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Embedding Robotic Process Automation into Process Management: Case Study of using *taskt*

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Abstract. XYZ Company routinely faced penalties imposed by the United States Internal Revenue Service (IRS) for non-compliance in depositing federal withholding taxes related to the managed benefits plans for its clients. Since the rules for depositing the federal taxes were complex and differed between the benefits plans, it was common for XYZ Company to accrue penalties imposed by the IRS. Desiring to eliminate penalties by complying 100% with the IRS guidelines, XYZ Company considered various solutions. Finally, XYZ Company implemented a Robotic Process Automation (RPA) solution using the open source tool—*taskt*—to achieve 100% compliance in depositing federal withholding taxes and eliminate penalties. Discussion of solution improvements, reflection and next steps, technical challenges, lessons learned, and design science retrospective is provided.

Keywords: Robotic Process, Automation, Case Study.

1 Introduction

Robotic Process Automation (RPA) has gained considerable momentum within organizational practice in recent times. Organizations competing in multiple industries have experimented with or implemented RPA solutions to address time-consuming, repetitive, and error-prone manual processes in order to increase productivity, minimize costs, and enhance customer service [1]. Many commercial vendors and open-source communities provide RPA tools such as Blue Prism, Automation Anywhere, UiPath, TagUI, and RPA Express [2].

RPA is capable of handling both external activities (e.g., customer-facing, supplier-facing) and internal activities (e.g., back-office functions, cross-functional communications, intra-departmental tasks) within organizations [3]. Since business processes are structured sets of work activity that are unique to organizations and the systems used to enable such processes are custom-designed or customized for contexts, there is considerable variability in business processes across organizations. Consequently, RPA implementations for similar business processes are also idiosyncratic to the processes, systems, and organizations. Despite the abundance of practice reports on RPA implementations available in the public domain, the details of RPA implementations

are rarely made available for public consumption due to potential violations in intellectual property rights and competitive advantage.

This paper describes a case study of an RPA solution developed for an organization that administers employee benefit plans in the United States. The case study is the result of a year-long engagement with the organization to identify and develop an RPA solution to: a) address challenges and delays in depositing federal withholding taxes accurately and on time, and b) eliminate penalties for non-compliance that are otherwise accrued.

2 Robotic Process Automation

RPA is a software solution that uses “bots”—i.e., software configured to handle specific work previously done by humans—to automate business processes [4]. It strives to mimic how humans may complete activities in digital processes using the same systems and user interfaces [5]. Bots are able to extract data from multiple sources, process such data using well-defined rules, and generate desired output that may be directed to other systems. By performing routine, rules-based service processes that lead to deterministic outcomes [6], bots can complement human employees such that human-robot teams may eventually yield significant benefits such as reductions in human error and staffing costs [7].

RPA solutions offer considerable advantages since they are essentially middleware systems that are configured or developed without altering the existing enterprise platforms and applications within the implementing organization. RPA aims to use software to manipulate data in existing enterprise applications such as enterprise resource planning (ERP) systems or Customer Relationship Management (CRM) systems as human employees may typically do and implement partially- or fully- automated systems to handle routine and time-consuming tasks [8]. Partial automation (also known as attended automation) requires a human to interact with the bots to complete the tasks whereas full automation (also known as unattended automation) may not require human intervention since the bots automatically trigger the necessary actions to mimic human behavior relating to the tasks.

Since the basic premise of RPA is to supplement human interventions with bots, it can be applied to any domain within organizations. Porter’s value chain [9]—which categorizes organizational activities into primary activities (i.e., inbound logistics, operations, outbound logistics, marketing and sales, and service) and secondary activities (i.e., procurement, human resource management, technological development, and infrastructure)—provides a useful lens by which to assess the extent to which RPA solutions can be adopted and implemented for organizational operations. Based on an illustrative set of RPA exemplars reported by practice (the details of which are available in Appendix A), Figure 1 shows the many ways in which RPA solutions can be gainfully adopted by organizations.

Organizations may reap several benefits as a result of RPA solutions including reductions in processing times, increases in productivity, improvement in compliance levels, improvements in data accuracy, and reductions in cost [1]. An analysis of prior

academic and practice literature demonstrates the potential and realized benefits of RPA within organizations, as shown in Table 1.

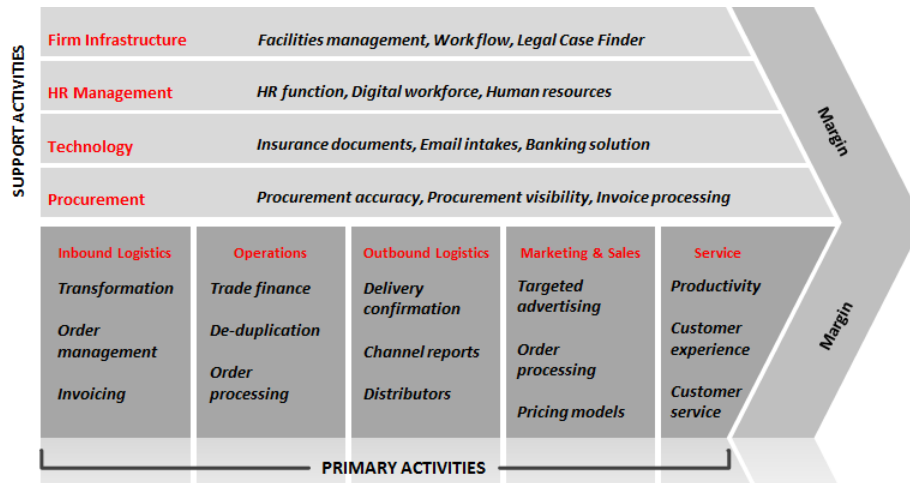


Fig. 1. Porter's Value Chain and Illustrative RPA Implementations

Table 1. Benefits of RPA

Study	Reduction in processing times	Increases in productivity	Improvement in compliance levels	Improvements in data accuracy	Reduction in cost
[4]	x			x	x
[10]		x		x	x
[8]		x			
[11]		x			x
[12]	x		x	x	x
[13]		x	x		x
[14]		x		x	
[15]					x
[16]	x	x		x	
[17]	x	x	x	x	
[18]	x				

As RPA matures and standards evolve, it holds much promise for organizations that strive automate tedious, time-consuming, and error-prone tasks. Currently, RPA platforms have evolved such that business users without much technical expertise can create RPA bots [19] without any code for rapid cross-platform deployment [20]. There is a general consensus that RPA robots are here to stay and are powerful as they

never sleep or make mistakes [21], enable organizations to streamline processes and improve customer service while reducing costs [22], and provide strategic value for business automation [23].

3 Case Study

XYZ Company—a pseudonym to protect the organization's anonymity—administers multi-employer Taft-Hartley benefits plans for employees in both union and non-union groups. One of its fiduciary responsibilities is to deposit federal income tax withholding for each fund accurately and in a timely manner.

The guidelines for depositing the tax monies are complex and governed by Publication 15 of the Internal Revenue Service (IRS) and may be updated every tax year. Depositors are considered either a monthly depositor or a semi-weekly depositor for a calendar year based on an annual determination of the aggregate amount of taxes reported on the original return filings during the employer's "lookback period." The lookback period for each calendar year is the twelve-month period ending the preceding June 30. Under the monthly rule, each month's taxes are required to be deposited on or before the 15th day of the following month. If the 15th of the following month falls on a Saturday, Sunday, or a legal holiday, the employer will have until the next business day to make a timely deposit. If an employer reported employment taxes of more than \$50,000 during the lookback period, the employer is a semi-weekly depositor and must deposit using the semi-weekly rule. Under this rule, the day a deposit is due is determined by the day of the payroll: a) The deposit for a pay day of Wednesday, Thursday, and/or Friday must be made on or before the following Wednesday, b) The deposit for a pay day of Saturday, Sunday, Monday, and/or Tuesday must be made on or before the following Friday, and c) The semi-weekly rule doesn't require an employer to make deposits twice a week (semi-weekly); rather, the deposits are due based on a schedule which divides the calendar week into two (semi-weekly) sections. Further, if the tax reaches \$100,000 or more within a deposit period, it must be deposited in time to settle on the next business day for either the monthly or semi-weekly depositor.

The IRS hands out severe failure-to-deposit (FTD) penalties for tax amounts that were not deposited properly or on time. The penalties are assessed based on the number of calendar days a deposit is late starting from the due date of the deposit. These rates are: a) 2% for deposits 1 to 5 days late, b) 5% for deposits 6 to 15 late, c) 10% for deposits more than 15 days late, and d) 15% for all other amounts.

During the period 2016-17, XYZ Company was slapped with approximately \$118,000 in penalties—actual numbers and not fictionalized—across all its client funds by the IRS. While deposit rules are defined, the process was purely manual and the responsibility of a single person in the accounting function. The manual process led to errors in the lookback period, deadlines for deposits, and deposit amounts. The specific individual during the year changed twice because of turnover, which further exacerbated the situation.

In May 2018, XYZ Company initiated project internally called the “100% Compliance Project” to ensure that penalties from IRS will never accrue again. The compliance project eventually incorporated Robotic Process Automation to achieve 100% compliance and eliminate IRS penalties.

For XYZ Company, the compliance project began with the installation of a 3-person project team to develop an understanding of the process maps, rules, reconciliation steps, interface mechanisms with the IRS, and potential solutions. There existed no process understanding of the sequence of steps to make a payment, record it for reporting and auditing purposes, exception reporting, and incorporating it into operational metrics which XYZ reports to its clients. While any losses are absorbed by XYZ, reports of these losses can easily influence client migration to competitors. As discussions started about how these payments are executed; the term “IRS payment process” was never considered to be a “process;” it was simply one individual’s responsibility.

The 3-person team did not have any process maps to rely on. The sole individual who had the responsibility of making deposits had left the company and poor internal records did not help in understanding how payments had been completed. The first task for the team was to review each detail of IRS PUB 15 and each individual rule and develop a common understanding of each rule in detail. Next, a matrix was prepared to match each set of rules with the 35 funds for which deposits are made to the IRS. This matrix was based on the lookback period for each fund. Each fund history was then examined to determine if it was likely to exceed the \$100,000 rule and put them in a separate category.

In a second pass at the rules, the team validated with the internal information technology (IT) group when the payment was triggered; what rules were applicable to each group of payments; payment due dates; recording; reconciliation against each fund; and reporting the timeliness of payments as an operational metric advertised to funds. Key observations of the process are noted below.

- The process starts with an update to an internal SQL system of a pension payment completed. The operational system records these payments on a daily basis and updates an internal table before ACH instructions are submitted to the correct financial institution.
- The rules are different for each fund. This was a key observation – based on the last three years of historical payments; each transaction is treated differently. Also, in each case, a missed payment is also treated differently. In the past, all IRS payments were being made the very next day as it simplified the task of the person with this responsibility.
- Payments are made individually by going on the IRS web site and completing a set of payment screens.
- Manual notes were created to keep records of payments but these records were often missed due to manual steps and had to be reconstructed by logging back into the IRS system and reviewing history of payments.
- There was no monthly or quarterly review of completed or missed payments.
- For audit purposes, information was incomplete and had to be created manually.

- The process had to be automated and managed and the end of the process under consideration for improvement was established as successful payment and sync of log data of completed payments being written back into the internal system of XYZ.

Interfacing with the IRS proved to be a challenge. The IRS requires the payments to be completed by Electronic Funds Transfer (EFT) through a free software [24] program known as the Electronic Federal Tax Payment System (EFTPS). EFTPS is available as a standalone program on the Windows platform or as a web-access program on the Internet. Three types of interactions are possible with EFTPS: an Electronic Data Interchange (EDI) mechanism for administrators who make more than 1000 payments in a single transaction, a batch-processing desktop software program that requires manual startup every day, and a web-based interface that allows a single payment per transaction.

The EDI option was not applicable for the XYZ Company since it did not have the required volume. Between the remaining two options, the batch-processing option seemed better but the limitations were obvious when experimenting with that system. Training humans to work with a complex set of screens, the need for multiple humans to execute the necessary data queries and convert the relevant results to data files that could be imported by the batch-processing software, and the complex set of rules within the batch-processing software that required interpretation promised to be nightmares in the long run. The XYZ Company even considered outsourcing the process involving EFTPS but would not completely address the problem.

The web-based interface for EFTPS was the only remaining option. However, this system was cumbersome in that it allowed only a single payment in a transaction and would require manual processing of every transaction, frequent and variable use, and accuracy in payments. There is also the need to correctly identify the accounts or funds for payments and the terms of payments to the IRS. The XYZ Company considered if this process could be automated—which led to the application of RPA for interfacing with the IRS.

Initially, the XYZ Company examined the commercial RPA solutions including UiPath, Blue Prism, and Automation Anywhere. The team reviewed various industry reports to better understand the RPA software market. In particular, a Gartner report provided market share statistics of various RPA vendors worldwide. The team reviewed the top three vendors by market share for 2018: UiPath (13.6%), Automation Anywhere (12.8%) and Blue Prism (8.4%) [25]. While all three solutions were appealing, the cost became largely prohibitive due to the annual license as well as the cost of the individual bots needed. The overall costs of the commercial RPA solutions for the project ranged from \$30,000 to \$100,000. This range captures the licensing fee for the product (approx. \$2,000 for studio); Annual plan (\$20,000); cost of each attended bot (\$1,800), and cost of each unattended bot (\$8,000). In addition, the cost of programming and implementation could not be estimated; largely, because of RPA being a new technology, they had no experience in how long it might take for full development, testing, piloting, and implementing.

A tentative forecast was established as shown in Table 2. The team believed that these costs would apply for any of the commercial off-the-shelf products. There was uncertainty in this budget: How many bots would be required? While the team estimated two; it seemed that there was no good way to ascertain this? And, how many work hours would be required? Given the high cost of each bot; the team had to be careful in the planning phase and chose the product which provided flexibility and permitted them to make mistakes and learn from them at minimal costs.

Table 2. Project Cost Estimates

Item	Cost (\$)
Studio license	2,000
Two unattended bots	3,600
Development (2 developers @ 100 hours)	12,000
Total	17,600

While the team spent about 2 weeks reviewing off-the-shelf RPA products, they ended up choosing an open source RPA tool—*taskt* [26]. This choice was based on the following criteria: a) no cost of individual bots, b) simple set of functions and easy to learn environment, and c) an efficient trade-off between upfront cost and development costs but this risk seemed acceptable. A justification was that the initial learning time and cost would help with future projects which might be amenable to bots.

Figure 2 shows the overall framework for the role of RPA in making payments to the IRS. The framework can be considered in three major parts—the inputs, the processing, and the outputs—based on the input-process-output (IPO) model that informs disciplines such as information systems, systems analysis, and software engineering. The “process” is handled by multiple bots and involves data extraction and validation, data upload and tracking, and communication and data processing. The input sources are many including the IBM AS400 servers, Microsoft SQL Server, and Notepad or Excel data files and the outputs are sent to the EFTPS and also SQL Server, master tracker, and Excel data files for tracking purposes.

Figure 3 shows the RPA process for payments to the IRS in three swim lanes, powered by the bot controller, the bot, and the admin involved in the process. The process is activated every night by the bot controller who has access to the configuration files such as the payment rules and the relevant dates. It begins with a SQL Server script that retrieves data from multiple AS400 servers. The federal withholding data are retrieved based on the IRS rules, formatted into an Excel sheet, and sent to the Chief Financial Officer (CFO) for approval. The bot watches out for approval from the CFO. Once the approval is received, the bot converts the Excel worksheet into text data, reformats the text data to be compatible with the EFTPS including the correct Automatic Clearing House (ACH) headers and details, and creates the payments file (shown as “A”). On a two-hour schedule, the bot verifies if a payments file has been generated, and if one exists, executes the EFTPS web-interface program (shown as “B”). The states “A” and “B” are shown to distinguish activities that are automatically triggered by time and manually triggered by actors. This step is virtually similar

to a person using the web-interface in that the bot executes the various steps one screen at a time (login, import, submit, sync) using keyboard, mouse, and cursor control actions, but executed by the bot. The bot continues to watch for any error messages and takes appropriate action. If it receives a standard error message, the bot takes action to correct and resubmit the payment; if the error message is new (in rare instances), the bot reports the error to the technical team. The bot obtains the sync information from EFTPS and records it in an internal system for verification by senior executives or decision-makers later. (Note: The system uses a few different temporary folders P1.1 through P1.4 during the intermediate steps.)

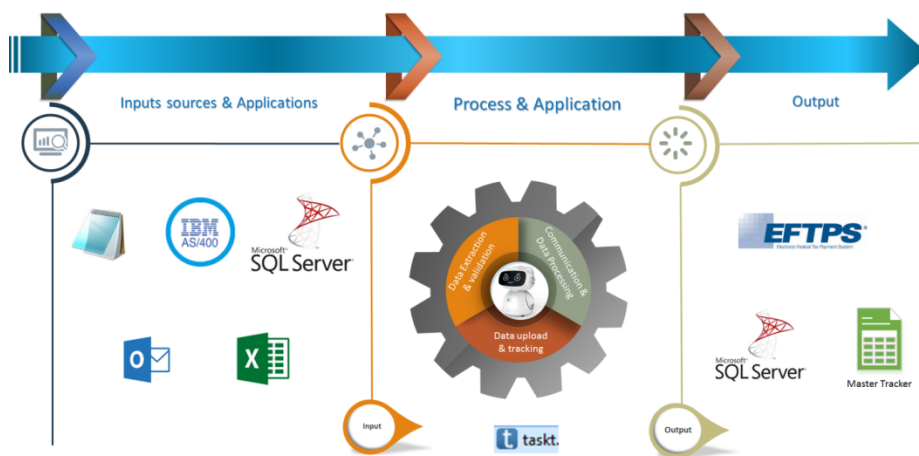


Fig. 2. Role of RPA in the IRS Payments Process

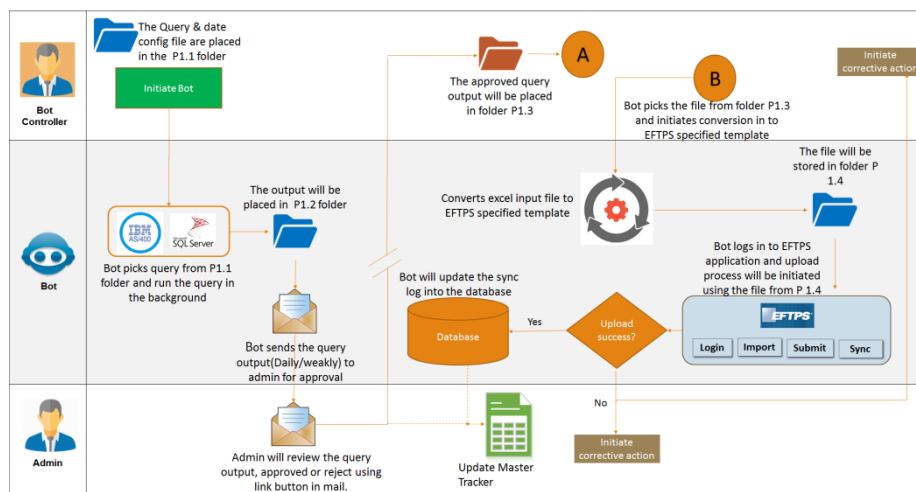


Fig. 3. RPA Process for IRS Payments

The “100% Compliance Project” has been a success for the XYZ Company since it has been able to correctly make payments to the IRS without incurring penalties. It has also been successful in demonstrating to the executive team and the operational team further applications of bots which can add efficiency to the organization.

4 Discussion

4.1 RPA Solution Improvements

The RPA implementation has been improved over time. Each step of the bot activities is now logged in a SQL table and sent via email and text to the technical team. A look-ahead capability delivers a message to the CFO outlining the upcoming set of payments to the IRS. This capability alerts the CFO to deposits forthcoming next day as advance warning. These alerts are triggered as emails and also SMS messages.

Compliance metrics are computed in real time such that any errors or failures can be quickly handled. Provisions for several audit reports for a more consolidated view of completed and potentially missed payments are now available to verify if the funds are in compliance with the IRS rules. For example, one dashboard provides a consolidated view of funds, action dates, federal withholding amounts, IRS due dates, scheduled dates, and deposit amounts. Views can be changed, filtered, and sorted for analysis. Table 3 shows an abbreviated view of the dashboard.

The tables are updated in real time as deposits are made. For instance, for the QWA fund, payments were made to employees during the period 12/29/2019 to 12/31/2019. The federal withholding for these payments totaled \$11,203.37, and based on the lookback period rules and total amounts, the payments to IRS should be completed by 1/2/2020. The due date is a calculated field based on the IRS deposit rules. The RPA process completes the payment and obtains the scheduled date via a sync command to the IRS server at completion. The dashboard shows the scheduled date to be 1/2/2020 and therefore, it is in compliance. The RPA solution adds the comment “Compliant” in the dashboard to make this obvious.

Table 3. Dashboard

Fund	Time Period	Withholding	IRS Due Date	Scheduled Date	Status
QWA	12/29/19 to 12/31/19	\$11,203.37	1/3/20	1/2/20	Compliant
NSC	12/1/19 to 12/31/19	\$157,844.29	1/3/20	1/2/20	Compliant

The Daily Ongoing Comparison (DOC) report, illustrated in Table 4, was added to the RPA dashboard as way to review the current ongoing deposits and examine any deviance from the prior month. Given the stable nature of deposits, the deviations were expected to be small (+/- 5%) from the previous month. This dashboard shows that there is no deviation in the deposits for the QWA fund from last month. However, a -6.12% deviation was reported for the NSC fund, which is due to the remaining deposits prior to the 15th, and was extracted from the live dashboard prior to that date.

The DOC report allows a quick review of any deviations immediately to determine if any have occurred due to errors, and allows the company to address any issues prior to delays and penalties.

Table 4. Daily Ongoing Comparison Report

Fund	Time Period	Withholding	Withholding	Deviation
		(Previous) February 2020	(Current) March 2020	
QWA	1 st to 15 th of month	<blank>	<blank>	0%
NSC	1 st to 15 th of month	<blank>	<blank>	-6.12%

The Annual Deposit Report (ADR), illustrated in Table 5, is generated at the end of the year to compare federal withholdings for each deposit fund and compare to the prior year. The RPA solution triggers deviations beyond +/- 5% variation to enable a deeper examination of the reasons. Both funds are within the expected deviation. In fact, all funds in the portfolio showed deviations below 0.25% with most deviations in the 0.00% to 0.01% range.

Table 5. Annual Deposit Report

Fund	2017-2018 Withholding	2018-2019 Withholding	Deviation
QWA	<blank>	<blank>	0.07%
NSC	<blank>	<blank>	0.25%

The <blank> entries in Table 3 and Table 4 represent actual numbers intentionally unreported to protect the organization but the deviations shown are accurate. The audit and compliance reports are necessary and an ongoing aspect of the RPA process to demonstrate the improvements due to RPA.

4.2 Reflection and Next Steps

Table 6 provides an overview of the state of the process before RPA and after RPA, including the vision for the future planned state of the process.

At the beginning of the project, the end goal appeared to be elimination of human intervention at any point in the RPA process. In the first version of the future state, there was no approval step built into the workflow, i.e., the process bypassed any approval steps and continued into the payment process through *taskt*. However, the inherent fear “What if there was an error in the amount/date/deposit account?” forced a rather “sudden” executive step in the RPA process. Several other well-intentioned arguments were presented as to why the process should not be fully automated, and it became apparent that one or more intermediate steps would need to be designed in order to obtain executive by-in for the RPA solution.

The rollout of the RPA solution included various phases as time went by and as the solution became more accepted.

- The CFO approval was built into the system which operated for 8 months without any flaw. This raised confidence in the accuracy and efficiency of the new process and approvals became routine and non-burdensome.
- The second phase of the approval process is currently in place where an approval email is sent to the CFO with a notification that an automated approval will take place in 4 hours unless the process is deferred for any reason. There has not been a single instance of deferrals after 4 months of operation.
- Currently, the final stage of programming is being completed, where the CFO approval step will be removed completely, and any review/audit of the deposits will be through the various dashboards designed for the process.

Table 6. Pre-RPA and Post-RPA States

Process step	Pre-RPA	Post-RPA
Trigger	Based on date when pension checks were written, using a calendar in Excel format given to an individual at the beginning of the year	Script detection of updates in SQL database of pension checks
Retrieve Data	Manually retrieve SQL report of total pension amount and federal withholding	Automatic
Analyze Report	None	Automated with scripts based on lookback period and rules of IRS Pub. 15
CFO Approval	None	Immediate
Federal Payments	Completed manually using the web version of EFTPS, possibly several days later	RPA-driven immediate after CFO approval (typical cycle time is 20 minutes)
Date/Amounts synchronized with IRS	No	Immediate at the end of the payment process
Daily dashboard and review	None	Ongoing and real time
Quarterly review for missed payments or errors	None	Automated in <i>taskt</i>
Annual, end-of-the-year analysis	None	Automated through ADR
Detecting missed payments	Manual when time permitted	Automated by running scripts to review past 7 days and compare against deposits, and see if any payments were missed
Audit capability	None	Built into the automated

system

The evolving nature of the decision-making process was an interesting exercise in executive confidence, which resulted in a changed RPA process and the acceptance of intermediate solutions that enabled buy-in for the RPA solution. In hindsight, it has now also pushed executives into an examination of other areas of the organization where similar solutions might be built.

4.3 Technical Challenges

The attractiveness of an open-source RPA tool was the availability a free and easy-to-use highly-scalable capability. The *taskt* command set includes several advanced features such as custom codes, optical character recognition (OCR), image recognition, and screen recorders, all of which can be built into scripts in repeatable mode. The tool also works directly with Microsoft Excel worksheets. However, as implementation progresses, we discovered that fitting the solution to the business process steps is not “plug-and-play.” These are not basic business user tools or interfaces, but require advanced programming skills to implement. The failure conditions need to be managed and most browser conditions require specific tweaks.

Several challenges unrelated to the underlying business processes but specific to the RPA implementation faced include: a) lack of proper documentation that made startup hard, b) problems when accessing third party applications such as ipswitch [27], c) difficulties in managing dependent functions for scenarios, d) lack of technical features such as browser automation or multiple windows management that require precise cursor control in the standard feature set of RPA packages, e) additional bots required to overcome default timeout settings such as 60 seconds on Selenium [28] when dealing with slow-loading web sites, f) incompatible features between the RPA tool and other browser elements such as xpath [29], and g) automation steps that may require special handling as in cases relating to web sites or downloaded files. These are not necessarily “show-stoppers” for the use of *taskt* or any RPA tool but are described here to alert readers to similar issues that are likely to emerge with any tools that require support and programming skills to manage. For the technical team at XYZ Company, these represented learning opportunities to develop and hone a skill set which can be used in other RPA projects of similar scope and function.

4.4 Lessons Learned

The implementation project using *taskt* had many lessons for the development team and the XYZ Company which are useful to highlight:

- While any repetitive process is a candidate for bot applications, not every repetitive process is a “good candidate.” It became apparent to the team that the bots could provide advantages in any repetitive tasks, they would be more useful in complex tasks which had the characteristics of: repetitiveness, decision bifurcation (such as either-or decision branches), and required multiple technologies such as server

scripts; manual tasks; and textual processing. Bots can potentially provide one single point of control which provides process efficiency.

- The first iteration of the bots is likely to identify process gaps even if the process analysis is done well. Bots in the current process quickly identified gaps where the process team had failed to take exceptions into account – for example, a new fund added to the portfolio which has not been previously associated with a payment mechanism, or, if a payment is retrieved twice. Each of the exceptions was often identified through bot failures during prototyping and led to useful conversations such as “Why would a duplicate payment even take place in the financial system?”
- Bots possess flexible ways of incorporating tools such as scripts, keyboarding utilities such as auto key, secure transmission such as SFTP, and decision rules. This flexibility was unexpected – actually, at certain points in the project, the team almost gave up and considered resorting to traditional ASP.NET programming which would be able to provide an 80-20 solution.
- More bots will likely be needed than initially planned. While the very first cost estimate was built on two bots (Why would we use more than one? This question was often asked in team discussions), they ended up using 10 unattended bots with two more planned to take care of exceptions which came up in later stages of the project.
- Bot refinement is an ongoing task. The project was first implemented on Feb. 15, 2019. In three months, the team had noticed various ways to streamline bot programming, process programming, and provide more benefits to business users.

4.5 Design Science Retrospective

While the case study provides an implementation view of a particular RPA toolset to solve what could have become a “business-stopping” problem (i.e., continued penalties by IRS would have resulted not only in financial loss but also customers and reputation), it is also important to evaluate the case study against accepted research principles. A recent addition to the field of information systems is design science research (DSR) [30][31] which specifies frameworks for identifying, conceiving, realizing, evaluating, and communicating the solution. The retrospective evaluation of the case study is based on the design science research methods [31].

- **Problem-centered approach:** The lack of automation in the IRS federal withholding deposit process was labor intensive, reliant on a single individual, and slow. This led to accumulation of deposit penalties, difficulties in proactive analysis and audit, and an environment of lack of trust by clients. The need for a more efficient automated solution triggered the development of the RPA solution.
- **Problem identification and motivation:** The timely deposit of federal withholdings is a legal requirement in the United States and the rules for deposits are complex. The IRS provides Application Program Interfaces (APIs) for larger organizations which make deposits in excess of 100,000 transactions per month. However, the process is largely manual, time consuming and fraught with delays for other organizations such as the XYZ Company. The formulation of a solution had to address these realities and build procedures consistent with legal regulations.

- **Objectives of the solution:** The objective was to develop an automated solution which enables the organization to meet its goals of 100% compliance with the IRS rules and use that capability as competitive advantage in the industry. The major challenge included the lack of process maps, identification of rules, and automation tools that could enable a potential solution. The expected outcome was a fully automated solution which could remove the burden of data extraction, analysis, reporting, and audit from any one individual with the long term goal of improving the financial health of the organization.
- **Design and development:** The artifact is the RPA-driven system which supports and automates IRS deposits of deferral withholdings. The implementation team relied on the research and practice literatures on process automation, RPA tools, and general business process reengineering to develop the solution. The design included the data extraction scripting engine, decision tool to compare data with the IRS rules, and transaction processing via the selected RAP tool. Multiple dashboards and reports address the reporting and auditing needs, and triggered an examination of deviations from preselected performance metrics.
- **Demonstration:** After an initial proof-of-concept prototype was developed, the artifact was extensively tested with one data set and synchronization logs of the IRS to assess the accuracy and timeliness of deposits. The rollout was authorized after extensive testing was completed with both the manual and automated processes running in parallel for a month. This demonstration increased the confidence of the organization and its stakeholders (such as the pension funds for whom the deposits were made).
- **Evaluation:** The fully functional RPA system was (and continues to be) subjected to ongoing evaluation through reporting tools such as DOC and ADR. The verification of the RPA system accuracy has since been replaced with an evaluation of underlying systems, uptime, and infrastructure to provide real-time data to the deposit system.
- **Communication:** Within the organization, several presentation and lunch meetings have been conducted to show how the RPA solution benefits the company and also how RPA in general can help achieve the operational and financial goals of the company. This paper serves the purpose of bringing the case study with all its idiosyncratic details to the academic and practitioner communities.
- **Contribution:** The RPA system resulted in an architecture and an application for the organization. The artifact was used effectively to address a long-standing problem within the organization. The immediate impacts of the artifact include: elimination of IRS penalties to zero, increased confidence of the organization in automated process solutions, initiation of a search for other areas of productivity, and increased trust and confidence among the organization's clients.

5 Conclusion

The experience of implementing an RPA solution at the XYZ Company demonstrates effective ways in which RPA may be implemented to automate mundane, time-

consuming, and repetitive processes. For XYZ Company, the RPA implementation was not only cost-effective but also proved to be the perfect solution to address the problem it faced. The implementation also shows ways in which processes for RPA can be identified, bots can be configured for semi-automation, and bots can be deployed for effectively solving problems in business processes.

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Appendix A

An illustrative set of RPA implementations reported by practice is classified using the Porter's value chain model to demonstrate the extent to which RPA can be useful in various domains within the organization.

RPA Example

Inbound Logistics [1]

PITT OHIO, a 3PL provider, drives transformation in logistics with RPA

Aggranda helps TCE Logistic with RPA that manages orders from three warehouses

Slant targets automation of 80% of their invoices from raw material with RPA

Operations [2]

An Indian bank used RPA to automate compliance checks on data from 400-500 unstructured documents

Large bank automates deduplication process using AutomationEdge

UK's leading communication infrastructure provider standardized its order management process with RPA

Outbound Logistics [3]

Australian FMCG food company automates delivery confirmation in ERP

RPA for distribution channel reports automation in media organizations

A UK-based Consumer Packaged Goods firm operating in 190 countries automates distributor creation process using RPA

Marketing & Sales [4]

A mobile network operator with 260 million subscribers used RPA for targeted advertising
UK's largest wholesaler VOW used RPA sales order processing to handle 100,000 lines of requests from 2,500 customers

An Indian insurer with customers in 1,000 cities and sales at 10,000 points used bots to compute premiums

Service [5]

Elisa, a leading telecom provider in Finland with 2.8 million customers, improved customer service with RPA

A heavy machinery manufacturer used RPA to improve resolution cycles and improve customer experience

Israel Discount Bank empowered its tellers using RPA to navigate desktop screens for improved customer service

Firm Infrastructure [6]

An Australian global facilities management company automated manufacturer rebate calculation functions on 200,000 invoice lines and 70+ manufacturer contracts

Implementing RPA helped Johnson & Johnson's finance department improve work flow and accuracy

Legal case finder bot to assist the legal team of a company

Human Resource Management [7]

A global bank operating in 189 countries with 10,000 employees used RPA to manage HR onboarding forms from many countries and many languages

An offshore outsourcing firm with 200,000 employees used RPA to manage employee turnover process

Walgreens uses Digital Workforce to improve shared service efficiency by 73%

Technology Development [8]

A UK-based organization uses UiPath to automate indexing of 10,000+ insurance documents

Automated complex email intake and data ingestion of 1 million emails for task routing by a top US bank

Banking RPA solution to screen status of customer credit accounts

Procurement [9]

Robotics help mining company set standards in procurement accuracy and efficiency

Leading real estate company simplified procurement and improved visibility by automating purchase requisitions in the procure-to-pay process

A global retail organization dealing with 2,000 vendors and 60 warehouses standardized their processes and reduced the invoice processing cost by 80% with AssistEdge RPA

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