

# Accounting Automation: An Experimental Study

Oana Cristina Stoica<sup>1</sup> and Liliana Ionescu-Feleagă<sup>2</sup>

<sup>1)2)</sup> *The Bucharest University of Economic Studies, Romania*

E-mail: stoicaohana14@stud.ase.ro; E-mail: liliana.feleaga@cig.ase.ro

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**Abstract**

Accounting automation and especially robotic process automation (RPA) has received notable attention from researchers in the past few years. This technology is known as the use of software bots to perform rule-based tasks, which are normally performed by people, such as bookkeeping. Drawing on the theory of reasoned action (TRA) and changing management, the present paper investigates the accounting practitioners' behavior toward bookkeeping automation through RPA and the extent to which the work experience is a factor that influences this change. Data is collected through experimental cases, having accounting practitioners from Romania as participants. Results show that employees in the accounting sector are more open to automation in comparison to manually working, but the work experience is not an influential factor. Some of the explanations could be related to the respondents' age and the companies where participants perform their activities. The originality of the study comes from the method used which is rarely used at the level of accounting research, although it could provide objective findings and leaves no room for interpretation. Findings could be of interest to practice as it shows that accounting practitioners are not an obstacle to automation, instead, they are willing to embrace the digitalization changes.

**Keywords**

accounting, automation, RPA, work experience, experiment, Romania

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**Introduction**

Advance in technology is likely to change many jobs around world in the upcoming years and accounting jobs are not set aside of this discussion. According to World Economic Forum (2020) report, accounting, and bookkeeping jobs, among others, rank second in the ten redundant job categories that are likely to disappear due to automation in the future. RPA represents one of the new automation tools for accounting industry being a good substitute for people in performing repetitive and routine tasks (Deloitte, 2017a). Nowadays, large accounting companies adopt this technology for enhancing the efficiency and effectiveness (Cooper et al., 2019).

Although previous studies discuss about the implementation of RPA, about its impact on companies and how companies benefit from this change (Kokina and Blanchette, 2019, Cooper et al., 2019, Lacurezeanu et al., 2020), there are relatively few studies discussing the employees' opinion regarding this change and whether they are a driving factor (Gotthardt et al., 2020). Thus, the present paper contributes to accounting automation research by showing whether the accounting practitioners are willing to embrace the automation and whether the work experience is also a factor that influences this change. Using a case-based experiment with 2 x 2 between subjects and a full factorial design and drawing on the TRA and change management theory, this study seeks to answer the following research questions: *How does the accounting practitioner react to changes in the accounting field due to automation? To what extent the work experience of the accounting practitioner is a factor that influences this change?*

Findings show that accounting practitioners are more attracted by automation and feel more comfortable with it in comparison to manually working, but the work experience is not an influential factor. One of the reasons is related to the fact that participants in the present study are young or work in large companies where the environment encourages the automation and employees got already used to it. This research contributes to the accounting automation literature in the following ways. First, as stated above, there are relatively few studies regarding the role of accounting practitioner toward automation and their reaction to

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this change. Second, this study uses the experiment as a research method to see how accountants react to automation, while other studies use different methods such as case studies (Fernandez and Aman, 2018; Gotthardt et al., 2020) or interviews (Kokina and Blanchette, 2019).

The remainder of the paper is structured as follows. The first section gives an overview on the most recent studies about RPA and discusses the theory for developing the hypotheses. In the second section the methodology of the paper is presented, while the third section discusses the main results. In the last part, the main conclusions and limitations are presented as well as implications and directions for future research.

## **1. Review of the scientific literature**

### **1.1. Backgrounds**

A relatively new trend in accounting automation is RPA which represents the use of software bots to execute, in an automated manner, tasks that are normally performed by people. This enables a faster handling time, less errors, lower costs, and processes higher volume of data (Deloitte, 2017b). Also, RPA can improve the total business value, helps in obtaining a greater service quality and improves employees' satisfaction and motivation (Dumitru and Stănculescu, 2020). With respect to accountants' jobs, Kokina and Blanchette (2019) found that repetitive, labor intensive, rule-based and high-volume tasks that use structured data and more than one system are appropriate for RPA implementation. Lacurezeanu et al. (2020) highlights in their review regarding RPA in auditing and accounting tasks that are suitable for RPA implementation. Among them, can be recalled the acquisition of inventories and their payments, month closing and reporting, the management of accounts payable and accounts receivable, suppliers, customers, creditors, debtors' accounting, raising the invoices, invoice receiving, approving, validating, and making payments, processing database updates, issuing payment notes, etc.

Many studies in the last few years focus on RPA and its impact on accounting jobs. As an example, Kokina and Blanchette (2019) state that there is a lot of uncertainty with regards to accountants' jobs due to automation and it can potentially bring the practitioners into non-accounting functions. Other studies suggest that, as the robots are taking humans' place in performing routine and repetitive tasks, it is expected for accountants to lose their jobs in the nearest future (Auerswald, 2012; Frey and Osborne, 2017). Some authors may suggest that humans could be thought as an obstacle for the accounting industry growth (Tschakert et al., 2016) because employees are afraid that they may lose their jobs due to RPA implementation (Gotthardt et al., 2020). On the other hand, Cooper et al. (2019) found that, according to the opinion of lower-level employees in Big 4 accounting firms, RPA has a positive influence on changing the work performed by them and improves their career prospects.

### **1.2. Theory and hypotheses development**

Over time, researchers have developed many theories regarding people's technology acceptance such as TRA, theory of planned behavior, theory of interpersonal behavior, technology acceptance model, extended technology acceptance model, Igbaria's model, social cognitive theory, diffusion of innovations theory, perceived characteristics of innovating theory, motivational model (Taherdoost, 2018). The theory that best suits the present study is TRA which was developed by Fishbein and Ajzen (1975) and it has been developed to study the behaviors of individuals based on the impact of attitude. According to TRA, an individual's intention to engage in a certain behavior best foretells whether the individual engages in the respective behavior, while intentions are predicted by subjective attitudes and norms. The attitude toward behavior represents a positive or negative feeling of an individual for performing a certain behavior, whilst the subjective norm refers to the perception of the individual that people around him consider that he should or not perform that behavior. In this paper's case, if the accountant practitioner has a positive feeling about automation, he will be more attracted and comfortable with it and vice versa. Also, if he thinks that people important to him believe that he should accept the automation, he will be more attracted and more comfortable with it and vice versa.

Another theory that suits this study is the change management. In conformity with Burdus (2000), people resistance to change could be explained by several reasons such as selective attention and memory, employee habits, addiction to other people's opinions, fear of the unknown, economic reasoning and lack of security. In this study employee habits will be explained more to show whether the work experience is a factor that could drive the change. Organizational changes that demand changes in employees' habits shall be met with resistance having that any change in personal habits needs effort and make people exit from their comfort zone Burdus (2000). This makes us understand that the more a person is used with a certain way of doing the work, the more difficult is for that person to change it. Habit narrows the predictive power of intention on usage behavior given that past behaviors could have a significant influence on continued usage (Limayem et al., 2007). If this is the case, it is expected that employees with less work experience

will be more attracted by automation and will feel more comfortable with it comparing with high experienced employees. Therefore, the three hypotheses are stated in alternative form as follows.

**H1:** *Automation of bookkeeping increases the level of attractiveness and comfortability for accounting practitioners.*

**H2:** *Less work experience increases the level of attractiveness and comfortability of accounting practitioners for automation.*

**H3:** *There is an interaction effect such that the positive effect of bookkeeping automation on attractiveness and comfortability is stronger for practitioners with less work experience.*

## 2. Research methodology

### 2.1. Design

In doing the research, a case-based experiment method with 2x2 between subjects and full factorial design has been chosen. Pontiggia and Virili (2010) and Tadesse and Murthy (2018) also used experimental methods in technology related studies. The four possible cases of the research are presented in the *Figure 1*. Study participants have been randomly assigned to one of the experimental groups. The variable that was manipulated was automation of the bookkeeping process and it has been operationalized through its presence or absence in the case-scenarios.

2x2 Design		Accountant's experience	
		Low	High
Automation	Yes	Low experience and automation	High experience and automation
	No	Low experience and no automation	High experience and no automation

**Figure no. 1. Factorial design**

*Source: Authors' own research.*

In conducting the study, two hypothetical cases related to management decision about RPA implementation on the bookkeeping process automation have been created. In the first instance, the management decides to automate the bookkeeping process and in the second one the management decides not to do it for at least two or three years.

The dependent variable of the study is represented by the level of *Attractiveness* or *Comfortability* of the accounting practitioner toward the given case (automation or manually working). The two independent variables are *Automation*, which is the manipulated variable, and *Accountant's work experience*. The idea of the study is to find out whether the accounting practitioner is more attracted and feel more comfortable with automation and whether this result is higher for less experienced accountants.

### 2.2. Participants

Study participants are employees working in accounting companies in Romania. This country has been chosen having that it is placed among the last countries in the European Digital Economy according to the European Commission study (2020) and the authors wanted to find out to what extent this matter is also valid at the accounting practitioners' level. The process of collecting the data was done during January – February 2021 and the participants were retrieved from the top accounting companies in Romania by turnover using the site "Top Firme". Subsequently the authors searched for a contact person in each company and sent the link for the participation via e-mail, asking the respective person to share it among the employees in the accounting and bookkeeping department. After one week of waiting, the number of responses was only 22 and a second e-mail was sent. After another one week, the number of participants increased with 34. To gain more observations for the study, the sample of companies has been extended with another 10 and the authors followed the same procedure. The companies are presented in the Appendix 1. Two weeks later, the total number of observations reached to 148. From the total sample, we removed 37 observations due to incompleteness, and the final sample consisted in 111 observations.

The population distribution on demographics is shown in *Table 1* below. From the total number of 111 observations, 81.1% were female participants while 18.9% were male participants. The situation is not surprisingly given that in Romania the accounting profession is mostly performed by women (Istrate, 2012) in comparison with more developed European countries where accounting is a male profession. The highest percentage of the participants is given by the participants between 25 and 30 years old (38.7%) and the

lowest one is given by the participants over 45 years old (8.1%). 79 participants (71.2%) finished their Master studies, 28 participants (22%) finished their Bachelor studies and only 4 participants (3.6%) finished their PhD studies. Furthermore, 54.1% of the participants were working in a multinational company and the remaining 40.2% of the participants were working in a Romanian company. Moreover, with regards to the professional certification, only 36.9% owe one, and the remaining part of 63.1% not.

**Table no. 1. Population distribution by demographics**

Gender		Age		Level of studies		Company type		Certification						
n	%	n	%	n	%	n	%	n	%					
f	90	81.1	< 25	20	18.0	Bachelor	28	25.2	M	60	54.1	Y	41	36.9
m	21	18.9	> 45	9	8.1	Master	79	71.2	R	51	45.9	N	70	63.1
			25 - 30	43	38.7	PhD	4	3.6						
			30 - 35	16	14.4									
			35 - 40	11	9.9									
			40 - 45	12	10.8									
Σ	111	100	Σ	111	100	Σ	111	100	Σ	111	100	Σ	111	100

*Source: Authors' own research.*

Where:

- f – Female
- m – Male
- M – Multinational
- N - No
- R – Romanian
- Y – Yes

### 2.3. Tasks

The experiment was created on Qualtrics with two different blocks randomized for having an equal number of participants for each of the two cases. The average time for filling in the questions was about 4 minutes excepting the outliers. The case consisted in three main parts. In the first part, participants were given few demographic questions such as gender, work experience age, level of studies, professional certifications, whether they work in Romanian or multinational company. The question about work experience was one of the most important having that the study seeks to find out whether there is a difference in technology acceptance between less experienced and more experienced accountants. On this respect the sample was split in two groups depending on the work experience using the median, thus obtaining a relatively equal number of observations.

In the second part of the experiment, participants were given a hypothetical case about a Romanian accounting company, where management decides to automate the bookkeeping process by using RPA, in the first case, and to not do it in the second case. Each participant had to read only the case that they were assigned to. After reading the case, respondents had to answer two questions on a 5-points Likert scale based on it. In the first instance, they were asked how attracted they are by that company, assuming they are taking into consideration a position there, and in the second instance they were asked how comfortable they feel with the management's decision, assuming they already work for that company.

The last part of the experiment was represented by the manipulation checks which were necessary to see if participants understood the case and the answers were based on it. The question was whether, in the case, management's decision was to automate or not the bookkeeping process using RPA.

## 3. Results and discussions

### 3.1. Main results

Table 2 shows the descriptive statistics for the analyzed variables on each experimental group, first for the dependent variable *Attractiveness* and second, for the dependent variable *Comfortability*. As shown, overall, participants are more attracted by automation ( $M = 3.88$ ;  $SD = 1.07$ ) in comparison with manually working ( $M = 2.77$ ;  $SD = 1.05$ ), but further analyses are needed to find out the significance of these results. Furthermore, less experienced accountants are more attracted by automation ( $M = 3.92$ ;  $SD = 1.04$ ) than manually working ( $M = 2.78$ ;  $SD = 0.94$ ), but also, high experienced accountants are more attracted by automation ( $M = 3.83$ ;  $SD = 1.13$ ) than manually working ( $M = 2.77$ ;  $SD = 1.17$ ).

**Table no. 2. Descriptive statistics**

<i>Panel A. Dependent Variable: Attractiveness (mean [SD])</i>						
<b>Automation</b>	<b>n</b>	<b>High experience</b>	<b>n</b>	<b>Low experience</b>	<b>n</b>	<b>Σ</b>
No	30	2.77 (1.17)	32	2.78 (0.94)	62	2.77 (1.05)
Yes	24	3.83 (1.13)	25	3.92 (1.04)	49	3.88 (1.07)
Σ	54	3.24 (1.13)	57	3.28 (1.13)	111	3.26 (1.19)

  

<i>Panel B. Dependent Variable: Comfortability (mean [SD])</i>						
<b>Automation</b>	<b>n</b>	<b>High experience</b>	<b>n</b>	<b>Low experience</b>	<b>n</b>	<b>Σ</b>
No	30	2.70 (1.09)	32	2.75 (0.98)	62	2.73 (1.03)
Yes	24	4.00 (1.10)	25	3.96 (1.06)	49	3.98 (1.07)
Σ	54	3.28 (1.27)	57	3.28 (1.22)	111	3.28 (1.22)

Source: Authors' own research.

When it comes to comfortability, the results for the accountants with a longer work experience show to be lower in the case of no automation (M = 2.70; SD = 1.09) than for automation (M = 4.00; SD = 0.10). In the case of less experienced accountants, the situation looks similar, in the sense that, they tend to feel more comfortable with automation (M = 3.96; SD = 1.06) compared to manually working (M = 2.75; SD = 0.98). Overall, accountants feel more comfortable with automation (M = 3.98; SD = 1.07) than manually working for the bookkeeping process (M = 2.73; SD = 1.03). As well as in the previous case, further analyses are needed to conclude the findings.

**Table no. 3: Hypotheses testing**

<i>Panel A. Results of ANOVA on dependent variable Attractiveness</i>					
<b>Source</b>	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Corrected Model	33.444	3	11.148	7.553	.000
Automaton	27.504	1	27.504	20.997	.000
Experience	.124	1	.124	.738	.742
Automation * Experience	.001	1	.001	.967	.978
Error	121.980	107	1.140		

  

<i>Panel B. Results of ANOVA on dependent variable Comfortability</i>					
<b>Source</b>	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Corrected Model	43.082	3	14.361	12.884	.000
Automation	43.078	1	43.078	38.649	.000
Experience	.001	1	.001	.001	.980
Automation * Experience	.055	1	.055	.050	.824
Error	119.260	107	1.115		

Source: Authors' own research.

Table 3 displays the ANOVA results for both analyses, first on *Attractiveness* and then on *Comfortability* as dependent variables. The results indicate that, overall, accountants put automation in front of manually working and the result is statistically significant (p-value < .01), thus, providing evidence for the first hypothesis for both dependent variables. Furthermore, the results regarding the work experience were not statistically significant, neither in terms of attractiveness (p-value = .742), nor in terms of comfortability (p-value = .980) and therefore, the second hypothesis needs to be rejected. Also, the level of interaction between automation and experience provides no statistical evidence for both attractiveness (p-value = 0.978) and comfortability (p-value = 0.824), thus, the third hypothesis is rejected as well.

### 3.2. Analysis of the manipulation checks

As discussed in the previous section, after filling in the study related questions, respondents had to answer on whether the management in the given case decided or not to automate the bookkeeping process. To provide stronger results to the present study, the authors removed the manipulation checks failures, and the final sample consisted in 86 respondents.

Table 4 displays the descriptive statistics for the analyzed variables on each experimental group, first for the dependent variable *Attractiveness* and second, for the dependent variable *Comfortability* after excluding the manipulation checks failures from the sample. Overall, accounting practitioners are more attracted by automation (M = 3.95; SD = 1.01) comparing to manually working (M = 2.52; SD = 1.00). Moreover, less experienced accountants show to be more attracted by automation (M = 4.00; SD = 0.86) than manually working (M = 2.40; SD = 0.82) and the results are similar in the case of high experienced accountants. As shown in the table, high experienced practitioners are more attracted by automation (M = 3.91; SD = 1.15) than manually working (M = 2.62; SD = 1.14).

**Table no. 4: Descriptive statistics excluding manipulation failures**

<i>Panel A. Dependent Variable: Attractiveness (mean [SD])</i>						
<b>Automation</b>	<b>n</b>	<b>High experience</b>	<b>n</b>	<b>Low experience</b>	<b>n</b>	<b>Σ</b>
No	24	2.62 (1.14)	20	2.40 (0.82)	44	2.52 (1.00)
Yes	22	3.91 (1.15)	20	4.00 (0.86)	42	3.95 (1.01)
Σ	46	3.24 (1.30)	40	3.20 (1.60)	86	3.22 (1.23)

  

<i>Panel B. Dependent Variable: Comfortability (mean [SD])</i>						
<b>Automation</b>	<b>n</b>	<b>High experience</b>	<b>n</b>	<b>Low experience</b>	<b>n</b>	<b>Σ</b>
No	24	2.63 (1.06)	20	2.40 (0.75)	44	2.52 (0.93)
Yes	22	4.00 (1.11)	20	4.05 (1.05)	42	4.02 (1.07)
Σ	46	3.28 (1.27)	40	3.22 (1.23)	86	3.26 (1.25)

Source: Authors' own research.

In relation to comfortability, the results for the practitioners with a longer work experience is lower in the case of no automation (M = 2.63; SD = 1.06) than for automation (M = 4.00; SD = 1.11). In the case of less experienced accountants, the situation looks similar, in the sense that, they tend to feel more comfortable with automation (M = 4.05; SD = 1.05) compared to manually working (M = 2.40; SD = 0.75). Overall, results show that accounting practitioners feel more comfortable with automation (M = 4.02; SD = 1.07) than manually working (M = 2.52; SD = 0.93).

**Table no. 5: Hypotheses testing excluding manipulation failures**

<i>Panel A. Results of ANOVA on dependent variable Attractiveness</i>					
<b>Source</b>	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Corrected Model	44.559	3	14.853	14.458	.000
Automaton	44.452	1	44.452	43.269	.000
Experience	.096	1	.096	.094	.761
Automation * Experience	.533	1	.533	.519	.473
Error	84.243	82	1.027		

  

<i>Panel B. Results of ANOVA on dependent variable Comfortability</i>					
<b>Source</b>	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Corrected Model	48.997	3	16.332	16.063	.000
Automation	48.902	1	48.902	48.096	.000
Experience	.164	1	.164	.161	.689
Automation * Experience	.404	1	.404	.397	.530
Error	83.375	82	1.017		

Source: Authors' own research.

Table 5 shows the ANOVA results for both analyses, first on *Attractiveness* and then on *Comfortability* as dependent variables after eliminating the manipulation checks failures from the sample. The results indicate that, overall, accountants are more attracted by automation and feel more comfortable with it in comparison to manually working and the result is statistically significant (p-value < .01), providing support for the first hypothesis. More than that, results regarding the work experience did not show to be statistically significant, neither in terms of attractiveness (p-value = .761), nor in terms of comfortability (p-value = .689) and rejects the second hypothesis. Furthermore, the level of interaction between automation and experience provides no statistical evidence for both attractiveness (p-value = 0.473) and comfortability (p-value = 0.530), and the third hypothesis needs to be rejected as well.

## Conclusions

This study has investigated whether the accountants' behavior and their work experience are factors that influence the automation pace for bookkeeping processes by using RPA. In conducting the study, an experimental method with 2 x 2 between subjects and full factorial design has been used. Findings show that accounting practitioners are more attracted by automation than manually working and feel more comfortable with it. The results could be interpreted in line with the (Fishbein and Ajzen (1975)'s theory of reasoned action. Employees in the accounting field have a positive attitude toward the using of automation tools and they believe that people important to them think that they should use it.

Furthermore, there was no statistical evidence for the work experience factor. Although less experienced accountants are more attracted by automation and feel more comfortable with it than manually working, the results for high experienced accountants turned out to be similar. Even though past behaviors could have a significant influence on continued usage (Limayem et al, 2007) and it was expected for employees with more work experience to be more reticent to automation, an explanation could be related to the fact that participants in the present study are young and work in big companies where automation is already put

in place. Young generation of accountants represents the millennial generation (White et al. (2020) and it has as a defining characteristic which is the affinity to the digital world (PwC, 2020). Also, an interaction effect between automation and work experience factor was not found.

This paper contributes to accounting automation literature as follows. First, previous studies discuss automation and digitalization in general from different perspectives, such as companies (Kokina and Blanchette, 2019, Cooper et al., 2020, Lacurezeanu et al., 2020), professional regulation (Troshani et al., 2018), accounting education (Vincent et al., 2020; Novak et al., 2021), while the present study discusses it from the accounting practitioners' perspective. Second, this paper uses an experimental method, whilst previous studies in accounting automation field use methods as interviews Kokina and Blanchette (2019) or case studies (Fernandez and Aman, 2018; Gotthardt et al., 2020).

The present study should be of interest for companies as it shows the accounting practitioners' willingness toward the use of automation regardless their work experience in the accounting field. Also, the results could be of interest for researchers as it tries a different method which is rarely used in accounting and especially in Romania. Its analysis is objective and leaves no interpretation room. The results of the study should be taken in line with some limitations. First, as stated above, participants are young and work in large accounting firms. Future studies could extend the study on older accountants and small companies. Second, this paper uses Romania as a study context, and it would be interesting to find out how accountants in other countries behave to automation and whether there are differences between countries at the level of accounting practitioners.

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## Appendix 1

### Top companies

Ref. no	Company name
1	ERNST AND YOUNG
2	PRICEWATERHOUSECOOPERS
3	KPMG
4	DELOITTE
5	BDO
6	MAZARS
7	TMF ROMANIA SRL
8	Fin Expert Consulting SRL
9	VULPOI & TOADER MANAGEMENT SRL
10	TPA
11	ROEDL AND PARTNERS
12	SOTER SRL
13	CONTEXPERT CONSULTING SRL
14	BOSCOLO AND PARTNERS CONSULTING SRL
15	RSM ROMANIA
16	ACCACE OUTSOURCING
17	TAXHOUSE SRL
18	NESTOR NESTOR DICULESCU KINGSTON PETERSEN CONSULTANTA FISCALA SRL
19	NOERR FINANCE AND TAX
20	APEX TEAM INTERNATIONAL SRL

*Source: authors' processing using <https://www.topfirme.com/caen/6920/cifra-de-afaceri/>*