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An Analysis of Robotic Process Automation for Accountants

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An Analysis of Robotic Process Automation for Accountants

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by
Olivia Sturgill
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Olivia T. Sturgill Date

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Dr. Joel Faidley, Thesis Mentor Date

This work is dedicated to:

My parents,

For your continuous love and support.

Dr. Joel Faidley,

For your assistance and dedication to this thesis.

Dr. Doug Dotterweich,

For your assistance and guidance for this thesis.

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For allowing me the opportunity to study at ETSU and causing me to grow as an individual and student.

Table of Contents

Executive Summary……... 4

Chapter 1: Introduction…… 5

Literature Review…… 5

Survey…….. 7

Contribution……. 8

Chapter 2: Methodology…….... **11**

Research Objective……. 11

Hypotheses and Equations……... 11

Data Source…….. 14

Chapter 3: Results……. 15

Research Question 1……. 15

Research Question 2……. 18

Research Question 3……. 20

Research Question 4……. 22

Research Question 5……. 24

Chapter 4: Summary, Conclusions, and Recommendations……...26

Summary of Results…….. 26

Conclusions and Recommendations……..27

Recommendations for Future Research…….28

References…… 30

Appendix…….. 31

Executive Summary

The objective of this thesis paper is to answer the question: is robotic process automation efficient/beneficial and should accountants consider its implementation? For accountants, robotic process automation is a software that "perform[s] tasks such as processing sales and financial transactions, managing data, communicating between different systems, and access management, as well as monitoring and reporting" (Seasongood, 2016). In order to determine whether or not RPA should be implemented, a survey was found that had over 500 responses from varying companies currently using RPA. A statistical analysis will be performed in order to determine if any statistical significances exist between questions (both the benefits and challenges of RPA), by countries, by employee sizes, and by business functions. Based on the results, a conclusion will be provided on RPA's implementation into the accounting field.

Chapter 1: Introduction

What is Robotic Process Automation?

Robotic process automation is a software, similar to Excel, that uses rules defined by business entities and analyses predefined activities to execute the self-directed implementation of a combination of activities and tasks to reach a conclusion and deliver results with human exception management, (Moffitt, Rozario, & Vasarhelyi, 2018). For accountants and auditors robotic process automation is software that does tasks such as processing sale transactions, financial transactions, data management, as well as the monitoring of data and transactions, and reporting transactions, (Seasongood, 2016).

Robotic process automation is intended to work alongside humans and based on what humans have programmed the software to do, learn and adapt to different situations. However, situations often change and sometimes this software could make mistakes based on how the context of each situation changes (Aalst, Bichler, & Heinzl, 2018). With correct programming, this situation can be fixed. The overall purpose of RPA is to, "…to improve the efficiency, accuracy, and timeliness of business process execution and to lower operational costs" (Softomotive, 2018). RPA is a software that can work twenty-four seven, three hundred and sixty-five days, all without taking a break. Every business strives to improve efficiency and lower costs, so automation poses a potential threat to jobs.

Is Robotic Process Automation a Risk?

Since this software is intended to automate different processes, the need for human employees significantly decreases. According to Monga from the Wall Street Journal due to automation, "the median number of full-time employees in the finance department at big

companies has declined 40% to about 71 people for every $1 billion of revenue, down from 119" (Monga, 2015). This is a significant impact on the number of employees, but the defense for RPA is that RPA can perform tasks and activities 70% faster than humans. This provides justification in that human employees will be able to devote more time to value-added activities (Taulli, 2019). Supposedly, the goal of RPA is to not take away jobs but rather provide the tools to allow employees to focus on other necessary work activities. According to the CEO of UiPath, one of the prominent providers of RPA, the goal is to take away the "boring" parts of a job and increase productivity, not take jobs away (Dines, 2018).

Robotic process automation is not only a risk to future and current accountants, but it could also potentially cause significant errors. Once the software is given instructions on what to do and how to do certain functions, it is intended to work by itself on certain things. However, since it is a software, it could potentially make errors, and make errors with certainty (Kirchmer, 2017). An error could go unnoticed for quite some time and once it's determined that there is a problem, it would be difficult to determine the root cause of the issue.

If businesses are willing to implement controls for RPA in the implementation stage, RPA could prove beneficial and efficient. However, if the RPA is not given the proper foundation to build on, it could be detrimental (Chandler, Power, Fulton, & Nueten, 2017). If businesses are willing to implement the proper controls; however, RPA could be an asset to the company. Businesses strive to be efficient and effective, and if RPA can meet these goals and reduce costs, businesses will begin to adopt RPA into their companies.

Survey

In order to determine if RPA is beneficial and efficient, a company named Softomotive worked in collaboration with KS&R, Inc., a global market research firm, to administer a global survey to 583 robotic process automation decision makers. For this study they defined robotic process automation as a software that, "help[s] automate routine, repetitive tasks across multiple business applications" (Softomotive, 2018). Softomotive divided the decision makers into five different categories based on their current *usage* of RPA within their companies. The five different categories are labeled as: explorers, testers, believers, trail blazers, and delayers. For purposes of their survey they grouped together explorers/ testers and believers/ trail blazers. Softomotive defines explorers as, "started to investigate RPA and how it might be able to help their business" (Softomotive, 2018). They defined testers as, "tried RPA on a small-scale but have made no significant commitments to it yet" (Softomotive, 2018). They defined believers as, "deployed RPA in certain parts of their business" (Softomotive, 2018). They defined trail blazers as, "extending RPA to new parts of the business or new geographies" (Softomotive, 2018). Finally, they defined delayers as, "RPA roll-out was stopped before completion or put on hold" (Softomotive, 2018).

Softomotive conducted 70 plus interviews in 7 countries including, the United States, Canada, the United Kingdom, Germany, Japan, and India. They also conducted 175 plus interviews in 3 company size categories within a business, 250-999 employees, 1000-2499 employees, and 2500-4999 employees. Finally, they conducted 115 plus interviews in the 5 functional roles within a business, business operations, finance/ accounting, human resources, IT/ technology, and procurement. This survey was conducted from July 25 -August 27, 2018 and

was administered online (Softomotive, 2018). There is no evidence of bias since the company name Softomotive was not affiliated with the survey, making this a blind study.

In total, Softomotive provided ten figures that describe the results of the questions asked. They asked about current RPA usage, what parts of the business are currently using RPA or considering RPA, individuals in different business functions driving the need to use/consider RPA, benefits of RPA, future use of RPA, factors in deciding to use RPA, potential questions, challenges of RPA, countries currently using RPA, and future use by countries. These figures provide a general overview of the results without a detailed description. Therefore, determining statistical significance of the survey results is difficult.

Contribution

In order to know if RPA is beneficial and efficient, comparisons of RPA decision maker surveys will be performed. This thesis will review what each company found to be beneficial and what each company found to be problematic. Knowing the potential benefits or costs of RPA will lead to whether or not accountants should consider its implementation. In order to determine if any statistical significance occurs between the data a micro-analysis will be performed. For this thesis, four different items from the Softomotive survey will be examined statistically: the benefits and challenges of RPA, the countries currently using RPA, the employee sizes of the different business executives surveyed, and the various business functions within a company that currently use RPA. In order to perform these analyses, the Chi-square test for the equality of proportions and the Marascuilo Procedure will be performed. The Chi-square ($\chi 2$) is used for nominal data and tests for, "significant differences between the *observed* distribution of data among categories and the *expected* distribution based on the null hypothesis" (Cooper &

Schindler, 2008). The Marascuilo Procedure will be used if the null hypothesis is rejected to determine what population proportions are statistically significant.

The audience of this thesis will be current and future accountants, potential investors, and businesses considering implementing robotic process automation. Accountants need an understanding of what robotic process automation is as it could potentially affect the availability of jobs in the future. It could also change the way job tasks will be performed and completed. For example, current and future accountants will potentially have to be trained on how to work with robotic process automation. Robotic process automation will also have to be implemented into various accounting curriculums. Rather than only being taught how to use Excel, students will also require training in RPA by professors.

Another audience for this thesis could be potential RPA investors. If this thesis proves RPA is beneficial and efficient, investors could use this information to aid in their decision to invest in RPA. However, if this thesis proves RPA is not beneficial and efficient, it could aid investors in the decision to not implement RPA. Another audience for this thesis are businesses considering RPA. This audience will find this thesis to be extremely beneficial. The survey that is being statistically analyzed was based on other businesses experiences with RPA. Specifically, what each business found to be challenging and what each business found to be beneficial. Based on the results that are found from the statistical analyses, it will determine if RPA was found to be overall beneficial and efficient. Businesses who are considering implementing RPA will base their decision on the opinions of businesses who currently have RPA.

Overall, this thesis will statistically analyze the survey results from businesses that are currently using RPA. To accomplish this, four different analyses will be done, by questions (specifically the benefits and challenges of RPA), by countries currently using RPA, by the

number of employees of the business executives surveyed, and by the various business functions within a company. Once these tests are performed it will be determined if RPA is beneficial and efficient, and based on those results it will provide the necessary information whether RPA should be implemented for accountants.

Chapter 2: Methodology

Research Objective

The objective of this research is to determine if Robotic Process Automation is beneficial and efficient for accountants. To determine this, a statistical analysis using quantitative methods will be performed on the survey results performed by Softomotive. The graphs that will be analyzed include "Extent Currently Using/ Considering RPA", "Benefits Realized to Data As A Result Of Using RPA", "Most Significant Challenges Company Is/ Anticipates Facing If Leveraging RPA", and "Current RPA Usage" (Softomotive, 2018). To analyze these graphs and questions, the chi-square test for equality of proportions will determine if there is a difference between the population proportions/ percentages. If it is determined that there is a difference between the population proportions, the Marascuilo Procedure will be used to determine *which* pairs of population proportions differ by comparing each proportion to one another and determine whether that difference is significant or not. If the difference between pairs is significant, recommendations and conclusions will be discussed.

Hypotheses and Equations

For the purpose of this study two tests will be performed for each category: the benefits and challenges of RPA, the countries currently using RPA, the employee sizes of the different business executives surveyed, and the various business functions within the companies currently using RPA. The first test is the Chi-square test for equality of proportions where hypotheses are formed to determine if the population proportions are different. H_0 represents the null hypothesis and H_a represents the alternative hypothesis. The basic Chi-square hypothesis is as follows:

$\Rightarrow$ H_0: There is no difference between the population proportions; $\pi_1 = \pi_2 = \pi_3$.

$\Rightarrow$ H_a: Not all population proportions are equal; $\pi_1 \neq \pi_2 \neq \pi_3$.

Each category and question will have independent hypotheses.

Research Question 1: Based on current RPA usage, is there a significant difference in what business executives found to be most beneficial with RPA?

- ⇒ H_0: There is no significant difference between the benefits of RPA.
- ⇒ H_a: Not all of the population proportions for the benefits of RPA are equal.

Research Question 2: Based on current RPA usage, is there a significant difference in what business executives found to be most challenging with RPA?

- ⇒ H_0: There is no significant difference between the challenges of RPA.
- ⇒ H_a: Not all of the population proportions for the challenges of RPA are equal.

Research Question 3: Are there significant differences in the countries currently using RPA?

- ⇒ H_0: There is no significant difference between the countries currently using RPA.
- ⇒ H_a: Not all of the population proportions for the countries currently using RPA are equal.

Research Question 4: Is there a significant difference in RPA usage by employee sizes for business executives?

- ⇒ H_0: There is no significant difference between the employee sizes of the different business executives surveyed.
- ⇒ H_a: Not all of the population proportions for the employee sizes of the different business executives surveyed are equal.

Research Question 5: Is there a significant difference in business functions currently using RPA?

- ⇒ H_0: There is no significant difference between the various business functions within companies currently using RPA.
- ⇒ H_a: Not all of the population proportions for the various business functions within companies currently using RPA are equal.

Once the hypotheses have been determined for each category, the Chi-square test for equality of proportions will be used to determine if any statistical significances exist in the data. The formula for this test is:

$$\chi^2 STAT = \sum_{all\ cells} \frac{(f_o - f_e)^2}{f_e}$$

Where f_o represents the observed frequency, or the data collected, and f_e represents the expected frequency. The deciding factor of rejection or failure to reject the null is when the chi-square test statistic is greater than the critical value, reject the null hypothesis, but if the chi-square test statistic is less than the critical value, fail to reject the null hypothesis.

If the null hypothesis is rejected for any of these hypotheses the Marascuilo Procedure will be used to determine which pairs of data are statistically significant by finding the absolute differences and by using this equation:

$$\text{Critical range} = \sqrt{\chi_U^2} \sqrt{\frac{p_j(1-p_j)}{n_j} + \frac{p_{j\prime}(1-p_{j\prime})}{n_{j\prime}}}$$

Where χ_U^2 represents Chi-square upper, p represents the sample proportions, and n represents the sample size. The Marascuilo Procedure was chosen for this thesis because it is only used for multiple populations and if the null hypothesis is rejected. Once this equation is solved it will be determined which pairs of proportions are significantly different by comparing calculated sample differences with critical range differences. A particular pair of proportions is significantly different if the absolute difference is greater than the critical range:

$$|p_j - p_{j\prime}| > critcal\ range\ for\ j\ and\ j'$$

Data Source

In order to perform these analyses Softomotive provided data regarding how many individual business executives were interviewed and surveyed. They provided the number of individuals interviewed by country, by business function, and by number of employees.

Countries:	
US	104
UK	78
Germany	74
Canada	107
Brazil	76
Japan	73
India	71
Total:	583

Table 1: *Number of Individuals Interviewed by Country*

Business Functions	
Finance/ Accounting	117
Business Operations	116
IT/ Technology	116
Human Resources	118
Procurement	116
Total:	583

Table 2: *Number of Individuals Interviewed by Business Function*

# of Employees:	
250-999 Employees	199
1,000-2,499 Employees	211
2,500-4,999 Employees	173
Total:	583

Table 3: *Number of Individuals Interviewed by # of Employees*

These numbers were then put into an Excel spreadsheet where PhStat was used to determine the chi-square value, the decision for the rejection or non-rejection of the null hypothesis, and the Marascuilo procedure. Next will be the discussion of the results shown.

Chapter 3: Results

Research Question 1

Research Question 1: Based on current RPA usage, is there a significant difference in what business executives found to be most beneficial with RPA?

H_0: There is no significant difference between the benefits of RPA.

The Chi-Square Test for equality of proportions was used to determine if there was a significant difference between what business executives found to be most beneficial with RPA. The row variables consisted of the potential benefits employers saw and the column variables were yes or no answers. The Chi-Square Test Statistic was 306.4, which was greater than the critical value of 19.7. Therefore, the null hypothesis, H_0, was rejected. This indicates that at least one pair of proportions is significant. To determine which pairs of proportions are statistically significant the Marascuilo Procedure was used.

The Marascuilo Procedure determined that most business executives found improving productivity to be the most beneficial aspect of RPA out of all other options. Overall, improving productivity had the highest proportion of business executives who thought improving productivity is a benefit of RPA. This conclusion was found by comparing the absolute difference between sample proportions with the critical range. Group one, improving productivity, had a significant difference over groups three through twelve. Group twelve, less expensive than enterprise applications, typically cost, had the lowest proportion of business executives who thought of it as a benefit of RPA.

Chi-Square	
Critical Value	19.67513757
Chi-Square Test Statistic	306.4129555
p-Value	3.89962E-59
Reject the null hypothesis	

Table 4: *Chi-Square Results for Benefits of RPA*

MARASCUILO TABLE			
Proportions	Absolute Differences	Critical Range	
| Group 1 - Group 2 |	0.11	0.128791254	Not significant
| Group 1 - Group 3 |	0.13	0.128266109	Significant
| Group 1 - Group 4 |	0.18	0.126477648	Significant
| Group 1 - Group 5 |	0.22	0.124541652	Significant
| Group 1 - Group 6 |	0.23	0.123984902	Significant
| Group 1 - Group 7 |	0.24	0.123398294	Significant
| Group 1 - Group 8 |	0.25	0.122781402	Significant
| Group 1 - Group 9 |	0.25	0.122781402	Significant
| Group 1 - Group 10 |	0.31	0.118415929	Significant
| Group 1 - Group 11 |	0.31	0.118415929	Significant
| Group 1 - Group 12 |	0.37	0.112811371	Significant
| Group 2 - Group 3 |	0.02	0.127249104	Not significant
| Group 2 - Group 4 |	0.07	0.125446145	Not significant
| Group 2 - Group 5 |	0.11	0.123493978	Not significant
| Group 2 - Group 6 |	0.12	0.122932484	Not significant
| Group 2 - Group 7 |	0.13	0.12234083	Significant
| Group 2 - Group 8 |	0.14	0.121718578	Significant
| Group 2 - Group 9 |	0.14	0.121718578	Significant
| Group 2 - Group 10 |	0.2	0.117313562	Significant
| Group 2 - Group 11 |	0.2	0.117313562	Significant
| Group 2 - Group 12 |	0.26	0.111653684	Significant
| Group 3 - Group 4 |	0.05	0.124906937	Not significant
| Group 3 - Group 5 |	0.09	0.122946209	Not significant
| Group 3 - Group 6 |	0.1	0.122382201	Not significant
| Group 3 - Group 7 |	0.11	0.121787875	Not significant
| Group 3 - Group 8 |	0.12	0.121162783	Not significant
| Group 3 - Group 9 |	0.12	0.121162783	Not significant
| Group 3 - Group 10 |	0.18	0.116736796	Significant

| Group 3 - Group 11 |	0.18	0.116736796	Significant
| Group 3 - Group 12 |	0.24	0.111047525	Significant
| Group 4 - Group 5 |	0.04	0.121079194	Not significant
| Group 4 - Group 6 |	0.05	0.120506448	Not significant
| Group 4 - Group 7 |	0.06	0.119902824	Not significant
| Group 4 - Group 8 |	0.07	0.119267853	Not significant
| Group 4 - Group 9 |	0.07	0.119267853	Not significant
| Group 4 - Group 10 |	0.13	0.114768812	Significant
| Group 4 - Group 11 |	0.13	0.114768812	Significant
| Group 4 - Group 12 |	0.19	0.108976849	Significant
| Group 5 - Group 6 |	0.01	0.118472914	Not significant
| Group 5 - Group 7 |	0.02	0.117858876	Not significant
| Group 5 - Group 8 |	0.03	0.117212833	Not significant
| Group 5 - Group 9 |	0.03	0.117212833	Not significant
| Group 5 - Group 10 |	0.09	0.112631735	Not significant
| Group 5 - Group 11 |	0.09	0.112631735	Not significant
| Group 5 - Group 12 |	0.15	0.106723854	Significant
| Group 6 - Group 7 |	0.01	0.117270403	Not significant
| Group 6 - Group 8 |	0.02	0.1166211	Not significant
| Group 6 - Group 9 |	0.02	0.1166211	Not significant
| Group 6 - Group 10 |	0.08	0.112015805	Not significant
| Group 6 - Group 11 |	0.08	0.112015805	Not significant
| Group 6 - Group 12 |	0.14	0.106073625	Significant
| Group 7 - Group 8 |	0.01	0.11599726	Not significant

| Group 7 - Group 9 |	0.01	0.11599726	Not significant
| Group 7 - Group 10 |	0.07	0.11136617	Not significant
| Group 7 - Group 11 |	0.07	0.11136617	Not significant
| Group 7 - Group 12 |	0.13	0.105387367	Significant
| Group 8 - Group 9 |	0	0.11534079	Not significant
| Group 8 - Group 10 |	0.06	0.110682236	Not significant
| Group 8 - Group 11 |	0.06	0.110682236	Not significant
| Group 8 - Group 12 |	0.12	0.104664371	Significant
| Group 9 - Group 10 |	0.06	0.110682236	Not significant
| Group 9 - Group 11 |	0.06	0.110682236	Not significant
| Group 9 - Group 12 |	0.12	0.104664371	Significant
| Group 10 - Group 11 |	0	0.105818793	Not significant
| Group 10 - Group 12 |	0.06	0.099507237	Not significant

Table 5: *Marascuilo Procedure for Benefits of RPA*

Research Question 2:

Research Question 2: Based on current RPA usage, is there a significant difference in what business executives found to be most challenging with RPA?

H_0: There is no significant difference between the challenges of RPA.

The Chi-Square Test for equality of proportions was used to determine if there was a significant difference between what business executives found to be most challenging with RPA. The row variables consisted of the potential challenge's employers saw and the column variables were yes or no answers. The Chi-Square Test Statistic was 36.5, which was greater than the

critical value of 14.07. Therefore, the null hypothesis, H_0, was rejected. This indicates that at least one pair of proportions is significant. To determine which pairs of proportions are statistically significant the Marascuilo Procedure was used.

The Marascuilo Procedure determined that most business executives found data security concerns to be the most challenging aspect of RPA out of all other options. Overall, data security concerns had the highest proportion of business executives who thought data security concerns is a challenge of RPA. This conclusion was found by comparing the absolute difference between sample proportions with the critical range. Group one, data security concerns, had a significant difference over groups six through eight. Groups six, seven, and eight, which were respectively, control and governance over what the robots were doing, negative impact on employee morale, and developing or documenting workflows, had the lowest proportion of business executives who thought of it as a challenge of RPA.

Chi-Square	
Critical Value	14.06714045
Chi-Square Test Statistic	36.50202218
p-Value	5.82737E-06
Reject the null hypothesis	

Table 6: *Chi-Square Results for Challenges of RPA*

MARASCUILO TABLE			
Proportions	Absolute Differences	Critical Range	
| Group 1 - Group 2 |	0.020222985	0.071323187	Not significant
| Group 1 - Group 3 |	0.04	0.06859397	Not significant
| Group 1 - Group 4 |	0.05	0.067118276	Not significant
| Group 1 - Group 5 |	0.06	0.065572612	Not significant
| Group 1 - Group 6 |	0.07	0.063951905	Significant
| Group 1 - Group 7 |	0.07	0.063951905	Significant
| Group 1 - Group 8 |	0.07	0.063951905	Significant
| Group 2 - Group 3 |	0.019777015	0.065834457	Not significant
| Group 2 - Group 4 |	0.029777015	0.064295459	Not significant

| Group 2 - Group 5 |	0.039777015	0.062680224	Not significant
| Group 2 - Group 6 |	0.049777015	0.060982696	Not significant
| Group 2 - Group 7 |	0.049777015	0.060982696	Not significant
| Group 2 - Group 8 |	0.049777015	0.060982696	Not significant
| Group 3 - Group 4 |	0.01	0.061253912	Not significant
| Group 3 - Group 5 |	0.02	0.059556244	Not significant
| Group 3 - Group 6 |	0.03	0.057766988	Not significant
| Group 3 - Group 7 |	0.03	0.057766988	Not significant
| Group 3 - Group 8 |	0.03	0.057766988	Not significant
| Group 4 - Group 5 |	0.01	0.057850466	Not significant
| Group 4 - Group 6 |	0.02	0.056006742	Not significant
| Group 4 - Group 7 |	0.02	0.056006742	Not significant
| Group 4 - Group 8 |	0.02	0.056006742	Not significant
| Group 5 - Group 6 |	0.01	0.054144802	Not significant
| Group 5 - Group 7 |	0.01	0.054144802	Not significant
| Group 5 - Group 8 |	0.01	0.054144802	Not significant
| Group 6 - Group 7 |	0	0.052170282	Not significant
| Group 6 - Group 8 |	0	0.052170282	Not significant
| Group 7 - Group 8 |	0	0.052170282	Not significant

Table 7: *Marascuilo Procedure for Challenges of RPA*

Research Question 3:

Research Question 3: Are there significant differences in the countries currently using RPA?

H_0: There is no significant difference between the countries currently using RPA.

The Chi-Square Test for equality of proportions was used to determine if there was a significant difference between what countries are currently using or adopting RPA. The row variables consisted of the various countries currently using RPA and the column variables were either Explorers/ Testers or Believers/ Trail Blazers. The Chi-Square Test Statistic was 23.63, which was greater than the critical value of 12.59. Therefore, the null hypothesis, H_0, was

rejected. This indicates that at least one pair of proportions is significant. To determine which pairs of proportions are statistically significant the Marascuilo Procedure was used.

The Marascuilo Procedure found that Japan and India were the slowest countries in adopting RPA, with Japan being the overall slowest in adoption. This indicates that there is an overall higher proportion of Explorers/ Testers than Believers/ Trail Blazers in Japan. This conclusion was found by comparing the absolute difference between sample proportions with the critical range. Group six, Japan, had a significant difference between groups two, three, and five, the UK, Germany, and Brazil respectively.

Chi-Square	
Critical Value	12.5915872
Chi-Square Test Statistic	23.6304246
p-Value	0.00061063
Reject the null hypothesis	

Table 8: *Chi-Square Results for Countries Currently Using RPA*

MARASCUILO TABLE			
Proportions	Absolute Differences	Critical Range	
| Group 1 - Group 2 |	0.112105263	0.267287824	Not significant
| Group 1 - Group 3 |	0.146865672	0.274567579	Not significant
| Group 1 - Group 4 |	0.030204082	0.252064713	Not significant
| Group 1 - Group 5 |	0.125263158	0.266481746	Not significant
| Group 1 - Group 6 |	0.198309859	0.25944748	Not significant
| Group 1 - Group 7 |	0.04173913	0.277423959	Not significant
| Group 2 - Group 3 |	0.034760408	0.289780835	Not significant
| Group 2 - Group 4 |	0.081901182	0.268555761	Not significant

| Group 2 - Group 5 |	0.013157895	0.282131349	Not significant
| Group 2 - Group 6 |	0.310415122	0.275496954	Significant
| Group 2 - Group 7 |	0.070366133	0.292488684	Not significant
| Group 3 - Group 4 |	0.11666159	0.275802051	Not significant
| Group 3 - Group 5 |	0.021602514	0.289037493	Not significant
| Group 3 - Group 6 |	0.345175531	0.282565296	Significant
| Group 3 - Group 7 |	0.105126541	0.299155821	Not significant
| Group 4 - Group 5 |	0.095059076	0.2677535	Not significant
| Group 4 - Group 6 |	0.228513941	0.260753544	Not significant
| Group 4 - Group 7 |	0.011535049	0.278645777	Not significant
| Group 5 - Group 6 |	0.323573017	0.274714965	Significant
| Group 5 - Group 7 |	0.083524027	0.291752242	Not significant
| Group 6 - Group 7 |	0.24004899	0.285341628	Not significant

Table 9: *Marascuilo Procedure for Countries Currently Using RPA*

Research Question 4:

Research Question 4: Is there a significant difference in RPA usage by employee sizes for business executives?

H_0: There is no significant difference between the employee sizes of the different business executives surveyed.

The Chi-Square Test for equality of proportions was used to determine if there was a significant difference between the various employee sizes of companies currently using RPA. The row variables consisted of the various employee sizes of companies currently using RPA

and the column variables were either Explorers/ Testers or Believers/ Trail Blazers. The Chi-Square Test Statistic was 19.09, which was greater than the critical value of 5.99. Therefore, the null hypothesis, H_0, was rejected. This indicates that at least one pair of proportions is significant. To determine which pairs of proportions are statistically significant the Marascuilo Procedure was used.

The Marascuilo Procedure found that the 250-999 employee size were the slowest company size in adopting RPA. This indicates that there is an overall higher proportion of Explorers/ Testers than Believers/ Trail Blazers in the company size of 250-999 employees. This conclusion was found by comparing the absolute difference between sample proportions with the critical range. Group one, employee size of 250-999, had a significant difference between groups two and three, employee sizes of 1,000-2,499 and 2,500-4,999 respectively. The difference between groups two and three is not significant, which indicates that both company sizes of 1,000-2,499 employees and 2,500-4,999 employees are adopting RPA at about the same rate, but overall faster than companies with 250-999 employees.

Chi-Square	
Critical Value	5.991464547
Chi-Square Test Statistic	19.08533651
p-Value	7.17252E-05
Reject the null hypothesis	

Table 10: *Chi-Square Results for Various Employee Sizes of Companies Currently Using RPA*

MARASCUILO TABLE			
Proportions	Absolute Differences	Critical Range	
| Group 1 – Group 2 |	0.165280334	0.119949494	Significant
| Group 1 – Group 3 |	0.219230769	0.128271044	Significant
| Group 2 – Group 3 |	0.053950436	0.127379899	Not significant

Table 11: *Marascuilo Procedure for Various Employee Sizes of Companies Currently Using RPA*

Research Question 5:

Research Question 5: Is there a significant difference in business functions currently using RPA?

H_0: There is no significant difference between the various business functions within companies currently using RPA.

The Chi-Square Test for equality of proportions was used to determine if there was a significant difference between the business functions of companies currently using RPA. The row variables consisted of the business functions of companies currently using RPA and the column variables were either Using RPA a great deal or Using RPA to some extent. The Chi-Square Test Statistic was 16.5, which was greater than the critical value of 9.49. Therefore, the null hypothesis, H_0, was rejected. This indicates that at least one pair of proportions is significant. To determine which pairs of proportions are statistically significant the Marascuilo Procedure was used.

The Marascuilo Procedure found that the business function of Finance/ Accounting was the business function that uses RPA the least. This indicates that there is an overall higher proportion of those only using RPA to some extent rather than using RPA a great deal in the Finance/ Accounting business function. This conclusion was found by comparing the absolute difference between sample proportions with the critical range. Group one, the Finance/ Accounting business function, did *not* have a significant difference between groups two through five.

Chi-Square	
Critical Value	9.487729037
Chi-Square Test Statistic	16.5005354
p-Value	0.002416065
Reject the null hypothesis	

Table 12: *Chi-Square Results for Business Functions of Companies Currently Using RPA*

MARASCUILO TABLE			
Proportions	Absolute Differences	Critical Range	
| Group 1 - Group 2 |	0.028242855	0.243174185	Not significant
| Group 1 - Group 3 |	0.106282475	0.242266298	Not significant
| Group 1 - Group 4 |	0.241215009	0.250306747	Not significant
| Group 1 - Group 5 |	0.200981394	0.255126098	Not significant
| Group 2 - Group 3 |	0.13452533	0.234314035	Not significant
| Group 2 - Group 4 |	0.269457864	0.242618167	Significant
| Group 2 - Group 5 |	0.229224249	0.247587224	Not significant
| Group 3 - Group 4 |	0.134932534	0.241708193	Not significant
| Group 3 - Group 5 |	0.094698919	0.246695579	Not significant
| Group 4 - Group 5 |	0.040233615	0.254596184	Not significant

Table 13: *Marascuilo Procedure for Business Functions of Companies Currently Using RPA*

Chapter 4: Summary, Conclusions, and Recommendations

The significance of RPA for accountants will be detailed in this final chapter. To reach a conclusion, a summary of the significant and noteworthy results from Chapter 3's analysis will be provided. Recommendations for readers interested in investing in RPA, accountants concerned by RPA, and recommendations for future research pertaining to RPA will also be discussed.

Summary of Results

First, the results from research question one, in regard to what business executives found to be most beneficial with RPA. Improving productivity was the overall most significant benefit of RPA while overall cost was not a benefit of RPA, indicating that most business executives found RPA expensive to implement. These results signify that RPA implementation is costly, however, it improves overall workplace productivity. This proves that RPA allows employees to focus on other necessary work activities by performing repetitive tasks.

Next, the results from research question two, in regard to what business executives found to be most challenging with RPA. The concern for company data security was the overall most significant challenge of RPA for most business executives. The least significant challenges that business executives found concerning were lack of control over what the robots were doing, the impact on employees' morale, and the documentation of workflows. These results signify a lack of trust with the overall security of company data; however, business executives are finding RPA trustworthy in some respects. They believe they have control over what the robots are doing, so while the robots are intended to work independently, the companies control what work the robots are producing.

Next, the results from research question three, which was in regard to countries currently using and adopting RPA. Japan and India are the slowest countries in adopting RPA, with Japan being the overall slowest in adoption. In Japan the overall higher proportion of users are Explorers/ Testers rather than Believers/ Trail Blazers. This indicates that while Japan is testing RPA, there are few who rely and believe in RPA. This could either allude to a lack of reliance in RPA or just not enough time to test RPA.

Next, the results from research question four, which was in regard to RPA usage by employee size for business executives. The company size that was slowest in adopting RPA was the companies with 250-999 employees. There was an overall higher proportion of Explorers/ Testers adopting RPA than Believers/ Trail Blazers. This result could indicate that smaller companies are either hesitant to adopt RPA or choosing to not adopt RPA at all.

Finally, the results from research question five, which was in regard to various business functions currently using RPA. The business function that uses RPA the least is Finance/ Accounting, which is a significant result for this research. This indicates a lack of reliance in RPA, or RPA is only useful in some aspects of finance and accounting procedures.

Conclusions and Recommendations

The implications of this study indicate several factors to consider when implementing RPA into a company. There are both advantages and disadvantages to implementing RPA as shown by this study. The major advantages of RPA is improving overall workforce productivity and larger companies with 1,000-4,999 employees are adopting RPA at faster rates. However, there are quite a few disadvantages. These disadvantages include the concern for security of data, the cost of implementation, and the slow adoption rates from Japan and smaller companies with

250-999 employees. The most significant result for this study was the business function of Finance/ Accounting using RPA the least.

First, an overall conclusion about the implementation of RPA will be discussed. For smaller companies with less cash to invest in software, RPA would need more testing and controls set in place in order to realistically implement RPA. While larger companies are implementing RPA at quicker rates, there is still the concern for security. Again, the recommendation of waiting for further testing and assessment of RPA should be used before implementation.

Next, a conclusion about the implementation of RPA for accountants. According to this research and according to the results of this survey, the overall business functions that used RPA the least were finance and accounting. This result comes from two potential areas, the lack of trust business executives has with the security of data, or RPA is useful for only certain parts of the accounting and finance procedures. The overall conclusion is that RPA is an uncertainty that needs more time to be developed as RPA is still relatively new.

Since RPA is still being developed, accountants should not feel an *immediate* threat by it. It is something to be aware of though, as it has the potential to become an everyday aspect of the accountants' lives. From this research, RPA seems to be more useful in other business functions such as IT/ Technology and Human Resources.

Recommendations for Future Research

Research on the development and progress of RPA needs to be performed by conducting another survey. RPA is constantly developing and improving, and more companies are implementing it into their workforce. In order for employers to reach a decision on implementation of RPA further studies and trial runs need to be performed. In order to receive

more accurate results a larger population is needed. The population chosen could either specifically pertain to accounting and finance or the population could cover a broader range, similar to the survey conducted by Softomotive. By conducting a survey with a larger population more precise recommendations can be provided about the effects of implementation.

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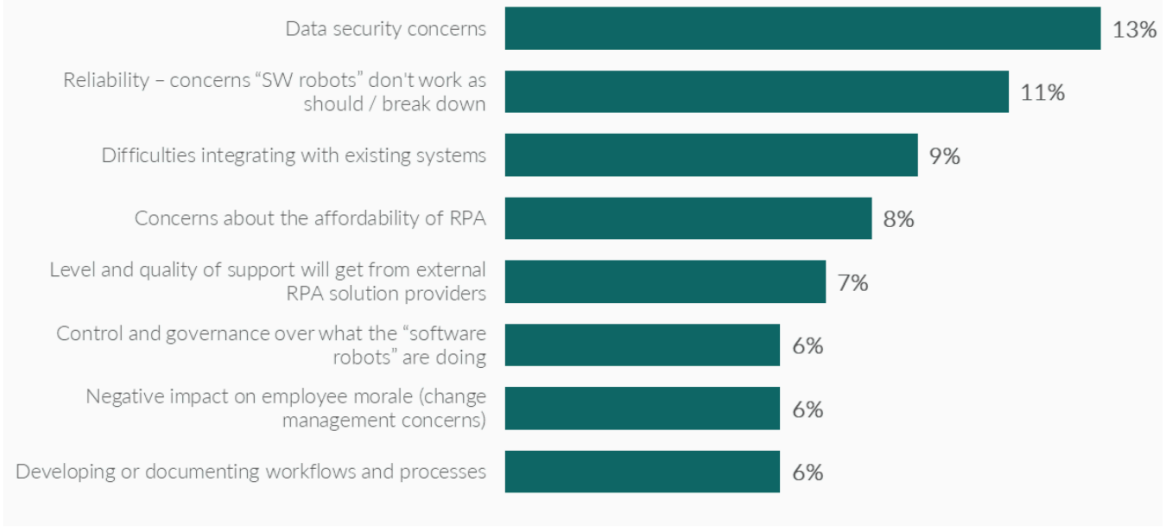
Appendix

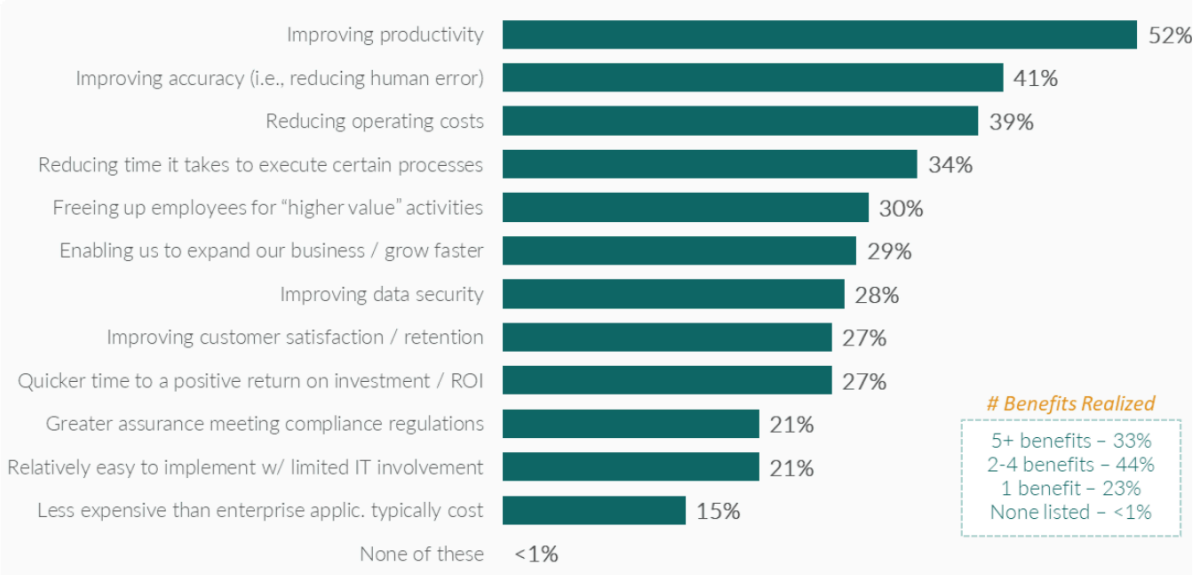
Figure 8: Most Significant Challenges Company Is / Anticipates Facing If Leveraging RPA



All other challenges were identified by 5% or fewer respondents

Source: "Softomotive Global Study 2018, RPA Solutions for Growth Companies"

Figure 4: Benefits Realized To Date As A Result Of Using RPA (Among Current RPA Users)



Source: "Softomotive Global Study 2018, RPA Solutions for Growth Companies"

Figure 9: Current RPA Usage

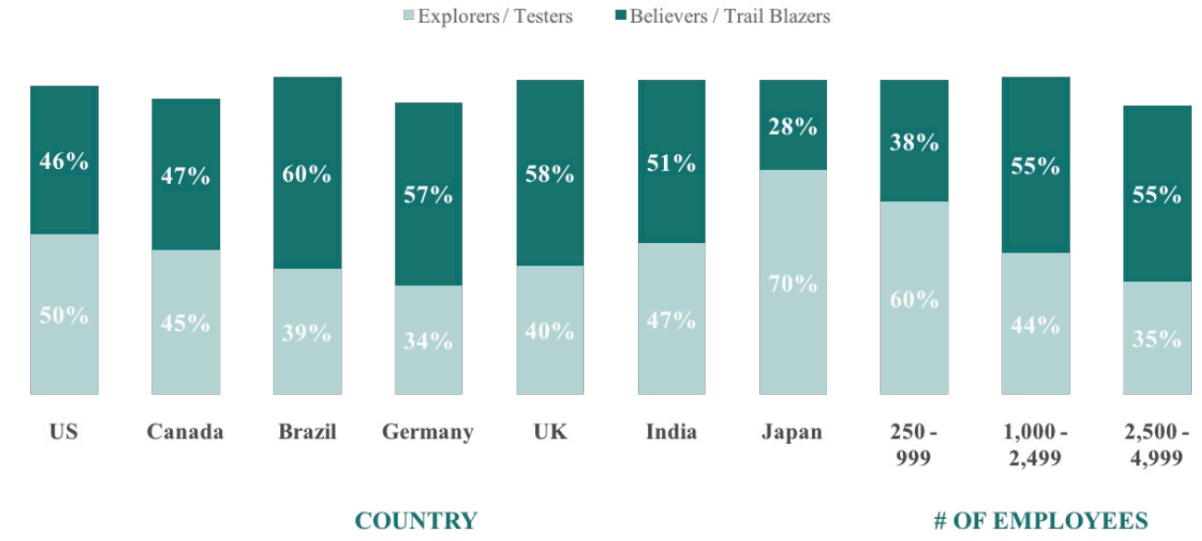


Figure 2: Extent Currently Using / Considering RPA