies of screen scraping, workflow automation tools, and artificial intelligence. It was not until "2015 that RPAs began to enter the mainstream" (Welsh, 2019, p. 2). Private industry reacted quickly and took advantage of the many benefits of RPA use, while reducing the burden of employee rote tasks.

This research paper explores current Robotic Process Automation (RPA) use and identifies application areas of RPAs that could cross over from private industry to government or from one government agency to another. Additionally, this paper reports and analyzes efficiencies gained by automating mundane simple processes, which allow redirection of employees' efforts and a shift to more challenging work.

A study of private industry and government entities revealed the business areas of finance and operations to be the top areas for RPA application. The benefits of an RPA application include cost savings, increased accuracy, increased productivity, increased scalability, and shift to high-level work. A secondary benefit of RPA use is employee job satisfaction.

The Office and Management Budget's RPA directive should be implemented swiftly and with diligence, thus the paper strongly recommends that government entities look at their internal processes to assess, which of these might be improved by RPA application. Another recommendation is that government offices interested in RPAs contact the Federal RPA community of practice as a resource to planning and implementing a good RPA process. This would reduce the risk of duplicating RPA efforts that already exist and allow utilization of existing RPAs.

Acknowledgments

I would like to acknowledge the Defense Contract Management Agency (DCMA) Huntsville, DCMA Central Region, DCMA Headquarters and Fourth Estate for my selection into the Defense Acquisition University Senior Service College Fellowship class of 2021. This has been an excellent learning experience in leadership, acquisition and strategy. I would like to thank former Colonel Jeffrey Caldwell and Colonel Paul Mazure as they were instrumental in the application process and support of my career development. A big thank you to my SSCF SES mentors Dr. Juanita Christensen, Mr. John Lyle and Ms. Marcia Holmes. I would also like to thank the Defense Acquisition University South Region leadership, Dean Mark Lumb, Director Mike Chandler, research advisor - Jack Coyne, and research reviewer - Dana Stewart. My heartfelt thanks to Ms. Michelle Munson, DAU Librarian for her research assistance. To my fellow classmates, I appreciated all the advice and support. I enjoyed all the texts and Microsoft team meetings. Finally, I want to thank my family for their support while I pontificated on the information absorbed during my DAU SSCF classes and on completing this paper.

Table of Contents

Page

List of Tables

Table **Page**

List of Figures

Chapter 1 – Introduction

Background

The President's Management Agenda (PMA) of 2018 set the long term vision for federal government workforce modernization in key areas. This agenda focused on the need for mission driven results, government services that equal or surpass private sector services, and effective stewardship of taxpayer funds. The PMA concentrates on three key initiatives - a solid modern information technology foundation, initiatives on data accountability & transparency, and federal workforce transformation (PMA, 2018). The PMA established cross cutting agency priority (CAP) goals for these three primary drivers so agencies could collaborate to influence change. These areas included improving customer experience, sharing quality services and shifting from low value to high value work.

CAP goal six dictated that federal agencies shift from low value to high value work (PMA, 2018). This goal will reduce the burden of repetitive administrative tasks through integrated information technology and automation software. The Office of Management and Budget (OMB) memorandum 18-23 dated August 27, 2018, also "prioritizes reducing the burden of low value activities and redirected resources to higher-value tasks" (OMB, 2018, p. 1). The memo specifically directed the Department of Defense (DoD) and other Chief Financial Officers (CFO) Act Agencies to "introduce new technology, such as robotic process automation (RPA), to reduce repetitive administrative tasks, and other process-reform initiatives" (OMB, 2018, p. 2). The new memorandum 18-23 augmented the previous OMB Memo 17-22, which "directs agencies to identify opportunities for workforce efficiencies and align the employees to meet the needs of the future" (Russell, 2019, p.5).

The President solidified his mandate of technology modernization by issuing Executive Order 13859 on February 11, 2019 creating the American Artificial Intelligence (AI) Initiative. This national strategy focuses on maintaining American superiority in AI (Federal Register, 2019). This initiative recognizes that AI is important to the financial and domestic security of America. Thus, AI must be shaped to be in line with the nation's ideals. The initiative requires executive departments and agencies to adhere to certain objectives including sustained investment in AI research and development and enhancing access to federal data, models, and computing resources, which reduces barriers to the use of AI technology. Additionally, the strategy urged the standardization of AI, the building of an AI workforce and cooperation with other countries while maintaining the security of U. S. AI technology (OSTP, 2019).

The Department of Defense released the 2018 Artificial Intelligence (AI) strategy one day after the president's American AI initiative. The AI strategy directed fast-tracked implementation of AI and the development of a leading AI workforce. Additionally, AI should be used in a human centric manner to create an efficient and streamlined organization. The approach aimed for AI processes such as RPAs to be used in a human centric manner to create an efficient streamlined organization. This strategy included:

> The ability of AI to reduce inefficiencies from manual, laborious, data-centric tasks will be harnessed across the Department with the objective of simplifying workflows and improving the speed and accuracy of repetitive tasks. These changes have the potential to shift human attention to higher-level reasoning and judgment, which remain areas in which the human role is critical. (DoD, 2018, p. 6)

Other initiatives and strategies helped to develop AI and allowed free flow of data in order to meet the future without silos and towards gaining efficiencies. These include the National AI Research and Development Strategic Plan of 2016 and 2019 which establish a set of objectives for federally funded AI research with the goal to produce new AI knowledge and technologies. The Open Data Act of 2018, which defines open data without locking in yesterday's technology prioritizes breaking down barriers to siloed databases. Additionally, the National Intelligence Director's augmenting intelligence using machine initiative of 2019 provides a context for the integration of AI technologies across the intelligence community (IC) and development of technical expertise (Russell, 2019).

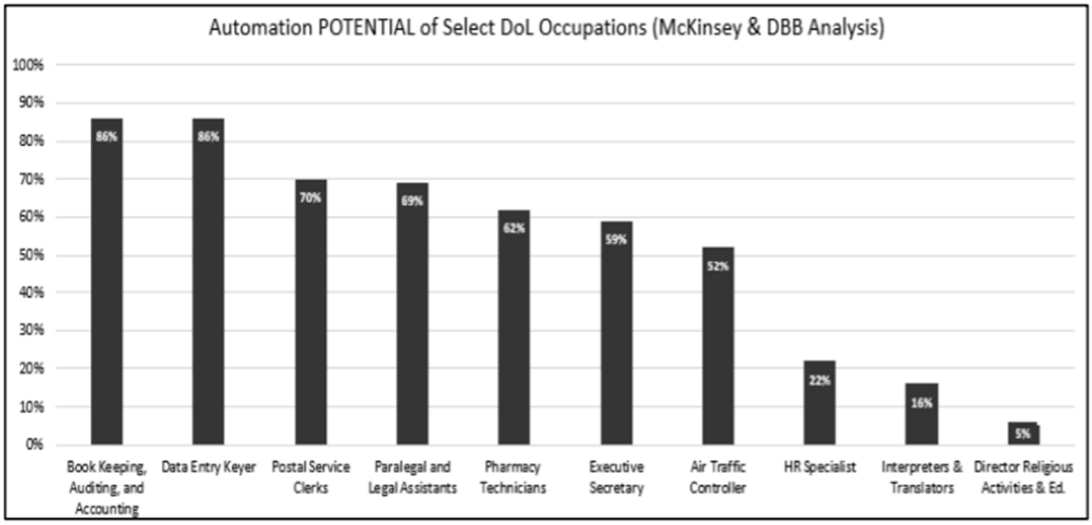
Problem Statement

The Department of Defense has been slow in fully adopting the use of Robotic Process Automation. A 2017 report by the Defense Business Board (DBB) stated that automation could possibly perform 45% of employee tasks. Figure 1 shows the potential for automation across different Department of Labor (DoL) occupations.

Literature has documented that the use of RPA is prevalent in the private sector but not much information is known of RPA in government institutions. Further research is required to investigate opportunities to incorporate RPAs used in the commercial sector into the DoD. Additionally, this research should reveal the business areas that are being automated and the efficiencies being gained. Furthermore, a study of how other federal entities are gaining efficiencies through RPA utilization is needed to find opportunities for DoD implementation.

Figure 1

Automation Potential of Select DoL Occupations (DBB, 2018, p.26)



Purpose of the Project

The purpose of this paper is to examine robotic process automation use in private industry and government agencies. This study will identify application areas of RPAs that could cross over from private industry to government or from one government agency to another. Additionally, this paper will report and analyze efficiencies gained by automating mundane, simple, processes/tasks, which allowed redirection of employees' efforts to more challenging work.

Significance of Research

The DoD's safeguarding American's superiority mission to leap to the forefront of technological advancement could be hindered if AI and RPA are not embraced. The DoD's AI strategy echoes this sentiment and states:

> Failure to adopt AI will result in legacy systems irrelevant to the defense of our people, erosion of cohesion among allies and partners, and reduced access to markets that will contribute to a decline in our prosperity and standard of living, and growing challenges to societies that have been built upon individual freedoms. (DoD, 2019, p. 5)

Additionally, the shift from low value to high value work will allow the nation to concentrate on keeping the superiority by focusing on the important work. The PMA's CAP Goal 6 Statement states:

> Federal agencies will shift time, effort, and funding from low to high-value work through the elimination of unnecessary requirements, burden reduction, optimization and streamlining, and workload automation. Based on the 2020 Customer Satisfaction Survey, Federal employees on average spend an estimated 275 hours per year on work they consider low-value. Over the next two years we will work to reduce the government-wide average by 15%, which could reduce the total hours of low value work employees have identified by up to 25 million hours. (Performance.gov, 2020)

Research Question

1. What is Robotic Process Automation (RPA)?
2. In what commercial and federal business areas are Robotic Process Automations being applied?
3. What current efficiencies are being gained by automating mundane simple processes/tasks and redirecting employees' efforts to more challenging work?
4. How can current private industry and government robotic process automation (RPA) practices be leveraged to integrate RPAs in the other federal entities processes?

Objectives and Outcomes

The initial focus of this research is to define artificial intelligence, specifically robotic process automation. The study will investigate implementation approaches, and both the benefits and challenges of RPAs. The different potential business areas in which RPAs are being used will be discussed. As a further objective, this paper will convey the current RPA practices in both private industry and government. RPA efficiencies discovered in the research will be reported. The last objective is to investigate which RPAs will be useful for further development and implementation in government.

The overall outcome of this research creates an understanding of the urgency for modernization of government technology. The study summarizes the directives that led to the call for artificial intelligence. This paper bridges the gap of knowledge of how RPAs are efficiently performing mundane, repetitive tasks. Moreover, this research advances the information needed for government entities to innovate and realize the efficiencies of RPAs.

Chapter 2 - Literature Review

This literature review researches the topic of robotic process automations (RPAs). This assessment will examine how RPAs are defined, processes of RPA implementation, and the challenges and benefits of RPAs. Business management areas that could benefit from RPAs will be presented. The literature review will then focus on RPAs private industry uses and the efficiencies being gained. The government agencies that utilize RPAs will be explored and any advantages realized discussed.

Robotic Process Automation

RPA Definition

A Robotic Process Automation is a software solution used to perform mundane repetitive work previously done by people. RPA enables creation of software robots ("bots") to automate business processes (Vincenzes, 2019). An RPA is the equivalent of a business software license, not a physical robot. Each RPA is a software robot that can be instructed very quickly to carry out an operational process with speed and accuracy. RPAs also known as bots function as a digital workforce that can perform repetitive tasks such as data entry and data transfers, but with added benefits of having a worker on 24 hours a day, seven days a week. (Vincenzes, 2019). RPAs are optimally used with high volume, standardized, rules-based, mature, stable processes where costs are clear and business value is well understood (Willocks, Lacity & Craig, 2015).

An RPA should not interfere with the company's current information technology (IT). The RPA acts in the same way a human would to access platforms, is non-invasive, and interacts with other systems through the presentation layer so no system programming logic is touched or

altered and no data is stored. RPAs automate and access the presentation layer of existing processes through applications and the outputs are verified by the business operations managers.

An RPA is used to automate a company's business process and is only as good as the business practices in a company. If the company's procedure currently generates bad data, then RPAs will not fix these actions. Erroneous inputs must be eliminated to avoid erroneous output. Therefore, before any software solution is sought out, a company should examine their processes and make improvements as needed before implementation.

RPAs have also been defined as "a low to no code commercial off the shelf (COTS) technology that can automate repetitive, rules-based tasks" according to the RP Program playbook (Federal Robotic Process Automation Community of Practice, 2020-a, p. 4). The PMA's CAP goal six states, "Federal agencies will shift time, effort and funding from low to high value work through the elimination of unnecessary requirements, burden reduction, optimization and streamlining, and workload automation" (Performance.gov, 2020, p. 2). RPA is a technology that provides organizations with these capabilities.

An article by the Chazey Partners offers the top ten things you must know about RPAs (n. d.). Some items that have not been discussed in the definitions above are that RPAs are enterprise-safe and designed to meet security, scalability, auditability and change management requirements. RPAs require an electronic input to commence working. RPAs have the ability to cross multiple systems and are user friendly with low requirements for technical support (Chazey Partners, n. d.).

RPA Example

Figure 2 and Table 1 below illustrate how an RPA could be used to automate certain steps of an invoice business process. (Guru 99, n.d.)

Figure 2

Invoice Business Process (Guru 99, n.d.)

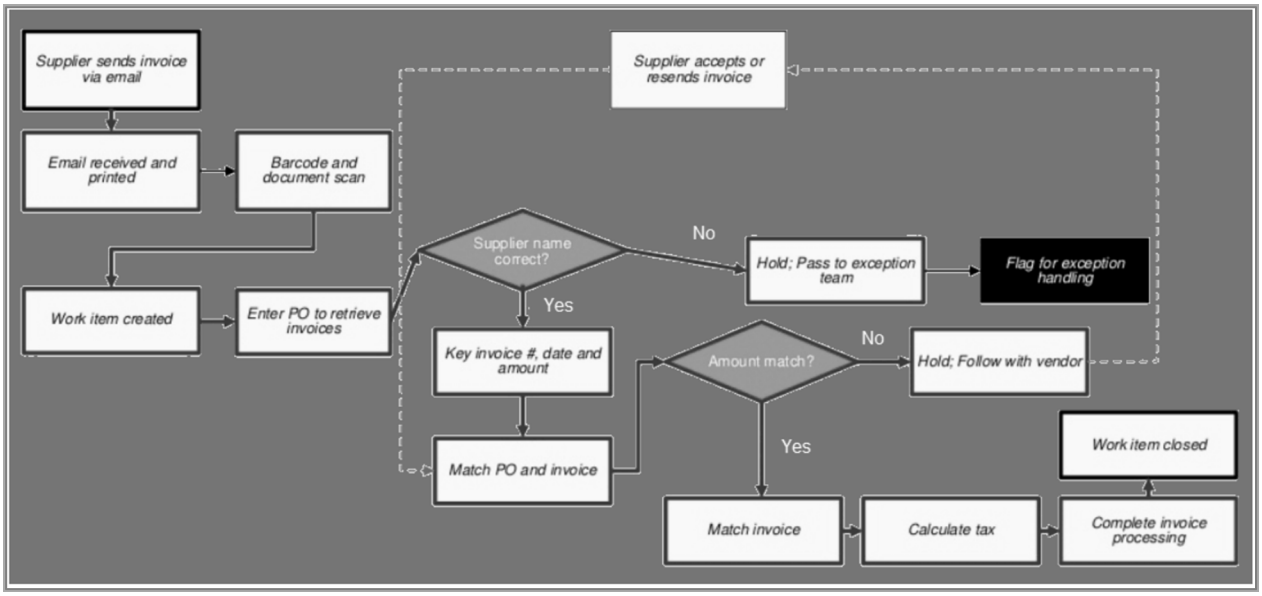


Table 1

Invoice Business Process Steps Automated (Guru 99, n.d.)

Description	Can be Automated via RPA?
Open invoice email from the supplier and print it for records	Yes
Barcode Scanning	Manual
Create work item in a legacy software system	Yes
Enter PO to retrieve Invoices	Yes
Check supplier name is correct or not?	Yes
Key Invoice, Data and Amount	Yes
Match PO and Invoice	Yes
Check if Amount is matches or not?	Yes
If amount match Matches Invoice, Calculate Tax	Yes
Complete Invoice Processing	Yes
Work Item Closed	Yes
If Amount does not match Hold, follow with vendor	Yes
Supplier accepts or resends Invoice	Yes
If Supplier name is incorrect to hold a pass to exception team	Yes
Flag for exception handling	Yes

RPA Implementation

Implementing RPA can provide many benefits including lower "cost, process efficiency accuracy, regulatory compliance, speed, reliability, error reduction, and improved customer satisfaction" (Willocks et al., 2015, p. 4). There are two models for implementation: in-house or outsourced. With the in house model, the company contracts with an RPA vendor to acquire, implement, support, maintain and manage the technology that is developed internally. The customer may contract for all of the above or keep some of those actions in house depending on their resources. When outsourcing, the contract will focus on services being performed, with the provider using its own software (Bott & Wright, 2017).

The implementation of an RPA must be managed to acquire and secure the needed support for the change. This safeguards the return of the investment. The Army Financial Management (FM) community has identified certain steps that should be taken to ensure a smooth transition. These lessons learned include planning and operationalizing an IT strategy, establishing a governance board with a welcoming and inclusive environment, initiating early multi-faceted customer relationship strategy to react to requests for information, designing an operating model that supports a rapid RPA launch, an option for long-term expansion, and institutionalizing an early digestible automation development methodology (Gex &Minor, 2019).

When examining which processes to automate, the article titled "Leveraging robotic process automation (RPA) to making government agencies happier" calls out six business process types to consider. These include high-cost impact processes (Vincenzes, 2019, p. 3). Those processes are expensive and involve multiple end users. Other considerations are the processes with high repetition or processes with high volume. These are usually low order

activities that can be automated. Other processes to consider are those which are likely to be multi-stepped and thus be prone to errors or mistakes.

The Internal Revenue Service's (IRS) executive lead for robotics process and intelligent automation, Reza Rashidi, identifies five key steps for implementing automation. These include "defining program goals, conducting pilots, setting up operating models, building centers of excellence and standing up shared services" (Constans, I., 2019, p. 2). Constans' (2019) article further states that RPAs should be an integral component of Information Technology (IT) strategy.

The General Service Administration (GSA) RPA Operating Model calls for four steps in implementing a robotic process automation to maximize productivity in private industry. First, the sales and marketing department must identify and scope an area for improvement and assess the risks. Second, the process and business experts along with the functional coordinator must assess the process for automation, document the process, make necessary improvements, and prioritize the project. Next, the RPA team must work with the factory manager to "design, develop, test, deploy, authority to operate (ATO) and user acceptance testing (UAT)" (Bartel, 2020, p.7). The Company's information technology office must be available to help with the IT platform, RPA bot credentialing and ATO. Finally, during operations the changed system must be monitored and performance measured for cost savings (Bartel, 2020).

GSA's community of practice (Federal RPA CoP) also expounds a methodology of lean six sigma for improving a process and elimination of waste before automation. GSA has provided an RPA form to screen candidates for automation (Appendix A). The form serves to determine the initial scope of the new project and provides an estimate of annual hours saved.

The form could also serve as the "contract between the process owner and the RPA team and could be used to facilitate the go /no go decision for automation" (Bartel, 2020, p. 21).

The GSA's RPA CoP published a "State of Federal RPA Report" in November 2020 that provided a standardized framework called RPA Maturity Model to gauge RPA program development with incremental steps to obtain maturity. The report also provided a baseline measure for RPA annual growth and determined the impact of RPA on the President's Management Agenda (PMA) cross-agency priority goal six (Federal Robotic Process Automation Community of Practice, 2020-b). The COP assessed the maturity of 23 government RPA programs in eight areas. These included: "1) automation in production, 2) annualized hours of workload reduction, 3) process improvement, 4) program impact, 5) opportunity identification, 6) production environment, 7) security and technology approach, and 8) intelligent automation capabilities" (Federal RPA CoP, 2020-b, p.5)

Table 2

RPA Maturity Model (Federal RPA CoP, 2020-b, p. 5)

	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5
Maturity Component	**(0-29 Points)**	**(30-49 Points)**	**(50-69 Points)**	**(70-89 Points)**	**(90-100 Points)**
Automations in Production	1-5 Applications (5)	5-20 Applications (10)	20-50 Applications (15)	50-100 Applications (20)	100+ Applications and Monthly Production of 5+(25)
Annualized Hours of Workload Reduction	0-5,000 Program Cumulative (0)	5-50,000 Program Cumulative (5)	50-150k Program Cumulative (10)	150k-300k Program Cumulative (15)	300k+ Program Cumulative (20)
Process Improvement	No Capability (0)	Basic PI Capability (3)	Intermediate PI Capability (4)	Advanced PI Capability (5)	
Program Impact	Processed Automated for Work Teams (1)	Processed Automated for Office-Level Units (2)	Processed Automated for Bureau/Divisions (3)	agencywide Processes Automated (4)	governmentwide Processes Automated (5)
Opportunity Identification	Ad Hoc Approach (1)	5+ Application Pipeline (3)	10+ Application Pipeline (5)	20+ Application Pipeline and Active Opportunity Generation (7)	30+ Application Pipeline & Multi-Customer Demand (10)
Production Environment	Pilot Desktop Automation (1)	VDI Attended Automations (5)	On-Prem Enterprise Platform (10)	Enterprise Cloud Platform (20)	
Security and Technology	Pilot Security Approvals and Publicly Available Data (0)	RPA Software ATO / Approval, Using PII on Ad hoc Basis, and Human User Credentials (3)	RPA Software & Enterprise Platform ATO / Approval, Standard Approach to Using PII, and 50%+ Unattended Automations (5)	RPA Software & Enterprise Platform ATO / Approval, Standard Approach to Using PII, and 50%+ Unattended Automations (7)	RPA Software & Enterprise Platform ATO / Approval, Standard Approach to Using PII, and 75%+ Unattended Automations (10)
IA Capabilities			Basic IA Capability (1)	Intermediate IA Capability(3)	Advanced IA Capability (5)

Key Definitions:
Basic PI Capability includes the introduction of standardized automation design documentation; **Intermediate PI Capability** includes process assessment, mapping, and improvement tools; **Advanced PI Capability** includes reengineering and metric definition.
Basic IA Capability includes use of native sensory tools to the RPA workflow; **Intermediate IA Capability** Introduces advanced sensory tools to automation workflow; **Advanced IA Capability** includes NLP, ML, image analysis, cognitive agents, or chat bots.

RPA Challenges

A recent article created a checklist of 21 pitfalls or challenges when using RPAs. The pitfalls are grouped into five categories. These include organizational, process, implementation, technical, and post-implementation (AI Multiple, 2021-a). The organizational pitfalls all involve "lack of time commitment from local teams, lack of leadership buy in, lack of IT support, lack of support from analytics/data function, lack of support from HR, unclear responsibilities and lack of a clear company RPA strategy" (AI Multiple, 2021-a, p. 2). The process pitfalls enumerated procedure difficulties. These included choosing a process that changes frequently, one that has an insignificant business impact, or one where errors are disproportionately costly. The article also warned of choosing a process that involves higher level cognitive tasks, a too complex process, or one where custom solutions exist. The implementation pitfalls urged that in-house RPA development with in-house personnel might not have enough capacity. Choosing an intensively programmed or scalable solution, and not utilizing readily available RPA tools currently on the market were presented as technical pitfalls. The post-implementation pitfalls included not building for scalability, not considering maintenance and not securing RPA privileged credentials (AI Multiple, 2021-a).

AI Multiple (2021-a), an AI industry analyst, suggests that the last pitfall of not securing RPA privileged credentials can lead to cybersecurity issues. Robotic Process Automation performs the same access functions that a human would to gain entry into a business system. RPAs interact with business processes to extract and move data from one process to another. As such an RPA requires authorization to log into systems and the privileged credentials are often hard coded directly into the script or rules based process the RPA follows. Otherwise, the RPA goes through the process of retrieving the credentials from a database. Since these credentials

are used continuously with other systems, the authorizations are more open to cyber-attack. To prevent this type of risk, credentials should be changed and secured so hackers cannot steal them or use them to gain access to critical systems, applications, and data (CyberArk, n. d.).

Organizations take three steps to protect against unauthorized access. The government's IT office can store privileged credentials in a centralized encrypted location and ensure these are removed from scripts and other insecure locations. Second, it can limit the bots and grant privileged access to only those specific applications that are needed for that task. Lastly, it secures the RPA console access by managing the credentials, and monitoring activity to suspend or terminate suspicious sessions (CyberArk, n. d.).

Nuummite (2020) Consulting also identified 17 challenges to RPA implementation. Some of these are not mentioned in the AI Multiple's article. These included not enough support from business, improper team structure, wrong use cases for automation, unclear expectations, lack of ownership or buy-in, and lack of RPA maintenance. A clear challenge in RPA implementation mentioned in the article is the lack of skilled resources. Another is that some processes cannot be automated end to end without integration with machine learning algorithms and OCR engines, which can be costly. Cultural change, not following RPA best practices, and inadequate support from the vendor are also listed as challenges. Implementation without IT involvement could risk "crossing wires with the IT architecture, security and infrastructure, and this can potentially result in them being excluded from the corporate disaster recovery plan" (Nuummite, 2020, pp. 6-7). Lack of controls and tracking mechanisms can lead to inconsistent outcomes. The ambiguity of technical staff and choosing the wrong platform due to lack of knowledge or cost are also challenges. And, lastly companies that fail to put the infrastructure in place is one of the biggest challenges of RPA implementation (Nuummite, 2020).

An article, “Put on Your Auditor Hat to Help Avoid Turbulence on the Intelligent Automation Journey”, urges auditors to consider the risks and possible impacts of RPA use (Asef-Sargent, Lewis, Everson, & Steinhoff, 2020). Six risks were identified including lack of adequate governance, poorly designed bots, badly configured bots, bots not monitored adequately, documentation not available and full IA lifecycle not considered. Potential impacts were offered as “process and input error, erroneous calculations, unauthorized transactions, data loss, non-compliance with laws and regulations” (Asef-Sargent et al., 2020, p. 4). Additional impacts were “business disruption, security breaches, reputational harm, loss of public confidence and negative impact on mission execution” (Asef-Sargent et al., 2020, p. 4). Actions to mitigate or eliminate the risks were also offered including addressing risk and governance upfront, prioritizing sound program development, adopting a change management process, controlling access to programs and data, supervising and reviewing bots, and re-perfomancing by auditors and end-of life for a bot (Asef-Sargent et al., 2020).

Another risk or challenge is that ethical biases that are inherent in some processes can inadvertently be designed into RPAs. For example, a recent article, “RPA in HR – automation raises ethical questions for HR leaders”, conveyed the concern that RPAs will not pick up on recruiting exceptions or anomalies and make uninformed decisions (Lanshore, n. d.). This type of bias was found in machine learning algorithms deployed by MIT in assessing resumes. The article, “MIT: Hiring algorithm design could impact candidate diversity, quality”, shows that even though a technology is available it should still be used judiciously as it could be considered discriminatory (Golden, 2020). MIT had built three resume screening algorithms that looked for qualified underrepresented groups of Blacks, Hispanics and women. The first and second

algorithms increased women applicants and the third algorithm increased Blacks, Hispanics and slightly less for women than the other two algorithms (Golden, 2020).

Automating recruiting processes have increased during COVID-19. Even though technology can be used it still does not eliminate bias. Amazon had to eliminate an AI based hiring tool in 2018 after it was found biased against females (Golden, 2020). Additionally, "a 2019 survey of adults by outsourcing company Yoh found 42% said that AI should not a have a role in selecting a candidate that is hired and 22% objected to AI's use in screening resumes" (Golden, 2020, p.3).

Robotic process automation is a relatively new business and legal considerations must be taken into account before signing a contract for RPA services or RPA technology. Several discussions must occur before acquisition of RPA technology to avoid or minimize the legal concerns. Key contractual items to negotiate include the "license scope, usage permissions including managed service providers and volume caps; service levels and performance metrics; intellectual property rights and indemnities; liability caps and exclusion; pricing terms and model; change management; and, exit transition support" (Bott & Wright, 2017, pp. 5-6).

RPA Benefits

Robotic Process Automations support the Department of Defense's line of effort to "Reform the Department for Greater Performance and Affordability" (Department of Defense, 2018, p. 12). RPAs are able to deal with "rules-based, dynamic processes, and carry out advanced judgment and decision-making tasks" (Willocks et al., 2015, p. 4). RPAs allow humans to shift from low value, high volume tasks, which are repetitive and mind numbing to more rewarding work, boosting efficiency. This in turn can help avoid employee burn out and allow the possibility of creativity and innovation. RPAs eliminate human error due to misplaced

keystrokes and accuracy and consistency increased. This reduces operational risk. The cost of completing tasks decreases since RPAs complete transactions with speed and helps organizations concentrate those resources elsewhere thus, increasing productivity. A digital workforce works continuously 24 hours a day, seven days a week. This allows transactions to fit to all global schedules with different time zones. Compliance and audit challenges are also streamlined since human access to sensitive systems and information is minimized or eliminated.

Audits are streamlined since some humans are eliminated from the process. A great advantage is programming skills are not needed to configure a software robot. The RPA quickly models the human steps. Defects in processing are automatically recorded for each test case and sprint. There is a seamless build and release management (Guru 99, n.d.)

A Deloitte 2018 RPA survey found that productivity can improve by 86%, quality and accuracy by 90%, compliance by 92% due to RPA application (CyberArk, n. d.). RPAs are deployed on an average within two to three months. RPA is also a scalable technology, and as mentioned, RPA allows for improved access to information by management.

RPA Business Applications

Eight of the most common administrative and support processes that have been automated using RPAs include invoice processing, sales orders, accounting reconciliation, enterprise resource planning (ERP), data entry, system queries, payroll, employee on-boarding, and user termination (JOLT Experts, 2019). All industries that deal with invoices are either receiving one or billing one. RPAs could be used to enter the receipt data regardless of the various vendor invoice formats, to reconcile errors and to make the necessary payments. Businesses with sales departments have certain tasks associated with this function such as data entry in the customer relationship management (CRM) system or the enterprise resource

planning (ERP) accounting updates. RPA bots can be used to input sales orders, maintain client databases, and invoice customers thus saving time to concentrate on new sales prospects. Robotic process automation is also being used in accounting to reconcile records in various data bases. Bots extract the data from the various documents such as bank statements and invoice payments to verify accuracy and match figures. Bots also reconcile purchase order delivery notes to ensure shipments are delivered as requested. ERP data entry could also be facilitated not just in sales as mentioned above but in other departments. ERP systems such as Oracle, SAP, NetSuite, and Microsoft Dynamics are used every day by finance, accounting, HR, and supply chain analysts. Reducing the hours of data transactions associated with entry, updates, processing, and validating could be done by RPAs. Data queries and data sharing between different departments through multiple portals and applications could be automated to give staff rapid access to data transactions. RPA could also be used by the HR department to automate the employee transactions that involve data from several databases. For example, employee records could be accessed to complete onboarding of new employees, set up payroll options deductions (i.e. insurance, benefits), validate time records, and create hard copy paychecks or electronic paychecks. RPAs could also be used to make sure exiting or out boarding employees who are terminated in all appropriate data bases and produce exit records to send to relevant stakeholders (JOLT Experts, 2019).

The Innovation Committee of the Federal Chief Information Officer's Council is part of the Office of Management and Budget. This committee's white paper titled "Robotic automation in federal agencies" (2020) discussed categories that current market RPA tools can address. These include acquisition and procurement, customer service, finance and accounting, human resources, and IT management. For example, acquisition and procurement bots are able to create

procurement requests and pull schedule data from multiple sources to create a single report. Customer service bots can automate some contact and call service centers by updating customer information, processing billing and orders, and dispersing this data to appropriate systems. Finance and accounting bots can work "reconciliations and appeals processes, claims and chargeback processing, reporting and financial auditing, and inventory processing" (IC-CIOC, 2020, p. 6). Human resource functions like "payroll processing, benefits management, education and training, recruitment, and onboarding tools" can be automated (IC-CIOC, 2020, p. 6). Additionally, employees can access HR self-service features, which improves access time and "provide greater consistency of experience and improve transparency and workflow" (IC-CIOC, 2020, p. 6). IT applications, infrastructure, network monitoring, management of folders, files, records, user and directories can all be automated. Forms development, email processing and distribution, and security and compliance processing can also be automated with bots (IC-CIOC, 2020).

Private Industry Use

An article in the International Journal of Research in Engineering, Science and Management titled, "A Review of Robotic Process Automation", named ten application industry areas for RPA use (Dechamma & Shobha, 2020). These included healthcare administrative work on patients, where medical records, insurance claims, and complaints could be automated. Insurance companies could use RPAs to automate data input of claims, collection and processing of documents. Banking/finance could use RPAs for fraud detection, customer service, credit card and mortgage processing. These two areas were also mentioned later in the article where it stated "Industries such as banking, finance and insurance have already implemented the RPA with high cost savings and higher productivity to support the industries" (Dechamma & Shobha,

2020, p. 5). Tax offices could use RPA for data retrieval, file tax appeals and reduce manual data entry processes. Human Resource departments are using RPA to facilitate onboarding, payroll, employee data management such as leave and expenses. Operations are using RPA for management of procurement process including vendor records, logistics tracking order and shipping documentation. Retail industry utilize RPA to track and update orders, and process shipping notifications in addition to categorizing/sorting product. Telecommunications RPA could monitor subscriber feeds, fraud management and update customer data. IT and customer service RPA are used for data entry, system checks, daily backup of information, running diagnostics, sending scheduled bulk email, and system administration tasks. Various other areas were procure to pay, cleansing of data, and data extraction (Dechamma & Shobha, 2020. The table below is a compilation of the 45 case studies conducted by AI Multiple with the industry, company, improved business function, RPA results and RPA vendor identified. It illustrates the wide range of business functions that robotic process automation has improved.

Table 3

45 Industry Case Studies (Research AI Multiple, 2020)

Company	Country	RPA	Industry	Business Function	Case Study	Results	Implementation in (months)
Line mobile communication app	Japan	Argos Labs	Tech	Technology	Mobile app testing and monitoring	Reduced quality assurance effort	
An automobile manufacturer	Japan	Argos Labs	Manufacturing	Technology	Online app testing and monitoring	Reduced quality assurance effort	
ANZ bank	Australia, New Zealand and India	Automation Anywhere	Financial Services	Various	Various processes	85% reduction in effort (equivalent to 400 FTEs)	33

Company	Country	RPA	Industry	Business Function	Case Study	Results	Implementation in (months)
Dell EMC	United States, India	Automation Anywhere	Tech	HR and Finance	Various processes including invoicing process, renewal quote generation	$2M savings per year	10 (from scoping the work to going live)
TreasuryOne	South Africa	Automation Anywhere	Financial Services	Operations	Back-office operations, including performing settlements and sending out deal confirmations	Error reduction	5
Juniper Networks	Global	Automation Anywhere	Tech	Operations	Invoice generation	Error reduction	
A global bank	Global	Automation Anywhere	Financial Services	HR	HR form tracking and management process	$1m savings p.a.	
Bancolombia	Colombia	Automation Anywhere	Financial Services	Operations	Back office processes	Reduction of labor and errors	
Logistics	Global	Automation Anywhere	Logistics	Operations	Document management automation	$0.4m savings p.a.	
Fortune 100 bank		Automation Anywhere	Financial Services	Operations	ACH payment processing	50 FTEs reassigned to higher value tasks error reduction	2.5
Quad/Graphics	USA	Automation Anywhere	Printing	Finance	Payments processing other processes	Faster turn-around-time	2.5
San Diego County - Health and Human Services Agency	USA	Automation Anywhere	Non-profit/ government	Operations	Processing customer applications	Reduced effort Reduced errors	
An imaging tools manufacturer		Automation Anywhere	Manufacturing	Finance	Order fulfilment process	Reduced effort Reduced errors	
Synergy	Australia	Automation Anywhere	Energy	Finance	Transactional billing process	$2.3m annual value savings Error reduction 280+ bots deployed	15

Company	Country	RPA	Industry	Business Function	Case Study	Results	Implementation in (months)
Cerner	USA	Automation Anywhere	Healthcare	IT	Migrating data from excel to Electronic Medical Records (EMR)	$130k benefits p.a. 628% ROI	3
Fortune 500 storage provider for hybrid cloud data centers		Automation Anywhere	Manufacturing	Finance	Order-to-cash	8 FTEs moved to higher value tasks $350k savings in 3 months	1.25
A food and beverage company		Automation Anywhere	Food and beverage	Finance	invoice processing help desk internal financial reporting	25 FTEs focused on high value tasks	<6 (for end-to-end invoice process)
A manufacturer of construction and mining equipment		Automation Anywhere	Manufacturing	Operations	Supply chain management	29% productivity increase Error reduction	6
A health insurance company		Automation Anywhere	Insurance	Operations	Member enrollment process Commercial claims testing audit	Reduced effort Reduced errors	
Commercial bank	USA	Automation Anywhere	Financial services	Operations	GAAR worksheet updates Appraisal orders Email notifications Other processes	Reduced effort	
A logistics company		Automation Anywhere	Logistics	Operations	Billing and other processes	25% reduction in turn-around-time 25% reduction in effort Error reduction	1.5
A top 30 bank	USA	Automation Anywhere	Financial services	Operations	Document ordering Data entry Data verification and other processes	Reduced errors $1m annual cost savings	
Core Digital Media	USA	Automation Anywhere	Tech	Operations	Extracting lead gen data from 50 different online publishers	$150k savings p.a.	

Company	Country	RPA	Industry	Business Function	Case Study	Results	Implementation in (months)
					in various formats		
Medical technology company	Global	Automation Anywhere	Tech	IT	Procure to pay IT system updates Data queries & analysis Other processes	50 FTEs reassigned to higher value tasks	
Stant	USA	Automation Anywhere	Manufacturing	Finance	Invoice matching Manual invoice creation Approval workflow Data validation Exception & metrics reporting General ledger coding	80% invoice straight through processing achieved	
One of Big 4	Global	Automation Anywhere	Professional services	Operations	Tax returns Business intelligence Reporting	$18m savings p.a.	
A life and financial services company	USA	Automation Anywhere	Insurance	HR Operations	HR record processing Physician statement orders	$200k savings p.a.	
A telco	Japan	Blue Prism	Telecom	Operations	Maintenance processes automated	78% reduction in effort IT audit quality improved thanks to detailed log files	3
Walgreens	Global	Blue Prism		HR	Various processes including worker's compensation claims	73% reduction in effort	
Coca Cola	Global	Blue Prism	FMCG	HR and Finance			
npower	UK	Blue Prism	Utility	Operations		$10M savings per year 2 million hours of work automated per year	

Company	Country	RPA	Industry	Business Function	Case Study	Results	Implementation in (months)
The Co-operative Banking Group	UK	Blue Prism	Financial Services	Operations	The excess queue procedure which determines how to treat insufficient funds is 80% automated	80% reduction in effort (AI Multiple, 2020)	
Shop Direct	UK	Blue Prism	e-Commerce	Operations	Customer-registration process for the new theft ID insurance program	Recruitment and training cost of 22 staff eliminated	
The Co-operative Banking Group	UK	Blue Prism	Financial Services	Operations	10 processes including Direct Debit cancellation, account closures, CHAPS payments, foreign payments, audit reports, Internet applications and Card and Pin Pulls	Audit conducted in one minute with automation versus 6-7 hours manually CHAPS process reduced to 20 seconds automatically versus 10 minutes manually	12
Xchanging	UK	Blue Prism	Professional Services	Operations	Various processes	30% average reduction in effort per process	
Telefonica O2	UK	Blue Prism	Telecom	Operations	15 processes representing 35% of back-office transactions	Reduced need for FTE growth, reduced turn-around time	
University Hospitals Birmingham NHS Trust	UK	Blue Prism	Healthcare	Customer Service	Patient self-check-in	50% reduction in effort 2x improvement in turnaround time Improved data quality	<3
University Hospitals Birmingham NHS Trust	UK	Blue Prism	Healthcare	Operations	Various processes including pharmacy stock control updates and patient record reconciliation		

Company	Country	RPA	Industry	Business Function	Case Study	Results	Implementation in (months)
Mid Essex Hospital Services NHS Trust	UK	Blue Prism	Healthcare	IT	Integration for an enhanced patient flow and self-service kiosk solution		2.5 (AI Multiple, 2020)
An automobile manufacturer	India	Option3 JiffyRPA	Manufacturing	Finance	Invoice processing automation	85% reduction in effort 10x improvement in turnaround time Reduction in errors	2
HP	Brazil	UiPath	Tech	Finance	Invoice tax accounting and reporting sub-processes automated	85% reduction in effort leading to $100k cost savings	12
EY	Global		Professional Services	Administrative	Crawling through meeting registrations and finding individuals that have not booked their air tickets	50% reduction in effort 20% reduction in air travel ticket prices	1.5
EY	Global		Professional Services	Various	Various processes	500 processes automated with 600 bots	
Fortune 500 tech company	Global		Tech	Finance	Quarterly financial report generation	70% reduction in effort and turnaround time Improved auditing capabilities thanks to detailed logs Reduced errors	
Max Healthcare	India	UiPath	Healthcare	Operations	Claims processing and data reconciliation	More than 50% of turnaround time is reduces	
U.S. Healthcare coverage administrator	US	Workfusion	Healthcare	Operation	Data extraction and data entry	Manual work is reduced by 85% Time stamp and other data extracted at a 99% accuracy rate, up from 62%	

Government Uses

Many agencies reported different stages of RPA implementation according to Nyczepir (2019-e). Figure 3 identifies the Federal offices which have invested and are implementing the AI R&D strategies including RPA. In the DoD, the Army Financial Management (FM) community adopted the use of RPAs early in fiscal year (FY) 2018.

Figure 3

Summary of Investments made by Federal Entities in the eight national AI R&D strategies (NSTC-a, 2019)

AI R&D Strategies	AFOSR	Army	Census	DARPA	DHS	DoD*	DOE	DOT	FBI	FDA	GSA	HHS	IARPA	NASA	NIFA	NIH	NIJ	NIST	NOAA	NSF	NTIA	ONR	VA
1. Make long-term investments in AI research	X	X		X	X	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	
2. Develop effective methods for human-AI collaboration	X	X		X	X	X	X	X		X			X		X	X	X	X	X	X		X	
3. Understand and address the ethical, legal, and societal implications of AI		X		X	X	X	X	X							X	X				X	X		
4. Ensure safety and security of AI systems		X		X		X	X			X			X	X				X	X	X			
5. Develop shared public datasets and environments for AI training and testing						X	X	X		X	X	X	X	X		X		X	X	X	X	X	X
6. Measure and evaluate AI technologies through benchmarks and standards				X	X	X	X			X			X			X	X	X	X			X	
7. Better understand the national AI R&D workforce needs			X			X	X						X		X		X	X	X	X			
8. Expand public-private partnerships in AI to accelerate advances in AI		X		X	X	X	X		X	X		X			X	X	X	X	X	X			

The Army FM community embraced these software solutions to achieve some of their strategic goals including system cost reduction, audit readiness, and decision-making through advance analytics (Gex &Minor, 2019). Current systems like the General Fund Enterprise Business System (GFEBS), which was waiting to be updated for a needed additional financial capability is instead being done by RPAs. Financial analysts would normally pull information from unliquidated obligations (ULO) for aging calculations. This mundane tedious task is done at a fraction of the cost by an RPA rather than modifying the GFEBS for a new ULO requirement. RPAs can also provide the data necessary for regular periodic audits which would normally be pulled by finance personnel. RPAs provide the needed multi-system reporting requirements until the Army's Enterprise Universe of Transactions (EUoT) is operational in FY 2021. The EUoT will interface and provide data from forty plus Army and DoD wide systems (Gex &Minor, 2019).

The General Service Administration (GSA) established a RPA community in April 2019 allowing for collaboration of best practices and sharing of new opportunities. During the Coronavirus pandemic, GSA has used bots to collect infection data from counties where U. S. federal buildings are located. This data helps with awareness and potential infectious risk for federal workers (Barnett, 2020). GSA's chief financial officer reported that the agency reduced more than 13,000 hours though the use of bots and estimated this number could grow to 50,000 hours annually (Asef-Sargent et al., 2020).

In May 2019, Defense Logistics Agency (DLA) permitted bots to work unattended twenty four hours a day. DLA estimated RPA will save its employees about 50,000 hours in its first year by taking over routine functions (Nyczepir, 2019-b). The DLA functions which were automated include G-invoicing, standardization of employee's names on spreadsheets during

onboarding, and time and date stamping when audit information is obtained. An article, "Put on Your Auditor Hat to Help Avoid Turbulence on the Intelligent Automation Journey", indicated the DLA expects to save an average of 200 hours over eight weeks per RPA and had deployed 75 bots by fiscal year 2019 to automate processes from finance to human resource management (Asef-Sargent et al., 2020).

During this same year - 2019, the Federal Emergency Management Agency (FEMA) rolled out a way to identify bots as a first step in RPA development. A Food and Drug Administration (FDA) agency, the Center for Drug Evaluation and Research (CDER) utilizes seven RPAs which verify drug intake forms as complete before forwarding to reviewers. CDER estimated the" new RPA projects in development will save 24,000 work hours annually, including those where bots schedule meetings and assign letters" (Nyczepir, 2019-c. p. 4).

Through RPA applications, the Centers for Medicare and Medicaid Services (CMS) automated incoming medical invoices, validated them and authorized Medicare Advantage payments. The process times increased by 98% with a 95% accuracy. Feedback to customers improved by 75%. Such were the improvements, that the CMS reported more than $1 million in savings (Asef-Sargent et al., 2020).

In the article, "Reducing workforce and budget constraints with RPA tools", more successes are documented by federal agencies. The article reported a podcast discussion centered on RPAs and their success stories. Examples included:

> The Internal Revenue Service (IRS) saved an estimated 15,000 full-time employee man-hours per year through use of RPAs. The Bureau of Labor Statistics (BLS) automated approximately 85% of the workload to convert text heavy records into codes for annual

work-related injury surveys, improving the accuracy of report analysis and shifting staff focus to higher-value work (FedScoop, 2020, p. 2).

The U.S. Customs and Border Protection (CBP)" saved the airline industry and travelers hundreds of hours and millions of dollars with bots that notified airlines of travel ban updates as the COVID-19 crisis unfolded" (FedScoop, 2020, p. 2). One benefit of RPAs is every component where an employee can touch a keyboard can be automated according to Snail Madhugiri, CTO for the U.S. Customs and Border Protection (CBP). CBP embraced RPAs in 2017 to reduce improper payments of hundreds of millions of dollars in entitlement programs such as Supplemental Nutrition Assistance Program (SNAP) or Social Security (FedScoop, 2020).

The COVID-19 pandemic caused Federal Emergency Management Agency (FEMA) workers to deal with country wide emergency declarations and to coordinate with multiple agencies. This all happened while FEMA's workers were on maximum telework. These circumstances urged FEMA to consider ways that RPAs could benefit its emergency management. FEMA is looking toward automating its validation of grant eligibility, the process for assigning funds during an emergency, and the accidental overpayment or wrongful payments to recipients. FEMA Chief Financial Officer, Mary Comans, indicated the field of emergency management needed to change and every dollar saved through modernization should go to the survivor that needs it (Barnett, 2020).

This sentiment of saved dollars being reinvested is seconded by Suzette Kent, Federal Chief Information Officer (CIO) in the article, "Saving from RPA should be reinvested in IT" (Nyczepir, 2019-d). She commented during a 2019 IT modernization summit that the money saved as a result of RPA implementations should be reinvested in other IT projects. According

to the Modernizing Government Technology Act of 2017, any money saved should flow into a working capital fund, but no structure exists to capture and track these funds (Nyczepir, 2019-d). The article further stated that only six agencies had created working capital funds to take advantage of the savings from IT modernization projects. These included the Department of Education, General Services Administration, Department of Labor, the Small Business Administration, Social Security Administration and the Treasury Department (Nyczepir, 2019-d).

The U.S. Department of Homeland Security (DHS) has seventeen security operations centers (SOCs) and the U.S. Citizenship and Immigration Service's (USCIS). SOC has become a model for DHS. USCIS uses an RPA to detect and respond to a security incident eliminating the first tier of analysts who stared at the screen and generated tickets. This automation allows USCIS to process over five terabytes of data a day, flag an issue as network-based or security-based and forward to the correct department for handling (Nyczepir, 2019-a). Since "80% to 90% of USCIS systems are on the cloud, the agency has become a development shop with nearly 4000 developers – about 100 in the SOC alone" (Nyczepir, 2019-a, p.4).

A small DoD branch, Washington Headquarter Services (WHS) reduced a backlog of more than 12,000 unmatched disbursements through the use of an RPA. Within seven months, the unmatched disbursements was reduced to 4000. In addition, the processing time shrank and was 77% faster and errors lessened to achieve a 95% success rate (Constans, 2019).

The Department of Veteran's Affairs (VA) is researching which RPAs can help with the digitizing of paper medical records into a veteran's existing electronic health record (EHR). "The VA inspector general reported last year that the department's backlog of health records awaiting digitization measured approximately 5.15 miles high and contained at least 597,000

individual electronic document files dating back to October 2016" (Mitchell, 2020, pp. 3-4). The VA has asked vendors to put forth their solutions for consideration in streamlining their documentation.

National Aeronautics and Space Administration (NASA) utilizes a bot to help process grants. The bot will scan images of grant applications to create a grant package. The RPA converts the image to a pdf format, creates a case folder, and stores pdf in the folder. It then assigns the case to a contracting officer in the grants department (Miller, 2018). This RPA eliminates the tedious steps to grant assessment and allows analysts to concentrate on evaluating the grants. NASA has acquired "another four bots and 15 are ready to go through development and more than 100 ideas have submitted for more potential use cases" (Mancher, 2019, p. 2). The four new bots support procurement requests, invoicing, distributing funds and human resources suitability reviews (Asef-Sargent et al., 2020)

Chapter 3 – Research Methodology

Methodological Approach

A qualitative research methodology was selected to conduct a literature review. This systematic, subjective approach was utilized to gain understanding into the following questions:

1. What is Robotic Process Automation (RPA)?
2. In what business areas are these basic artificial intelligences being applied?
3. What current efficiencies are being gained by automating mundane simple processes/tasks and redirecting employees' efforts to more challenging work?
4. How can current private industry Robotic Process Automation (RPA) successful practices be integrated into the federal agencies RPAs acquisition process?

Data Collection

A literature review gathered all the relevant research published on the topic of robotic process automation (RPA). Research author, John Creswell, cited the identification of key terms as the first step in conducting a literature research (Creswell, 2015). For this data collection, the use of key search terms such as defense acquisition, federal agencies and robotic process automation helped to find the relevant articles for this research paper. The second step in conducting this review was to locate the literature. An extensive search for articles was conducted through several bibliographical database services including ProQuest, EBSCOhost and Google Scholar (scholar.google.com) and through academic libraries including University of Alabama Huntsville (UAH), Webster University (WU) and Defense Acquisition University (DAU). Consultation with research librarians helped narrow down research categories. The use of filters for peer reviewed articles, English language only, and published from years 2015 to

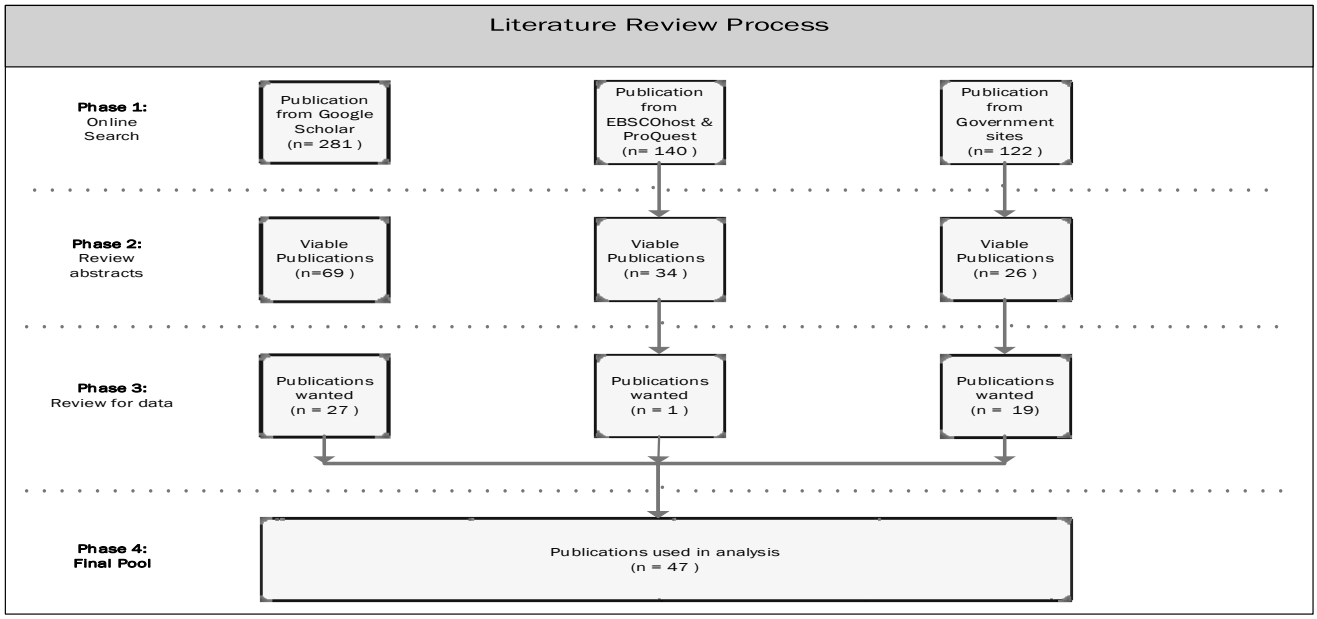
2020 reduced search results to a lesser degree. A manual search of the journals which had the highest count of being cited as a resource helped narrow down the articles. Government information reviewed through USA.gov, OPM, GAO, and DTIC produced several policies and valuable government data. Review of articles citations and references provided an additional source of resources to investigate. At this stage, articles were critically evaluated for selection. This is the third step in conducting a literature review (Creswell, 2015). The articles were then assessed for credibility and relevancy to the topic. Figure 4 outlines the four phases of literature review process resulting in the final pool of articles used in the analysis (Weber, 2020). Once synthesized, the literature was organized, which is the fourth step in conducting a literature review (Creswell, 2015). Articles were categorized according to which of the four research questions were answered with the data. Creswell's 2015 research book, *Educational Research: Planning, conducting and evaluating quantitative and qualitative research (5th Edition)*, was used as a reference for qualitative research.

Validity of the Research

To ensure validity in the data, searches were conducted primarily on university search engines or scholarly search engines. Peer reviewed, primary source articles were considered if actual statistical or metric data was offered. When possible triangulation, the process of corroborating evidence from different data types or methods, was utilized to enhance the accuracy of data. (Creswell, J., 2015). Secondary literature sources like journal articles, which commented on research data, were used to supplement concepts and bring forth new trends in robotic process automation.

Figure 4

Literature Review



Limitations of the Study

The research, analysis, and writing of this paper were limited in timeframe due to the Senior Service College Fellowship program being an academically rigorous intensive 10-month course. The program schedule is fully loaded and an in-depth literature review would have required more time for analysis. The research was further limited in scope by not being able to survey or interview potential candidates. This resulted in possible loss of insight to current uses of robotic process automation and other low level artificial intelligence in Department of Defense services and agencies. An attempt was made to request data when possible from departments who utilize robotic process automation. The research was to a degree limited because robotic process automation is a fairly new technology and has only been adopted by the

military with the past few years. New applications for RPAs are still being developed by private industry and modified for government use.

Chapter 4 – Findings

Summary of Findings

As confirmed by the literature review, Robotic Process Automations are most beneficial to use with high repetition, high volume, low order activities and/or multi-stepped processes. The RPA implementation can be done in-house or outsourced depending on the in-house RPA resources. RPAs do come with challenges as documented in this paper. The difficulties identified include organizational, process, implementation, technical, and post-implementation pitfalls. However, if these can be overcome then, the benefits to the organization can be tremendous.

A simple analysis of the forty five private industry companies mentioned in the literature review reveals that companies are concentrating RPAs in certain business areas. These are listed in decreasing number of business area uses: operations-24 RPAs, finance-11 RPAs, human resources-5 RPAs, information technology-3 RPAs, technology-2 RPAs, various-2 RPAs, administrative-1 RPA, and customer service-1 RPA. The benefits seen by these companies included reduction in effort and errors, improvement in turnaround time, improvement in quality, dollars saved, and number of employees shifted to high value.

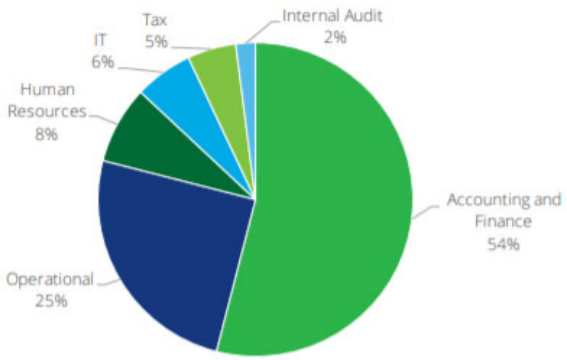
A simple analysis of the thirteen government entities mentioned in the literature review indicates that the federal government RPAs concentrated on three operations, three finance, two administrative, one human resources and three unreported business areas. The benefits reported by the government included dollar cost savings, percentage work text conversion (transferring text from word or pdf to another format), percentage process time efficiency increase, percentage accuracy, hour reduction, and workload reduction. These are all great results. However, the

government did not concentrate enough on the business area of human resource processes for RPA application since it is one of the top three for private industries studied.

A Deloitte 2017 RPA survey confirms the findings of this report that accounting and finance, operational, and human resources are the top three business process areas for private industry (see Figure 5) (Deloitte, 2018). But, the government reported cases fall short of the human resources RPA usage. This might be attributed to the literature reviewed not reporting or identifying a business areas for three federal entities.

Figure 5

Deloitte RPA usage per business process areas (Deloitte, 2018)



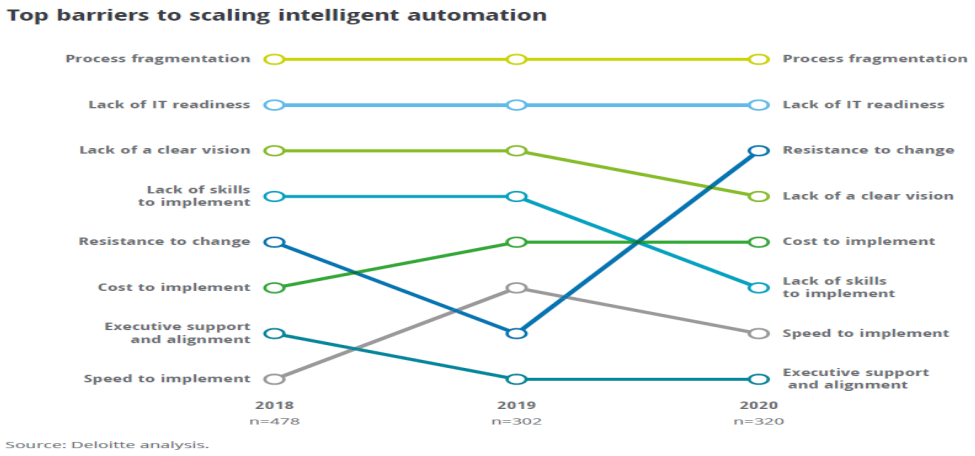
RPA results most often measure performance results in certain organizational business areas, but there are tangible employee benefits as well. RPA usage is very important as it relieves employees from the tedious redundant work and allows concentration on more cerebral work. This shift in work focus can lead to higher job satisfaction and employee retention. According to Chris Huff, chief Strategy Officer at Kofax, a Forbes study on 302 senior executives found "92% of organizations see an improvement in employee satisfaction as a result of Intelligent Automation and Robotic Process initiatives" (Huff, 2019). Leveraging robotic

process automation to handle rote tasks benefits the workforce culture and is the first step in the process of moving to a more complex artificial intelligence and greater efficiencies.

Federal agencies are investing in AI Research and Development (R&D) strategies and other initiatives to work smarter not harder as evidenced in Figure 3 - Summary of Investments made by Federal Entities in the eight national AI R&D strategies (NSTC-a, 2019). However, there are still uninformed and resistant federal entities that have delayed and not planned for any RPAs. These barriers to robotic process automation change exist and are confirmed by a Deloitte analysis of 441 executives from 29 countries and a wide range of industries (Deloitte, 2020). Process fragmentation, lack of IT readiness, and resistance to change are the top three barriers.

Figure 6

Top Barriers to scaling intelligent automation (Deloitte, 2020)



At the other end of the spectrum are those federal operations that have already implemented RPA but might unnecessarily be duplicating efforts. Michael Wooten, federal chief procurement officer for the Office of Management and Budget's (OMB's) Information Technology Vendor Management Office (ITVMO), finds himself in the position of having to

monitor RPA procurement to prevent multiple buys of different RPAs for the same function by different agencies. “Wooten wants different agencies using RPA for different repeatable processes and then sharing those tools with others that need them” (Nyczepir, 2020, p. 4).

To make the RPA implementation process easier to understand, GSA has produced a Robotic Process Automation Guide together with the Federal RPA Community of Practice. This RPA program playbook provides an instructional manual on how to implement the RPA process and introduces a RPA maturity model to assess growth of RPAs once implemented. This playbook serves as a good how to guide in determining the process needed to start an RPA journey (Federal RPA CoP, 2020-a). An assessment of 23 government RPA programs was conducted by the Federal RPA CoP. This State of Federal RPA report showed the number of RPAs increased in fiscal year 2019 from 219 to 460 in fiscal year 2020. This was a 110% increase in RPA deployment. The number of hours saved increased from 285,651 hours in 2019 to 848,336 in 2020. This was a 196 % increase in annualized hours saved by RPA use (Federal RPA CoP, 2020-b). These numbers show the future potential of RPA application and the possible benefits.

Chapter 5 – Recommendations

In 2018, the Office of Management and Budget (OMB) memorandum 18-23 specifically directed the Department of Defense (DoD) and other Chief Financial Officers (CFO) Act Agencies to "introduce new technology, such as robotic process automation (RPA), to reduce repetitive administrative tasks, and other process-reform initiatives" (OMB, 2018, p. 2). The following recommendations are made in order to comply with OMB Memo 18-23 and to leverage the RPA private industry data for federal use.

Recommendation #1: Utilize Federal RPA CoP as a Resource

Government agencies have always been burdened by the bureaucracy of documenting processes or processing forms in ways to provide good stewardship of taxpayer's money. Robotic process automation can help in automating hard copies of data. An estimate by Deloitte Center for Government Insights show 235 million pages of records will be automated with a goal of 500 million pages by fiscal year 2024 (Rice, 2020).

A recommendation is made that the DoD and other federal agencies contact the Federal RPA CoP during RPA planning before acquisition or design. This group has experience in RPA implementation and the different stages of RPA maturity. The 2020 Federal RPA Community of Practice guide book would be a good first step in RPA consideration (Federal RPA CoP, 2020-a).

Recommendation #2: Establish an Office for RPA Transformation

A recommendation is made that an Office for Robotics Process Automation Transformation Initiative (ORPATI) within DoD be established to ensure that duplication of efforts between agencies does not occur. The office would be the government's Center of Excellence for RPA ensuring RPA is optimally applied across the government. The ORPATI

will establish and manage the RPA Product Lines or a line of application for common processes for government use.

Recommendation #3: RPA should be at the forefront of operational and acquisition strategies

The use of Robotic Process Automation is not being utilized to its fullest potential by the Department of Defense. Deloitte Center for Government Insights estimates that federal employees spend 4.3 billion hours a day on multiple tasks and RPAs could free up 1.3 billion of these hours (Rice, 2020). That's a 30% reduction in work hours.

In the light of the current economy and the onset of information technology advancements, the use of Robotic Automation Processes should be the forefront of operational and acquisition strategies. The Department of Defense must use the latest RPA technology to meet the President' Management Agenda intent or goal of shifting time, effort and resources to high-value efforts from low-value rote tasks (PMA, 2018).

Recommendation #4: Develop an RPA information campaign

Given that resistance to change is the top third barrier to scaling intelligent automation, it is recommended that an informational RPA campaign be rolled out throughout the DoD. Awareness of the benefits of RPA technology has to permeate to the lowest levels. Since 80% of RPA usage has been found in the accounting and finance, and operational business capabilities, these areas should be targeted first to get the maximum effectiveness possible.

References

AI Multiple. (2020). 45 RPA case studies: Explore RPA in your industry & function. Retrieved from https://research.aimultiple.com/rpa-case-studies/

AI Multiple. (2021-a). 21 Pitfalls/Challenges &A checklist to tackle them in 2021. Retrieved from https://research.aimultiple.com/rpa-pitfalls/

AI Multiple. (2021-b). Top 67 RPA usecases/applications/examples [2021]. Retrieved from https://research.aimultiple.com/robotic-process-automation-use-cases/

Asef-Sargent, J., Lewis, A. C., Everson, K. E., & Steinhoff, J. C. (2020). Put on your auditor hat to help avoid turbulence on the intelligent automation journey! The Journal of Government Financial Management, 68(4), 19-25. Retrieved from https://search.proquest.com/docview/2376135554?accountid=40390

Barnett, J. (2020). With a pandemic and hurricane season crushing FEMA, the agency could use some bots. Retrieved from https://www.fedscoop.com/fema-rpa-bots-financial-management-coronavirus/

Bartel. (2020). GSA Community of Practice webinar: Maximizing the value of RPA with process improvement [Power Point slides]. Retrieved from brandon.bartel@gsa.gov, personal communication, December 16, 2020.

Bhatt, M. (2020). Top 17 challenges of RPA implementation. Retrieved from https://nuummite.consulting/top-17-challenges-of-rpa-implementation/

Bott, A. & Wright, T. (2017). Legal Issues in Robotic Process Automation. Retrieved from https://www.jdsupra.com/legalnews/legal-issues-in-robotic-process-69765/

Chazey Partners. (n. d.). Top ten things you need to know about RPA. Retrieved from https://chazeypartners.com/articles/top-ten-things-need-know-rpa/

Constans, I. (2019). Shared framework underlies successful RPA project. Retrieved from https://www.govloop.com/shared-framework-underlies-successful-rpa-projects/

Creswell, J. (2015). *Educational Research: Planning, conducting and evaluating quantitative and qualitative research (5th Edition).* Pearson Education, Inc., Boston, MA.

CyberArk.com. (n. d.).Robotic Process Automation (RPA). Retrieved from https://www.cyberark.com/what-is/robotic-process-automation/

Dechamma, P. R., & Shobha, N. S. A Review on Robotic Process Automation. Retrieved from https://www.ijresm.com/Vol.3_2020/Vol3_Iss5_May20/IJRESM_V3_I5_60.pdf

Defense Business Board (DBB). (2018). Implications of Technology on the future Workforce. Retrieved from https://dbb.defense.gov/Portals/35/Documents/Reports/2017/DBB%20FY17-04%20Implications%20of%20Technology%20on%20the%20Future%20Workforce%20-%20Final%20(Jun%202018).pdf

Deloitte. (2018). Internal Controls over financial reporting considerations for developing and Implementing bots. Retrieved from https://www2.deloitte.com/content/dam/Deloitte/us/Documents/audit/ASC/us-aers-robotic-process-automation-internal-controls-over-financial-reporting-considerations-for-developing-and-implementing-bots-september2018.pdf

Deloitte. (2020). Automation with intelligence; Pursuing organization-wide reimagination. Retrieved from https://www2.deloitte.com/us/en/pages/operations/articles/global-robotic-process-automation-report.html

Department of Defense (DoD). (2018). Summary of the 2018 National Defense Strategy. Retrieved from https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf

Department of Defense (DoD). (2019). Summary of the 2018 Department of Defense Artificial Intelligence Strategy. Retrieved from https://media.defense.gov/2019/Feb/12/2002088963/-1/-1/1/SUMMARY-OF-DOD-AI-STRATEGY.PDF

Federal Register. (2019). Executive Order 13859 of February 1, 2019: Maintaining American leadership in artificial intelligence. Retrieved from https://www.federalregister.gov /documents/2019/02/14/2019-02544/maintaining-American-leadership-in-artificial-intelligence

Federal Robotic Process Automation Community of Practice (Federal RPA CoP). (2020-a). RPA Program Playbook. Retrieved from https://digital.gov/pdf/rpa-playbook-v1.1.pdf

Federal Robotic Process Automation Community of Practice (Federal RPA CoP). (2020-b). The state of federal RPA. Retrieved from https://digital.gov/guides/rpa/state-of-federal-rpa/

FedScoop Radio. 2020. Reducing workforce and budget constraints with RPA tools. Retrieved From https://www.fedscoop.com/radio/reducing-workforce-and-budget-constraints-with-rpa-tools/

Gex, C., & Minor, M. (2019). Make your Robotic Process Automation (RPA) implementation successful. *The Journal of the American Society of Military Comptrollers*. 64(1) 19-22. Retrieved from https://cdn.flipsnack.com/widget/v2/widget.html?hash=fc3eoiflu&bgcolor=EEEEEE

Golden, R. (2020). MIT: Hiring algorithm design could impact candidate diversity, quality Retrieved from https://www.hrdrive.com/new/mit-hiring-algorithm-design-could-impact-candidate-diversity-quality/587748

Guru 99. (n. d.). RPA tutorial: What a robotic process automation? Application. Retrieved from https://www.guru99.com/robotic-process-automation-tutorial.html

Huff, C. (2019). Worker Satisfaction improves intelligent automation and RPA. Retrieved from https://www.hrtechnologist.com/articles/digital-transformation/worker-satisfaction-improves-with-intelligent-automation-and-rpa/

Innovation Committee -Chief Information Officers Council (IC-CIOC). (2020). Robotic process automation in federal agencies. Retrieved from https://www.cio.gov/assets/resources/robotics-process-automation-whitepaper.pdf

JOLT Experts. (2019). Eight common business processes you can automate with RPA. Retrieved from https://www.joltag.com/blog/8-common-business-processes-you-can-automate-with-rpa

Lanshore. (n.d.). RPA in HR – Automation raises ethical questions for HR leaders. Retrieved from https://lanshore.com/knowledge_articles/rpa-in-hr-automation-raises-ethical-questions-for-hr-leaders/

Mancher, M. (2019). The three waves of accelerating RPA in government. Retrieved from https://www.nextgov.com/ideas/2019/08/3-waves-accelerating-rpa-government/159495/

Miller, J. (Host). (2018, May 23). Ask the CIO: 4 bots relieved NASA employees form doing "low-value work. (no episode number)[Audio podcast episode]. In *Ask the CIO- A Federal News Network Podcast*. Retrieved from https://www.podcastone.com/episode/4-bots-relieve-NASA-employees-from-doing-low-value-work

Mitchell, B. (2020). VA looks to RPA to speed up digitization of its health records. Retrieved from https://www.fedscoop.com/va-speed-up-digitization-health-records-rpa/

National Intelligence (NI). (2019). National Intelligence Strategy of the United States 2019. Retrieved from https://www.dni.gov/files/ODNI/documents/National_Intelligence_Strategy_2019.pdf

National Science & Technology Council (NSTC-a). (2019). 2016-2019 Progress Report:

Advancing Artificial Intelligence R&D Retrieved from https://www.whitehouse.gov/wp-content/uploads/2019/11/AI-Research-and-Development-Progress-Report-2016-2019.pdf

National Science & Technology Council (NSTC-b). The national artificial intelligence research and development strategic plan: 2019 update. Retrieved from https://www.hsdl.org/?view&did=831483

Nuummite.Consulting. (2020). Top 17 challenges of RPA implementation. Retrieved from https://nuummite.consulting/top-17-challenges-of-rpa-implementation/

Nyczepir, D. (2019-a). Citizenship and immigration services ramps up SOC automation. Retrieved from https://www.fedscoop.com/uscis-soc-automation-coe/

Nyczepir, D. (2019-b). Defense agency surmounts “big” security challenge for robotic process automation. Retrieved from https://www.fedscoop.com/defense-logistics-agency-security-rpa/

Nyczepir, D. (2019-c). RPA is helping with FDA’s drug evaluation and research. Retrieved from https://www.fedscoop.com/rpa-drug-cder-pharma/

Nyczepir, D. (2019-d). Saving from RPA should be reinvested in IT, says Federal CIO. Retrieved from https://www.fedscoop.com/rpa-savings-federal-agencies-reinvest-suzette-kent/

Nyczepir, D. (2019-e). Tech 2019 in review: Agencies embrace RPA – AI less so. Retrieved from https://www.fedscoop.com/2019-review-artificial-intelligence-robotic-process-automation/

Nyczepir, D. (2020). OMB’s IT Vendor Management Office will help agencies buy AI. Retrieved from https://www.fedscoop.com/it-vendor-management-office-ai/

Office of Management & Budget (OMB). (2018). Office Management &Budget Memorandum

M-18-23: Shifting from low-value to high-value work. Retrieved from https://www.whitehouse.gov/wp-content/uploads/ 2018/08/M-18-23.pdf

Office of Science & Technology Policy (OSTP). (2019). Accelerating America's Leadership in Artificial Intelligence. Retrieved from https://www.whitehouse.gov/articles/accelerating-americas-leadership-in-artificial-intelligence/

Performance.Gov. (2020). PMA CAP Goal Action Plan: Shifting from low value to high value work. Retrieved from https://trumpadministration.archives.performance.gov/CAP/action_plans/july_2020_Low-Value_to_High-Value_Work_UpdatedVersion.pdf

President's Management Agenda (PMA). (2018). President's Management Agenda: Modernizing the government for the 21st century. Retrieved from https://www.whitehouse.gov/wp content/uploads/2018 /04/ ThePresidentsManagementAgenda.pdf

Russell, A., (2019). Operationalizing AI for the USMC. Retrieved from https://www.dtic

Vincenzes, P. (2019). Leveraging robotics process automation (RPA) to making government agencies happier. Retrieved from https://www.govloop.com/community/blog/leveraging-robotic process-automation-rpa-to-making-government-agencies-happier/

Weber, R. (2020). Research Practices for Information Collection and Consolidation: Session two putting information together [PowerPoint slides]. Retrieved from https://uah.instructure.com/courses/50513/files/4077461?module_item_id=888010

Welsh, J. (2019). What the history of RPA technology says about its future. Retrieved from https://globalpayrollassociation.com/blogs/technology/what-the-history-of-rpa-technology-says-about-its-future

Willocks, L., Lacity, M., & Craig, M. (2015). Paper 15/05: The it function and robotic process

Automation. Retrieved from http://eprints.lse.ac.uk/64519/1/OUWRPS_15_05_published.pdf

Glossary of Acronyms and Abbreviations

AI – Artificial Intelligence

AIM – Artificial Intelligence Multiple

ATO – Authority to Operate

BLS – Bureau of Labor Statistics

CAP – Cross-Agency Priority

CBP – U. S. Customs and Border Protection

CDER – Center for Drug Evaluation and Research

CFO – Chief Financial Officer

CIO – Chief Information Officer

CMS – Centers for Medicare and Medicaid Services

CoP – Community of Practice

COVID 19 – Coronavirus Disease 2019

CRM – Customer relationship management

CTO – Chief Technical Officer

DAU - Defense Acquisition University

DBB – Defense Business Board

DCMA – Defense Contract Management Agency

DHS – U. S. Department of Homeland Security

DLA – Defense Logistics Agency

DoD – Department of Defense

DoL – Department of Labor

DTIC – Defense Technical Information Center

ERP – Enterprise Resource Planning

EUoT – Enterprise Universe of Transactions

FEMA – Federal Emergency Management Agency

FDA – Food and Drug Administration

FM – Financial Management

FTE – Full time employee

GAO- U.S. Government Accountability Office

GFEBS – General Fund Enterprise Business System

G-invoicing – Government invoicing

GSA – General Service Administration

HR – Human Resources

IC – Intelligence Community

IC- CIOC - Innovation Committee -Chief Information Officers Council

IRS – Internal Revenue Service

IT – Information Technology

ITVMO – Information Technology Vendor Management Office

MIT – Massachusetts Institute of Technology

NASA – National Aeronautics and Space Administration

NI – National Intelligence

NSTC – National Science & Technology Council

OMB – Office of Management and Budget

OPM – U. S. Office of Personnel & Management

ORPATI – Office for Robotic Process Automation Transformation Initiative

OSTP – Office of Science and Technology Policy

PMA - Presidents Management Agenda

PO – Purchase Order

R & D – Research and Technology

RPA – Robotic Process Automation

SAP – Systems Applications & Products

SES – Senior Executive Service

SNAP – Supplemental Nutrition Assistance Program

SoC – Security Operations Center

SSCF – Senior Service College Fellowship

UAH – University of Alabama Huntsville

UAT – User Acceptance Test

ULO – Unliquidated Obligations

USCIS – U. S. Citizenship and Immigration Service

VA – U. S. Department of Veteran's Affairs

WHS – Washington Headquarter Services

WU – Webster University

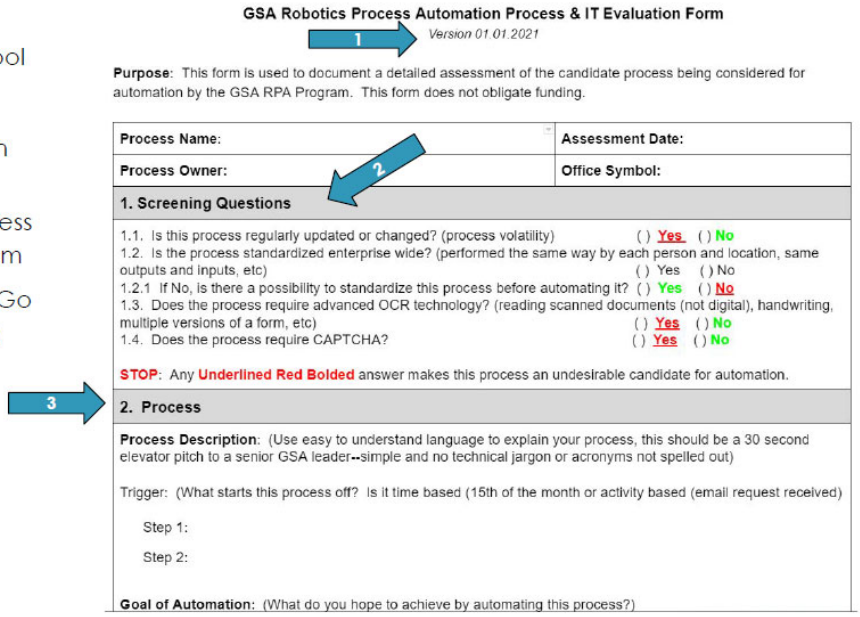
APPENDIX A

RPA Assessment Form

GSA RPA Process & IT Evaluation Form

Purpose:

- Candidate Screening Tool
- Project Scoping
- Initial Benefit Calculation *(Annual Hours Saved)*
- Contract between Process Owner and the RPA Team
- Facilitates initial Go/No Go decision for Automation



GSA Robotics Process Automation Process & IT Evaluation Form

Version 01.01.2021

Purpose: This form is used to document a detailed assessment of the candidate process being considered for automation by the GSA RPA Program. This form does not obligate funding.

Process Name:	**Assessment Date:**
Process Owner:	**Office Symbol:**

1. Screening Questions

1.1. Is this process regularly updated or changed? (process volatility) ( ) Yes ( ) No
1.2. Is the process standardized enterprise wide? (performed the same way by each person and location, same outputs and inputs, etc) ( ) Yes ( ) No
1.2.1 If No, is there a possibility to standardize this process before automating it? ( ) Yes ( ) No
1.3. Does the process require advanced OCR technology? (reading scanned documents (not digital), handwriting, multiple versions of a form, etc) ( ) Yes ( ) No
1.4. Does the process require CAPTCHA? ( ) Yes ( ) No

STOP: Any **Underlined Red Bolded** answer makes this process an undesirable candidate for automation.

2. Process

Process Description: (Use easy to understand language to explain your process, this should be a 30 second elevator pitch to a senior GSA leader--simple and no technical jargon or acronyms not spelled out)

Trigger: (What starts this process off? Is it time based (15th of the month or activity based (email request received)

Step 1:

Step 2:

Goal of Automation: (What do you hope to achieve by automating this process?)

(Bartel, 2020, p. 21)