End-user satisfaction as a result of RPA - a finance and accounting perspective

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ABSTRACT,

This research explores the effect of robotic process automation on end-user satisfaction with a focus on accounting and finance professionals. RPA technology is recently gaining a lot of attention from both academia and companies. Literature review suggested that limited research is done on the social-cultural implications of automation like end-user satisfaction. In order to fill this existing gap in the literature this paper investigated four predictor variables of end-user satisfaction. Perceived usefulness, perceived ease of use, user involvement in system development and perceived organizational support constructs are investigated for their impact on the satisfaction of RPA end-users. The study made use of primary data collected via an online survey (N=30), targeting finance and accounting professionals. The data was analyzed using factor analysis and multiple linear regression in order to arrive at a prediction model. It was found that all four predictors had positive relationship with end-user satisfaction, however only Perceived ease of use and perceived organizational support had statistically significant impact on the outcome variable. The main implication for RPA solution providers is to focus their efforts on the ease of use of their product as it has the biggest contribution to end-user satisfaction.

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Keywords

Robotic process automation, knowledge workers, accounting, finance, end-user satisfaction

1. INTRODUCTION

Automation has been around us whether we realize it or not, from the first printing process to virtual assistants like Alexa automation has always been evolving. The International society of automation defines the concept as “the creation and application of technology to monitor and control the production and delivery of products and services” (ISA, n.d.). There are many studies that have been done regarding automation of easy and repetitive tasks, these studies focus on how machines and robots substitute low and medium skill workers (Goos et al., 2009; Acemoglu & Restrepo, 2017). Recent developments in automation technologies like artificial intelligence, machine learning, optical character recognition however lay the foundation for “intelligent automation”. Schatsky (2014) defines the concept of what? as “systems that sense and synthesize vast amounts of information and can automate entire processes or workflows”. These systems are capable of “collecting, analyzing, and making decisions about textual information” (Schatsky, 2014). These improvements laid the foundations for a new branch of business process automation namely robotic process automation (RPA). These RPA solutions if implemented properly can automate more complex business processes like storing, migrating and entry of data, invoice processing and more that were previously done manually by knowledge workers (Dilmegani, 2017). At this stage RPA solutions cannot completely substitute a knowledge worker; they are still not mature enough to operate autonomously and currently have a complementary effect on educated work. RPA solutions at their core resemble virtual employees that need to be programmed and instructed as to what exactly to do. These types of new developments may be the reason why, it is projected that for 25% of workers, about sixty to seventy percent of everyday activities performed would change dramatically because of automation. (OECD,2016).

Syed et al. (2020) identified contemporary challenges with the implementation of RPA systems amongst those were the socio-cultural implications, like user satisfaction. Therefore, it is important to understand how these robotic processes in the workplace will affect end-user satisfaction (EUS), so both public and private enterprises could start managing the inevitable transition towards automation. Statistics provided by Bhatt (2019) suggest that between 30 and 50 % of RPA projects fail. The reasons why RPA implementations fail are many, however providers and researchers agree that one important factor is the stakeholder buy-in (Xenith, 2020: Willcocks et al., 2019). According to a survey conducted on areas most affected by RPA business leaders point to finance and accounting processes (Raconteur, 2019). This is why RPA solutions and the satisfaction of their end users in the finance and accounting industry (knowledge workers) will be the main focus of this paper.

There has recently been a lot of "hype" surrounding RPA solutions, which is due in part to the impressive results of numerous public and private sector enterprises (Dilmegani, 2019). RPA is becoming an important subject for academic study, Figure 1 shows the increasing presence of this technology in publications papers through years 2012 to 2018, each number representing one paper that has “RPA” in the title. (Ivančić et al. 2019, Santos et al. 2019).

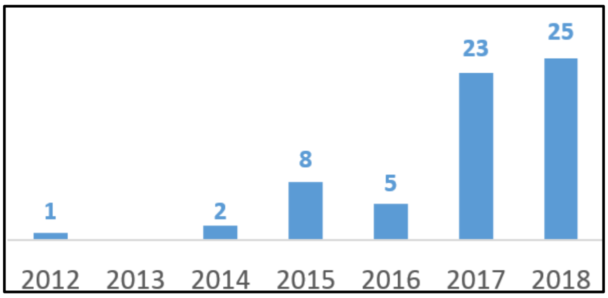

Figure 1. Number of RPA papers

Despite its increased attention in academics, RPA has gained importance in the general public as represented in google trends. Figure 2 shows the chart represents the search interest relative to the highest point in time. A value of 100 corresponds to peak popularity and a value of 50 means the technology was half as popular.

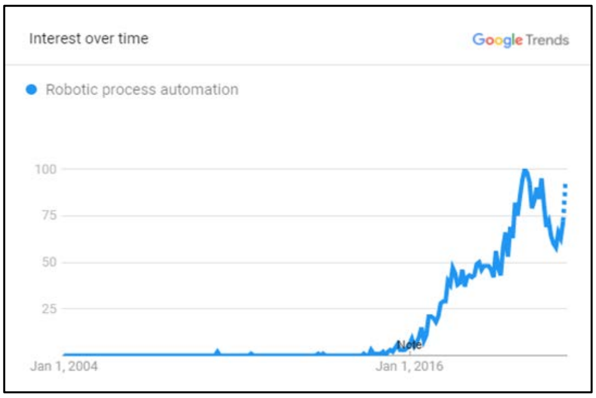

Figure 2. Trend of RPA searches on Google

As can be seen from Figure 2, the searches for RPA technology are increasing rapidly, while at the same time the popularity of RPA in academia is increasing as well. Those two figures point to the growing importance of this technology.

Nevertheless, the marketing of RPA software is centered on increasing a company's overall efficiency, productivity, and success. However, employees of companies implementing RPA solutions are rarely considered in marketing, and there appears to be virtually no consequence for employees. The social factors, which are also present in RPA, are one of the most difficult challenges for successful automation projects (Hindel et al. 2020). The problem is much more urgent in sectors such as finance and accounting, where RPA will simplify 42 percent of internal activities and mostly another 12 percent (Plaschke et al. 2018). Furthermore, the global forecast for financial services indicates that the banking system will be digitized, and will have a major impact on finance and accounting. This will result in thousands of closing divisions and downsizing (Kreger & Zaikovska, 2020). Furthermore, Frey and Osborne (2013) predict that the odds of automating bookkeeping, accounting, and auditing, credit analysts in their work on job computerizations are 98 percent. All of these elements, taken together, make a compelling case for more study in this field.

The aim of this paper is to shed light on the issue of end user satisfaction with RPA in the finance and accounting industries, as well as to create a baseline for future research into the subject. Furthermore, portions of an emerging scientific framework for measuring user satisfaction will be included in this study. This study may help to verify or expand the structure. In practice, if proven reliable, RPA providers may use the questionnaire used in this analysis to continually assess and enhance their customer satisfaction levels. Companies who plan to adopt or are in the process of implementing the RPA solutions will gain a greater understanding of how their workers may feel about the transformation and use the findings of this research to help them through the transition.

The prime aim of this paper is to determine how the use of RPA technology impacts the satisfaction of finance and accounting practitioners (end-user satisfaction) and to determine the actual level of satisfaction with this technology. As previously said, RPA will only simplify some aspects of the finance and accounting processes. Furthermore, since RPA lacks the ability to use people's cognitive potential or to consider logically that they are an individual, it is common to see semi-automation in the workplace (Servion, 2021). However, since this requires humans and autonomous machines to collaborate, it is important to consider the satisfaction levels of knowledge-workers. To do this, the following key questions must be answered:

How does RPA affect the end-user satisfaction amongst finance and accounting practitioners?

In order to accomplish the above research objectives, this work is organized as follows. Section two includes a review of current RPA literature, technological adoption and IS user satisfaction. Hypotheses are also built in this segment to better address the research's reaction. In Section Three, a theoretical structure focused on recent literature would be addressed for the particular case of user satisfaction with RPA in the financial and accounting industries. The fourth section will go into the analysis type, how data is collected and evaluated, the analytical tools, and the rationale behind these approaches. Section five presents the analysis findings in a sequential order. Graphs and tables are used to explain the conclusions. Section 6 summarizes the main conclusions, explanations of those findings, and ramifications. There will also be limitations and recommendations. Section 7 or the conclusion has a concise explanation, a synopsis, and an outline. This segment ends with a presentation of the information that adds to the scholarly literature. Section five presents the analysis findings in a sequential order.

2. LITERATURE REVIEW

2.1 RPA – robotic process automation

According to the Institute of robotic process automation and artificial intelligence (IRPAAI, 2021) RPA is “the application of technology that allows employees in a company to configure computer software or a “robot” to capture and interpret existing applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems”. This technology is designed to execute digital tasks that are often repetitive in nature; Davenport & Kirby (2016) classify them as repeated task automation. To fully understand why this technology has gained popularity so quickly a look into its advantages and disadvantages is necessary.

2.1.1 RPA advantages

Perhaps the biggest advantage of RPA is the robot’s “tirelessness”. It works faster, more efficiently and with better quality results. According to Fersht & Slaby (2012) a robot typically replaces up to 1.7 of his human colleagues. This allows for a substantial amount of cost savings. For example, Xchanging a company in the business process outsourcing industry automated 14 of its core processes and averaged a 30% cost savings on each one (Willcocks et al., 2015). The low learning curve is a general advantage for all robotic process automation practitioners as it focuses on simpler user interfaces (Anagnoste, 2017). Like mentioned earlier this new technology aims at automating repetitive tasks that take up most of employee time, for practitioners this means processes such as accounting, accounts payable and receivables, financial planning and analysis and payroll (Plaschke et al., 2018). This leads to better utilization of employee capabilities for high value and strategic tasks like conducting forecasts, business development and managing external relations.

2.1.2 RPA challenges

Despite the abundance of benefits reported by literature, disadvantages are also present. The lack of intellectual capacity in the digital worker only allows for automation of processes that are rules-based (Asatiani & Penttinen, 2016). If a process is not completely done by the RPA and requires human input this increases the process complexity (Alberth & Mattern, 2017). Another implication of the lack of cognitive capacity in RPA robots is that they cannot adapt well. This has a direct impact on workers since they will need to repair or monitor them, or in the case of a failure to be able to fix it (Alberth & Mattern, 2017). This creation of new tasks for employees may be counterintuitive to one of the major selling points of RPA, namely the elimination of repetitive tasks so workers can focus on more valuable tasks.

The robotic automation process industry also faces challenges that are yet to be solved. One of RPA's most significant benefits, the faster processing times could sometimes be a downside if not programmed correctly. This can lead to the robot making mistakes faster (Kirchmer, 2017). When it comes to implementing any technological innovations a new mindset as well as a new skill set is required. RPA is no exception as it needs to be maintained regularly in order to work properly and also reviewed from time to time to make sure that it runs efficiently. This maintenance could pose a big challenge for companies (Stople et al.,2017). Kirchmer (2017) also points out that a challenge will be the wide access robots have in order to automate tasks. This could from a security perspective pose even a threat to a company reputation.

Regardless of the benefits and drawbacks, RPA implementation is still not easy. As mentioned earlier between 30 and 50 % of the initial RPA projects fail. To battle these overwhelming failure rates companies should look into better project management techniques and focus more on the critical success factors (CSF). Amongst those CSF are user satisfaction, user acceptance, user involvement and organizational support. Those four factors are explained in detail in the following sections.

2.2 End-user satisfaction

In simple terms end-user satisfaction is defined as the attitude of a person in his/her working environment towards an information system. In their research on end-user computing satisfaction (EUCS) Doll & Torkzadeh (1988) conceptualized it “as the affective attitude towards a specific computer application by someone who interacts with the application directly” (p. 261). End-user satisfaction is a generic term for measuring satisfaction with a host of technologies. DeLone & McLean (2002) concluded that end-user satisfaction (EUS) is a crucial indicator of effective technology execution in enterprises. In their meta-analysis. Mahmood et al. (2000) conducted research investigating forty-five empirical studies about variables that affect information technology end-user satisfaction, they identified nine variables and grouped them into three categories: perceived benefit and expectations (PBE), organizational support and encouragement (OSE), user background and involvement (UBI). This research however is limited in time, scope and therefore only some of the variables presented by Mahmood et al. (2000) can be investigated properly. The independent variables that are chosen to be investigated in this research are theorized to have the biggest impact on the satisfaction of the end-user. The following segments will clarify all the variables that will be used to measure End-user Satisfaction in this study.

2.2.1 Perceived usefulness and perceived ease of use

Perceived usefulness (PU) and perceived ease of use (PEOU) are the integral components of the Technology acceptance model (TAM) which is a theoretical framework developed by Davis (1985). The TAM is an extension of Fishbein and Ajzen (1975) theory of reasoned action (TRA), arguably the most widely applied model of users' acceptance and usage of technology (Venkatesh & Davis, 2000). According to Davis (1993) perceived usefulness is a perception of an individual employee that using the new technology will enhance or improve her/his performance. Additionally, Jahangir & Begum (2008) suggest that PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance". PEOU is defined by Davis (1989) as "the degree to which a person believes that using a particular system would be free from effort" (p. 320). Legris et al. (2003) investigated the use cases of TAM in literature and grouped them into 3 categories: office automation, software development, and business application. As mentioned earlier RPA combines automation of business processes and we can safely say that variables of TAM can be used for the purpose of this research. However, TAM is also widely criticized by researchers. Legris et al. (2003) argued that "the model (TAM) hardly explains more than 40% of the variance in use" (p. 192). Later an extension of the TAM model was formulated by Venkatesh et al. (2003) – Unified theory of acceptance and use of technology (UTAUT), which explained as much as 70% of the variance in intention of using technology. In this new extended framework PU and PEOU are also integral parts. Apart from predicting user intention to adopt technology the TAM has also been used to predict information technology user satisfaction (Park et al.,2012; Jahangir & Begum, 2008; Panner, 2017, Lee et al., 1995). Taking into consideration this information the following hypotheses are going to be tested to help with the answering of the research questions:

H1: Perceived usefulness has a positive impact on end-user satisfaction.

H2: Perceived ease of use has a positive impact on end-user satisfaction.

2.2.2 User involvement in system development

User involvement (UI) is said to be "one of the essential principles of information systems development" (Doll & Torkzadeh, 1990, p.339; Senn, 1978). According to Ives & Olson (1984) "User involvement refers to participation in the system development process by representatives of the target user group" (p.587). Two relevant theories from Organizational Behavior that are considered to be the foundation of user involvement are participative decision making (PDM) and planned organizational change (POC). Ives & Olson (1984) argued that predicted outcomes of UI and those two theories have strong parallels. PDM relates to employees having a participative function when it comes to management decision making regarding their jobs. PDM benefits are increased satisfaction and productivity. POC theory considers the quality of the implementation process to be the success of a project overall, where involvement only is not sufficient. In general, there are claims in literature that user involvement is a very important part of project success and therefore end-user satisfaction: "User participation is critical to the success of the MIS project." (Powers & Dickson 1973, p. 156). Furthermore, researchers believe that the lack of UI leads to negative results: "There is little involvement in developing a system and too little ownership of the resulting system. These conditions lead to lack of and dissatisfaction with the system." (Lucas 1978, p. 43). However, Ives and Olson (1984) argue that benefits of UI are not convincingly demonstrated due to the concept being poorly grounded in theory and methodologically flawed. Findings of Tait & Vessey (1988) which argue that UI has a positive effect on system success but it is not found to be significant further polarize the debate. In this field of research, however, literature generally agrees with the conviction that user participation in the program design would improve user satisfaction. Taking into account the aforementioned information the following hypothesis is suggested:

H3: User involvement in system development positively influences end-user satisfaction.

2.2.3 Organizational support

Organizational support theory (OST) explains that employees develop a general perception concerning the extent to which the organization values their contributions and cares about their well-being (Eisenberger et al., 1986). This perception is called perceived organizational support or POS. Kurtessis et al. (2015) in their meta-analytic study of POS and evaluation of OST found out that perceived organizational support was strongly positively correlated with job satisfaction by a factor of ρ = 0,65. Their study also revealed that POS is negatively correlated with job stress (ρ=–.43), burnout (ρ=–.46) and emotional exhaustion (ρ=–.47). User satisfaction is part well-being "POS also fulfills socioemotional needs, resulting in greater identification and commitment to the organization, an increased desire to help the organization succeed, and greater psychological well-being" (Kurtessis et al., 2015, p. 20). In a recent research Maan et al. (2020) argued that organizational support was positively related to job satisfaction. This research supported the findings of previous research on organizational support (OS) Alcover at al. (2018). Bilgin & Demirer (2012), also conducted research on the relationship between OS and job satisfaction and found that it had a significant positive relationship. Based on this the following hypothesis was constructed:

H4: Perceived organizational support positively influences user satisfaction.

Table 1 below summarizes the hypotheses that will be tested in this research paper.

Table 1. Variables and Hypothesis

	Variable	*Hypothesis*
H1	PU	Perceived usefulness has a positive impact on end-user satisfaction.
H2	PEOU	Perceived ease of use has a positive impact on end-user satisfaction.
H3	UISD	User involvement in system development positively influences end-user satisfaction.
H4	POS	Perceived organizational support positively influences user satisfaction.

3. THEORETICAL FRAMEWORK

This research will focus on investigating the relationship between robotic process automation and end-user satisfaction amongst finance and accounting professionals by using the aforementioned variables. The framework suggested by Mahmood et al. (2000) that investigated the relationship between dependent variable IS end-user satisfaction and the independent variables as can be seen in the Table 2 below.

Table 2. Theoretical framework adapted from Mahmood et al. (2000)

Dependent variable	*Category*	*Independent variable*
IT end-user satisfaction	PBE	User expectations
		Ease of use
		Perceived usefulness
	OSE	User attitude towards IS
		Organizational support
		Perceived attitude of management
	UBI	User involvement in development
		User skills
		User expereince

However, for the purpose and limited scope of this study only some of the variables can be investigated and therefore a more conservative theoretical framework is presented in Figure 3.

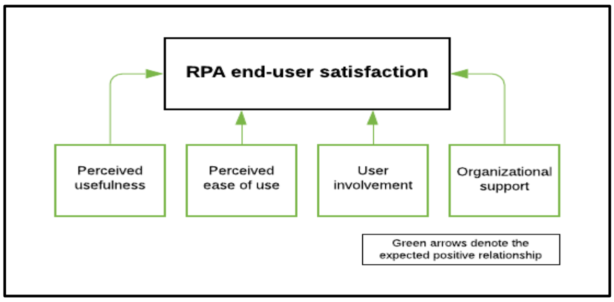

Figure 3. Theoretical framework

There were two factors that were taken into consideration in order to explain the selected variables. First was that the variables needed to already have an existing, reliable and objective measurement scale, because the approach of this research is descriptive not exploratory. Since this study aims to make a comprehensive capture of end-user satisfaction every category from the original framework is kept: perceived benefits and expectations (PBE), organizational support and encouragement (OSE), user background and involvement (UBI), however only some of the variables are picked from each category. RPA as mentioned above is a novel solution as it provides increased scope for business process automation that was not the case with business process automation (BPA) or straight through processing (STP). Perceived usefulness and ease of use were chosen because of their well-established literature footprint in novel IS technology adoption. The motivation behind choosing user involvement is that it is considered by many researchers to be a crucial success factor in adoption of information technology and this was also the case in predicting end-user satisfaction in the meta-analysis that Mahmood et al. (2000) conducted.

Motivation behind choosing OST and POS is the fact that it deals with how individuals perceive the support they get from the organization and could have an impact on end user-satisfaction (Biswakarma, 2017).

4. METHODOLOGY

This research will aim to gain a better understanding of the end-user satisfaction by looking through the lens of the automation industry in particular RPA. This will be done by using an already existing but altered theoretical framework to further validate existing findings or contrast them. Therefore, the most logical methodology approach for this paper to follow is fundamental or basic research.

4.1 Research design

In order to draw relevant conclusions, the data collected needs to be accurate, therefore it needs to be collected first hand to fit the specific purpose of this research (Reitz, 2004). Furthermore, due to the novel nature of the RPA industry no real secondary data is available for the end-user satisfaction. Those two factors are the rationale behind choosing to collect data from a primary source. To answer both research questions we need to test the four hypotheses already outlined in the previous sections. Therefore, generating data that can be transformed into meaningful statistics from which conclusions can be drawn is essential. Furthermore, the research aims to quantify attitudes towards RPA technology. This means that quantitative research is the perfect fit for this purpose (Carrasco & Lucas, 2015).

Online surveys were chosen as the collection method in this research. Firstly, they allow for faster, cheaper and more accurate collection of data than traditional paper questionnaires. Secondly the results from the online questionnaire are easier to use for participants, this is because they can do it in a time that is comfortable for them. Furthermore, online surveys are easier to use for researchers as well, because the data is instantly available for analysis. However, the perhaps the most important rationale behind choosing the online survey as the data collection method for this research is the ability to selectively send it to the units of observation (SmartSurvey, 2021).

The survey used in this paper will be created with Qualtrics XM software. This research is designed to serve a descriptive purpose; therefore, the study will be cross-sectional. The units of observation and the main focus of the study will be on finance and accounting professionals that are working with RPA solutions in their jobs. Contacting RPA providers was not successful as none of the identified leaders by Anagnoste (2017) RPA solution providers answered namely: Automation Anywhere, Blue Prism and UiPath. Therefore, these companies won't be the main source of data, rather in this research units of observation are contacted directly regardless of the RPA solution they use. Additionally, control variables are introduced to gather information about gender, age and industry, no personal identifiable information will be collected which is in accordance to the BMS Ethical Committee guidelines. Furthermore, information about what RPA solution provider the participants use and for how long have they been using the solution for will be collected. Those control variables will help to with identifying differences in gender, age groups and industries as well as differences related to the RPA solution providers. As mentioned above the data collected will be of quantitative nature. Therefore, to analyze the data also quantitative methods will be used. Analysis of the data will be conducted using IBM SPSS 25 statistical software. In order to send out the survey to the units of analysis use of LinkedIn and Email were used.

4.2 Measurement

User satisfaction as mentioned above is an attitude towards the software or technology an individual is using in his working environment. In depth research was conducted to pick the most comprehensive measurement items. Starting with PU and PEOU this research will utilize the original measurement statements as described by Davis (1985). User involvement and end-user satisfaction will be captured by the measurement statements developed by Doll & Torkzadeh (1988, 1990). Organizational support will be measured using the short perceived organizational support survey statements originally developed by Eisenberger et al. (1986). The aforementioned measure statements were used to create the online survey (Appendix B). The original measurement statements for all independent variables and the dependent one utilized a five-point Likert scale.

This was not changed and measurement statements were only tailored to RPA software. Furthermore, as stated in the Methodology section, control variables are introduced and the statements used can be seen in Appendix B. The scale for measurement ranged from strongly disagree, somewhat disagree, neither agree nor disagree, somewhat agree and strongly agree. This scale was inserted in SPSS via a numerical scale from 1 to 5 (Appendix B).

5. DATA ANALYSIS

5.1 Results

The data set used in this data analysis as mentioned earlier is collected from an online survey administered to the units of analysis. The survey was sent out to a total of 156 respondents, and was answered by 30 representatives (N = 30). Looking at the results 18 of the participants were male and the other 12 were female. Nineteen of the respondents were in the age group 26-36 years old (63,3%) followed by those in the age group 37-46 (20 %). There were 17 participants from the financial industry (56,7%) and 13 from the accounting industry. Most of the respondents (11) used UiPath as their RPA solutions provider, followed by Blue Prism (6) and Automation Everywhere (5). However almost a third of the respondents used other RPA solutions providers like Kofax, Microsoft and Nintex. More than half of the participants (19) used their RPA solution of choice for more than 6 months, whereas 10 of the respondents used the RPA solution for less than 6 months.

The questionnaire used the original constructs for measuring the four independent variables (UISD, PU, PEOU, POS) and dependent variable (EUS). The data analysis workflow was done as follows. First an initial reliability analysis of the scale’s was conducted (Appendix A). This was done by combining the items from the original constructs. Next, items needed to be checked that they load correctly on each construct, so factor analysis was conducted. After that items that had low loadings were removed from the constructs. When the factor analysis was done and low loading items were removed a new construct was created by summing the remaining items into their corresponding components. This step was done in order to calculate correlations for the constructs, and after that to aid with creation of a linear regression model. The paper utilizes multiple linear regression, due to having four predictor variables. The final step is the creation of the multiple linear regression model which will be preceded by the assumptions that are necessary in order to conduct multiple linear regression. The following subsections follow the exact order outlined above, but in greater depths.

5.1.1 Initial reliability analysis

In order to check the internal reliability of the constructs prior to conducting a factor analysis Cronbach’s alpha was utilized. In the following paragraph the information from the initial analysis of the original constructs is summarized.

The measurement scales for perceived usefulness and perceived ease of use developed by Davis (1985) attained satisfactory internal reliability with 0.736 and 0.797 value for Cronbach’s alpha respectively. Next, user involvement in system development (Doll & Torkzadeh, 1990) and perceived organizational support (Eisenberger et al., 1986) achieved even higher Cronbach’s alpha values of 0.813 and 0.886 respectively. Finally for the dependent variable end-user satisfaction the Cronbach’s alpha value of 0.515 was relatively low, indicating that some of the items used in the construct should be removed. In the following sub-sections explanations about what changes are made to each construct is discussed in greater detail.

5.1.2 User involvement in system development

During the initial analysis of the construct User involvement in system development the Cronbach’s alpha was 0.813 and the number of items that comprised the construct is 8. After the reliability analysis in SPSS the output suggested deleting one item from construct User involvement in system development in order to increase the validity to 0.823. In table 3 can be seen the improved internal validity and the removed item. Furthermore, descriptive statistics of the revised construct show the M= 3.74 and a SD = 0.77.

Table 3. Reliability and Descriptive statistics UISD

Reliability statistics		
	Cronbach's alpha	0.823
	Number of Items	7
Descriptive Statistics		
	Mean	3.74
	Std.Deviation	0.77

5.1.3 Perceived usefulness

During the initial analysis of the construct Perceived Usefulness the Cronbach’s alpha was 0.736 and the number of items in the construct were 6. After the initial reliability analysis SPSS output suggested deleting one item from construct Perceived usefulness in order to increase the validity to 0.779. In table 4 below a summary of the reliability and descriptive statistics for the new revised variable is shown. Descriptive statistics of the latest construct point to a M = 4.33 and a SD = 0.51.

Table 4. Reliability and Descriptive statistics PU

Reliability statistics		
	Cronbach's alpha	0.779
	Number of Items	5
Descriptive Statistics		
	Mean	4.33
	Std.Deviation	0.51

5.1.4 Perceived ease of use

During the initial analysis of the construct Perceived ease of use the Cronbach’s alpha was 0.797. After the initial reliability analysis SPSS output suggested deleting one item in order to increase the validity of the construct PEOU to 0.825. In table 5 below a summary of the reliability and descriptive statistics of the revised PEOU independent variable is shown. Descriptive statistics point to a M = 3,76 and a SD =0.83.

Table 5. Reliability and Descriptive statistics PEOU

Reliability statistics		
	Cronbach's alpha	0,825
	Number of Items	5
Descriptive Statistics		
	Mean	3,76
	Std.Deviation	0,83

5.1.5 Perceived organizational support

During the initial analysis of the construct Perceived organizational support the Cronbach's alpha was 0.866. After the initial reliability analysis SPSS output suggested deleting one item in order to increase the validity of the construct POS to 0.873. In table 6 below a summary of reliability and descriptive statistics of the revised construct POS is presented. Descriptive statistics point to a M= 3,94 with a SD=0,65.

Table 6. Reliability and Descriptive statistics POS

Reliability statistics		
	Cronbach's alpha	0,873
	Number of Items	7
Descriptive Statistics		
	Mean	3,94
	Std.Deviation	0,65

5.1.6 End-user satisfaction

During the initial analysis of the construct End-user satisfaction the Cronbach's alpha was 0.515. After the analysis in SPSS the output suggested that deleting six items from construct End-user satisfaction in order to increase the validity of the construct to 0.710. In table 7 below a summary of the reliability and descriptive statistics is presented after the changes were implemented to the new construct. Descriptive statistics show point to a M = 4,27 and a SD = 0.42.

Table 7. Reliability and Descriptive statistics EUS

Reliability statistics		
	Cronbach's alpha	0,710
	Number of Items	4
Descriptive Statistics		
	Mean	4,27
	Std.Deviation	0,42

5.2 Factor analysis

With the initial reliability analysis done and new revised constructs showing no potential concerns in terms of internal validity a Factor analysis of all independent variables was conducted. The recommended sample size for factor analysis could not be achieved for this study due to the novel nature of the technology as well as time constraint related to the study. Nevertheless, research suggests that smaller sample sizes can achieve good results (Winter et al.,2009). Next, a Kaiser-Meyer-Olkin test was conducted to test how good is the data for factor analysis. This test achieved a value of 0,561 which is considered by Kaiser (1974) to be enough. This can be attributed to the low sample size in combination with the 24 items used to measure the predictor variable. However, the Bartlett's test of sphericity suggested a statistically significant result with p = 0.001. This suggest that the variables used are related and therefore suitable for structure direction (Appendix C). The factor analysis was done using principal component setting for extraction with number for extraction variables being 4, since this research uses 4 predictor constructs. The Varimax rotation method was utilized for this factor analysis in order to expose the relevant items. The eigenvalues for the extracted components suggest that they explain 25.25% (POS), 14.17 % (PU), 12.03% (PEOU) and 10.61% (UISD) of the variance (Appendix A).

Setting for the factor analysis allowed only loadings with absolute value greater than 0.4 to appear, making it easier to interpret the results. As seen in Table 8 all 24 items have loadings higher than 0.5. Therefore, there was not need to remove items from the constructs. Additionally, 7 of the 24 items had cross loadings, however the highest loading value for each item in a particular construct was chosen.

Table 8. Factor Analysis

Rotated component matrix	*Component*			
Item	PU	PEOU	POS	UISD
Q6_1	0.519			
Q6_2	0.663			
Q6_3	0.786			
Q6_5	0.788			
Q6_6	0.729			
Q6_7	0.61			
Q6_8	0.686			
Q7_2		0.708		
Q7_3		0.651		
Q7_4		0.783		
Q7_5		0.603		
Q7_6		0.66		
Q8_1			0.881	
Q8_2			0.628	
Q8_3			0.651	
Q8_5			0.714	
Q8_6			0.862	
Q9_2_R				0.693
q9_3_r				0.897
Q9_4				0.599
q9_5_r				0.79
Q9_6				0.729
q9_7_r				0.793
Q9_8				0.69

5.3 Regression analysis

The regression analysis will conclude the data analysis section. In order to make sure that our data is ready for a multiple linear regression analysis a thorough investigation of the assumptions for linear regression is required.

First thing that was considered was the sample size of the data. Researchers conducting linear regression use a rule of thumb that states that for each predictor variable there should be at least 10 observations. The data used in this research falls short of this rule, since only 30 records were acquired. This rule applies if the dependent variable is normally distributed. To check if the outcome variable is normally distributed, tests of normality were conducted via SPSS (Shapiro-Wilk and Kolmogorov-Smirnov). The results from both tests suggest that dependent variable End-user satisfaction is normally distributed (Appendix D).

The second assumption is multicollinearity. In order to assume that the predictor variables are not multi collinear the correlations between them should be less than 0.7, additionally predictor variables should correlate with the outcome variable at a value greater than 0.3. This assumption of multicollinearity is satisfied as none of the predictor variables correlate with each other greater than 0.7 while at the same time the correlations with the outcome variable are greater than 0.3 (Appendix D).

The final assumption is that there is a linear relationship between the predictor variables and outcome variable. The normal probability-probability plot shows no evidence to suggest that the assumption is not satisfied (Appendix D). Additionally, the scatterplot with the residual and predicted values present no potential problems (Appendix D). Last the standard residual range is also satisfactory.

With all the assumptions accounted the results from the multiple regression analysis is presented in table 9.

5.3.1 Model Summary

Table 9. Model Summary

Model summary					
1	R	R Square	Adj. R Square	Std. Error	Sig.
	0.807	0.651	0.596	1.929	0.000
Predictors: (Constant), POS_sum, UISD_sum, PEOU_sum, PU_sum					

In table is presented the model summary of the regression analysis conducted via SPSS. Since the first assumption for the multiple regression analysis was slightly violated interpreting the R squared will not be relevant. It will be more appropriate given the smaller sample size of the data to interpret the Adj. R square. Overall, the model explains 59.6% of the variance in the dependent variable End-user satisfaction. Additionally, this prediction model is statistically significant.

The ANOVA statistics (Appendix D) present a statistically significant value to reject the null hypothesis that the slope of the line is equal to zero.

5.3.2 Coefficients

Table 10. Coefficients

Coefficients					
	Unstandardized (B)	Std. Error	Standardized (B)	t	Sig.
Constant	-11.317	3.994		-2.83	0.009
UISD_sum	0.132	0.106	0.179	1.254	0.221
PU_sum	0.433	0.252	0.274	1.718	0.098
PEOU_sum	0.377	0.177	0.296	2.125	0.044
POS_sum	0.291	0.134	0.304	2.17	0.04
Dependent Variable: EUS_sum					

Table 10 presents the coefficients from the regression analysis. In order to compare and rank the four predictor variables the standardized coefficients beta need to be used.

They a suggest that the biggest contribution to the prediction model had variable POS with 0.304 followed by PEOU with 0.296. Additionally, PU and UISD contribute with 0.274 and 0.179 respectively. Furthermore, Partial correlations suggest that the biggest unique contribution to the model has variable POS with 0.256 followed by PEOU with 0.251. From the analyzed data its evident that predictor variables POS and PEOU have a significant positive effect on the outcome variable EUS. These tests of significance present enough evidence to accept two of the hypotheses outlined earlier in the paper. However, this is not the case for the other two independent variables UISD and PU.

In table 11 below the hypothesis's verdicts are summarized.

Table 11. Hypotheses Verdicts

	Variable	*Verdict*	*Sig.*
H1	PU	Reject	0.098
H2	PEOU	Accept	0.044
H3	UISD	Reject	0.221
H4	POS	Accept	0.040

5.3.3 Secondary regression

After conducting the multiple regression with the four predictor variables, a follow up regression analysis was conducted – combining the PU and PEOU construct into a new variable called TAM. Since these two components are a part of the TAM model which is used to predict user satisfaction it made sense to combine them into one construct. The new construct was tested for its reliability using Cronbach's alpha (0,682) and also met all the assumptions for multiple linear regression also satisfying the sample size assumption which was not the case when the constructs were not combined. The motivation behind the secondary regression was to more confidently interpret the R squared value instead of the Adj. R squared value which was relatively lower. The statistics from this analysis can be found in appendix D (Table D 6). The model is still statistically significant with a $p \approx 0.001$, however now it is more appropriate to interpret the R squared value. The data suggests that the model explains 65.1% of the variance in the outcome variable end-user satisfaction, which is a marginal improvement from 59.6% explained by the previous model. Looking at coefficients from the secondary regression analysis they suggest that the combination of the two constructs into one now have a significant effect on end-user satisfaction ($p = 0.003$), which was not the case when the two constructs were tested separately. Additionally, POS and UISD also had a marginal improvement on their contribution towards the outcome variable. However, UISD still does not contribute significantly to the model with a $p = 0.183$.

6. DISCUSSION

The goal of this paper is to identify how RPA technology use impacts the end-user satisfaction with a focus on finance and accounting professionals. In order to do that a framework for end-user satisfaction was adopted and tailored to the scope and time limitations associated with a bachelor thesis project. All this is done to answer the following research question: „How does RPA affect the end-user satisfaction amongst finance and accounting practitioners? ". It was found that two out four predictor variables had a significant impact on the end-user satisfaction of accounting and finance professionals.

In regards to user involvement in system development, it was expected that it has a positive relationship with end-user satisfaction. After the initial reliability analysis, it was found that seven items from the original statements from Doll & Torkzadeh (1990) loaded on the construct UISD. Descriptive statistics of the component suggest a M= 3.74 and a SD = 0.77. Looking at the mean it indicates that on average the respondents somewhat agree that they are involved in the development of the RPA solution. It was found that user involvement in system development had a positive effect on end-user satisfaction. The contribution to the regression models however, is the lowest out of all the predictor variables with a standardized coefficient of

0.179. Further, the effect of the involvement of professionals in the development of the system were found to be not significant (p = 0.221). This means that even though higher participation in the development of the RPA solution translated to increased end-user satisfaction the relationship is not deemed significant (N=30). In literature there is not enough research that investigates the direct effects of user involvement in system development on end-user satisfaction. Rather user involvement in system development is very important for system success and therefore it should impact end-user satisfaction. This is due to the greater sense of ownership towards the system. Additionally, the UISD construct was expected to have the biggest effect on end-user satisfaction as suggested by Mahmood et al. (2000), however this was not the case. On the contrary it contributed the least toward the prediction of the outcome variable end-user satisfaction.

In regards to perceived usefulness it was expected to have a positive effect on end-user satisfaction. After the initial reliability analysis, it was found that five items from the original survey from Davis (1985) loaded onto the construct PU. Descriptive statistics of the component suggest a M = 4.33 and a SD = 0.51. Those statistics suggest that on average respondents somewhat agree that their RPA solutions of choice are useful. The analysis of the data points out that there is a positive relationship between predictor variable perceived usefulness and outcome variable end-user satisfaction. From the regression analysis it is evident that it contributes to the overall model with a coefficient of 0.274. The contribution of PU to the model however, is not statistically significant (p = 0.098). This means that even though higher perceived usefulness increases the end-user satisfaction levels it does not do so in statistically significant amounts. The findings from the study further confirm literature findings regarding the effect of PU on end-user and user or customer satisfaction. Results from Park et al. (2012), Panneer (2017) and Lee et al. (1995) however suggest that there is a significant effect which was not found in this study. Additionally, it is important to point out that both studies had very different units of observation in contracts to this research.

In regards to perceived ease of use it was expected to have a positive effect on end-user satisfaction. After the initial reliability analysis, it was found that five items from the original statements from Davis (1985) loaded onto the construct PEOU. Descriptive statistics of the construct suggest a M = 3,76 and a SD =0.83. The data suggest that on average respondents lean towards somewhat agree that the RPA solutions are easy to use. From the analysis it is evident that PEOU has a positive relationship towards end-user satisfaction. The contribution of PEOU to the overall model is relatively good with a coefficient of 0.296. This result is statistically significant (p = 0.044). That means that higher perceived ease of use significantly translated to increase end-user satisfaction. This finding further solidifies statements regarding the significant positive effect of PEOU on end-user satisfaction made by Park et al. (2012), Panneer (2017) and Lee et al. (1995). However, this confirmatory statement should be considered together with the fact that the studies have very different units of observation.

In regards to perceived organizational support it was expected to have a positive effect on end-user satisfaction. After the initial reliability analysis, it was found that 7 items from the original statements from Eisenberger et al. (1986) were loading on to construct POS. Descriptive statistics of the component point to a M= 3,94 with a SD=0,65. Those statistics suggest that on average respondents tend to somewhat agree that their organization is supportive of them and their actions. From the analysis it is evident that POS has a positive relationship with end-user satisfaction. The overall contribution to the prediction model for POS was the greatest and amounted to a coefficient of 0.304. This result is statistically significant (p = 0.04). This means that higher perceived organizational support significantly translates to increase end-user satisfaction. This finding is congruent with other literature that suggests that perceived organizational support has a significant positive effect on end-user satisfaction (Mahmood et al., 2000).

In regards to the combination of the two constructs PU and PEOU into a combined variable TAM, it yielded some interesting results. While being a relatively reliable construct with a Cronbach's alpha = 0.682, the overall improvement to the prediction model is noticeable with an increase of 5.5 % in explained variance. Descriptive statistics point to a M = 3,82 and a SD = 0,373. Those statistics suggest that overall respondents would some agree that they find their RPA solution both ease to use and useful. As mentioned in the discussion on PU and PEOU there is a positive relationship towards EUS. However, combining the two variables now yield a statistically significant result (p = 0.003). This finding suggests that overall, the TAM is significant predictor of end-user satisfaction. This is congruent with literature findings by Park et al. (2012), Lee et al. (1995) and Panneer (2017).

7. CONCLUSION

As stated in the introduction RPA technology is a new and growing industry attracting the interest of researchers and companies. Overall, the investigation into this technology is rather minimal. Furthermore, from the existing papers the focus is more or less on the company side benefits and successful implementation. There is very little knowledge if people are satisfied with these solutions. That is why the main focus of this study was to investigate the satisfaction of end users utilizing RPA technologies. The paper investigated four of the predictors associated with end-user satisfaction. Detailed insights are given to the impact of each variable. Results from this research (N=30), show that perceived ease of use and perceived organizational support constructs are statistically significant predictors of end-user satisfaction. Perceived usefulness and User involvement in system development had positive impacts on end-user satisfaction but their contribution was not statistically significant. The first regression analysis yielded an explained variance of 59.6 %. However, if constructs perceived usefulness and perceived ease of use are combined into one component the explained variance of the model is increased to 65.1%. Additionally, the new combined component is found to be statistically significant. Generally, all four predictor variables have a positive relationship towards the outcome variable end-user satisfaction. This is in line with existing literature on the topic. According to the findings of this research the biggest impact on the end-user satisfaction has predictor variables perceived ease of use and perceived organizational support. This means that if an RPA solution is easier to use then an end-user is generally more satisfied with that solution. Additionally, if the end-user of an RPA technology believes that overall, their organization values their contribution and cares about their well-being then they will be more satisfied with that RPA solution.

7.1 Limitations

This research contains certain limitations. First, the sample size was small, as a result a rather poor score was achieved on the KMO test (0.561). Furthermore, the response rate is relatively low 19.23% of the sent-out surveys were completed. In order to make a better prediction model and provide more accurate results perhaps a larger sample size is necessary. Additionally, the respondents were contacted mainly through LinkedIn and Email. Another limitation associated with this study is that collecting data about RPA solutions is not easy because it is an emerging industry and especially when the research is narrowed even further to finance and accounting professionals. Furthermore, the scope of this research and the ongoing situation with the global pandemic makes it very difficult to conduct research in any other way than by means of internet communication, email and social media. According to Eikebrokk and Olsen (2020), the financial sector in Norway has an average of 1.6 years of experience with RPA, with a standard deviation of 1.2, and the public sector has 0.7 years of experience. This study is limited only to accounting and financial professional utilizing RPA technology. Finally, this study did not cover all outlined by Mahmood et al. (2000) predictor variable of end-user satisfaction.

7.2 Recommendations and practical implications

As mentioned in the limitation section this study does not cover all the outlined predictors of end-user satisfaction. It is recommended to research the whole theoretical framework as suggested by Mahmood et al. (2000) in order make a better and more accurate prediction model. Additionally, moderating variables of the independent variables were not introduced nor measured in this study. It is recommended to investigate moderating relationship between variables in order to achieve a more complete picture of end-user satisfaction. Additionally, it is recommended that research into the same topic in different industries be conducted.

This study presents evidence that could be utilized by RPA providers to make a better product with an improved end-user satisfaction. In particular this study outlines that predictor variables PEOU and POS have a relatively high effect on the end-user satisfaction. This suggests that RPA providers should pay more attention on the ease of use of their product. The survey used in this research, had reliable results so it could be replicated by RPA companies to evaluate their end-user satisfaction levels.

8. ACKNOWLEDGMENTS

I would like to express my great appreciation to my two supervisors Marie Molitor and Franziska Koefer. They were extremely helpful and supportive through this whole research process. I would also like to thank the participants who took part in this research. At last, I would like to thank my family, friends and colleagues for their feedback, support and encouragement throughout my studies.

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10. APPENDIX

10.1 Appendix A

Table A 1 Initial internal reliability analysis

Author	Variable	Items	Cronbach's Alpha
Davis (1985)	PU	6	0,736
	PEOU	6	0,797
Doll & Torkzadeh (1988, 1990)	EUS	10	0,515
	UISD	8	0,813
Eisenberger et al. (1986)	POS	8	0,866

This table presents the initial reliability analysis of the constructs.

Table A 2 Eigenvalues

	Initial Eigenvalues		
Component	Total	% of Variance	Cumulative %
1	6,060	25,252	25,252
2	3,399	14,165	39,416
3	2,888	12,033	51,449
4	2,547	10,614	62,064
5	1,782	7,426	69,490
6	1,096	4,566	74,055
7	1,010	4,208	78,263
8	,913	3,804	82,068
9	,749	3,121	85,189
10	,653	2,720	87,909
11	,552	2,298	90,207
12	,463	1,927	92,134
13	,414	1,727	93,861
14	,399	1,661	95,521
15	,302	1,258	96,780
16	,252	1,049	97,829
17	,157	,653	98,482
18	,107	,446	98,929
19	,089	,370	99,298
20	,077	,319	99,617
21	,037	,156	99,774
22	,031	,128	99,902
23	,019	,080	99,982
24	,004	,018	100,000

This table presents the Initial Eigenvalue in relation to the factor analysis conducted in the research.

10.2 Appendix B

Table B 1 Survey Items Excluding Control Variables

ITEMS	STATEMENTS	SOURCES
	USER INVOLVEMENT IN SYSTEM DEVELOPMENT	
Q6_1	I participated in initiation of the project	(Doll & Torkzadeh, 1990)
Q6_2	I participated in determining RPA objectives	
Q6_3	I participated in determining the user's information needs	
Q6_4	I participated in assessing alternative ways of meeting the user's information needs	
Q6_5	I participated in identifying sources of information	
Q6_6	I participated in outlining information flows	
Q6_7	I participated in developing input forms/screens	
Q6_8	I participated in developing output formats	
	PERCEIVED USEFULNESS	
Q7_1	Using this RPA solution in my job would enable me to accomplish tasks more quickly.	Davis(1989)
Q7_2	Using this RPA solution would improve my job performance.	
Q7_3	Using this RPA solution in my job would increase my productivity.	
Q7_4	Using this RPA solution would enhance my effectiveness on the job.	
Q7_5	Using this RPA solution would make it easier to do my job.	
Q7_6	I would find this RPA solution useful in my job.	
	PERCEIVED EASE OF USE	
Q8_1	Learning to operate this RPA solution would be easy for me.	Davis(1989)
Q8_2	I would find it easy to get this RPA solution to do what I want it to do.	
Q8_3	My interaction with this RPA solution would be clear and understandable.	
Q8_4	I would find this RPA solution to be flexible to interact with.	
Q8_5	It would be easy for me to become skillful at using this RPA solution.	
Q8_6	I would find this RPA solution easy to use.	
	PERCEIVED ORGANIZATIONAL SUPPORT	
Q9_1	The organization values my contribution to its well-being.	Eisenberger et al.(1986)
Q9_2_R	The organization fails to appreciate any extra effort from me.*	
Q9_3_R	The organization would ignore any complaint from me.*	
Q9_4	The organization really cares about my well-being.	
Q9_5_R	Even if I did the best job possible. the organization would fail to notice.*	
Q9_6	The organization cares about my general satisfaction at work.	
Q9_7_R	The organization shows very little concern for me.*	
Q9_8	The organization takes pride in my accomplishments at work.	
	END-USER SATISFACTION	
Q13_1	The RPA solution provides the precise information I need.	(Doll & Torkzadeh, 1988)
Q13_2	The information content meets my needs.	
Q13_3	The RPA solution provides reports that seem to be just about what I need.	
Q13_4	The RPA solution provides sufficient information.	
Q13_5	The RPA solution is accurate.	
Q13_6	I am satisfied with the accuracy of the system.	
Q13_7	I think that the output is presented in a useful format.	
Q13_8	I think that the information is clear.	
Q13_9	I get the information I need in time.	
Q13_10	The RPA solution provides me with up-to-date information.	

Table B 2 Control variables

Items	*Purpose*	*Statements*
Q1	Age	What is your age?
Q2	Gender	What is your gender?
Q3	Industry	What best describes the industry you work in?
Q4	RPA provider	Which robotic process automation (RPA) provider are you currently using?
Q5	Use time software	For how long have you used the RPA solution?

Table B 3 Likert Scale conversion in numerical way via SPSS

Number in SPSS	*Statement*
1	Strongly disagree
2	Somewhat disagree
3	Neither agree nor disagree
4	Somewhat agree
5	Strongly agree

10.3 Appendix C

Table C 1 KMO and Bartlett's test of sphericity

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.561
Bartlett's test of Sphericity	Approx. Chi-square	526.074
	df	276
	Sig.	0.001

10.4 Appendix D

Table D 1 Tests of Normality for dependent variable – End-user satisfaction

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
EUS_sum	,122	30	,200*	,951	30	,181

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Shapiro-Wilk test score is not significant, furthermore Kolmogorov-Smirnov test is not significant as well this suggests that variable End-user satisfaction is normally distributed.

Table D 2 Correlations

Correlations

		EUS_sum	UISD_sum	PU_sum	PEOU_sum	POS_sum
Pearson Correlation	EUS_sum	1,000	,540	,666	,616	,625
	UISD_sum	,540**	1,000	,545	,335	,371
	PU_sum	,666**	,545**	1,000	,494	,488
	PEOU_sum	,616**	,335	,494**	1,000	,409
	POS_sum	,625**	,371*	,488**	,409*	1,000

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Figure D 3 Normal P-P plot of regression standardized residual

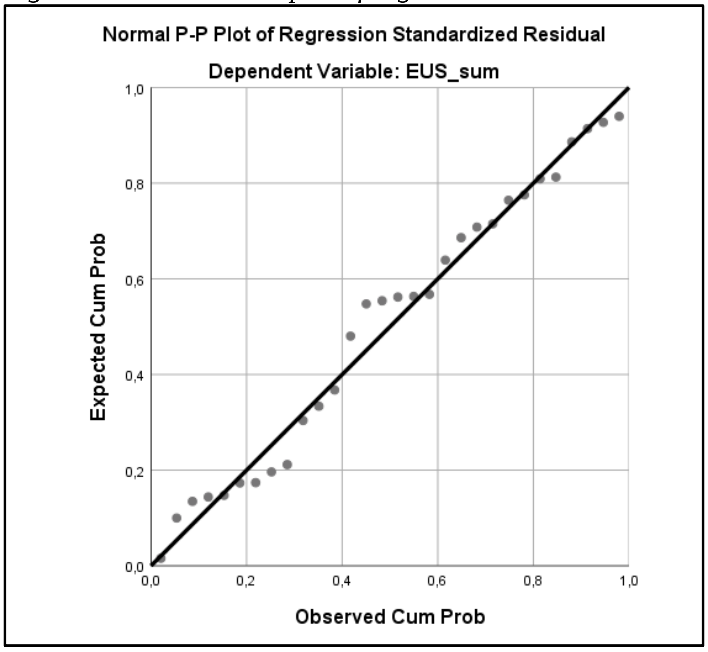

Figure D 4 Scatterplot of residuals

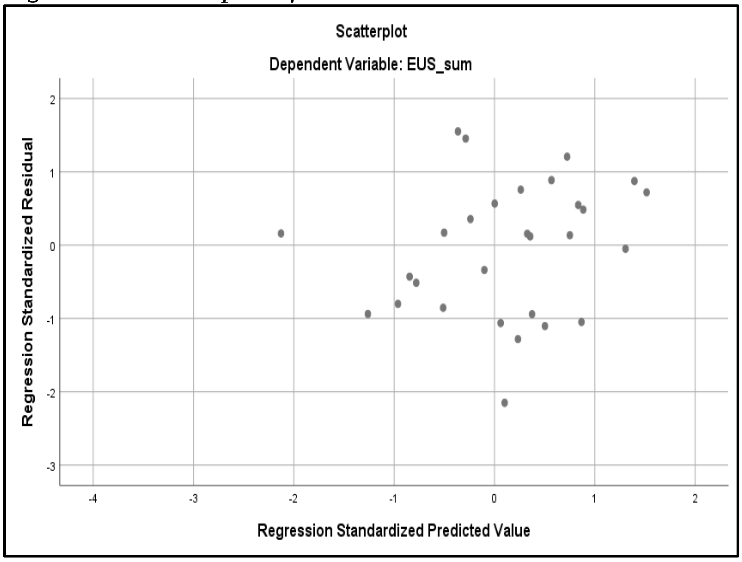

Table D 5 ANOVA

Anova	Sum of Squares	df	Mean Square	F	Sig.
Regression	173.70	4	43.43	11.67	0.000
Residual	93.00	25	3.72		
Total	266.70	29			

Dependent Variable: EUS_sum
Predictors: (Constant), POS_sum, UISD_sum, PEOU_sum, PU_sum

Table D 6 Secondary multiple linear regression – Model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,807[a]	,651	,611	1,892

a. Predictors: (Constant), POS_sum, UISD_sum, TAM_sum

Table D 7 Secondary multiple linear regression – ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	173,604	3	57,868	16,162	,000[b]
	Residual	93,096	26	3,581		
	Total	266,700	29			

a. Dependent Variable: EUS_sum

b. Predictors: (Constant), POS_sum, UISD_sum, TAM_sum

Table D 8 Secondary multiple linear regression - Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-11,159	3,798		-2,938	,007
	TAM_sum	,397	,119	,489	3,346	,003
	UISD_sum	,137	,100	,185	1,369	,183
	POS_sum	,293	,131	,306	2,236	,034

a. Dependent Variable: EUS_sum