The impact of performance communication on process efficiency – A RPA implementation project

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List of Abbreviations:

RPA – Robotic Process Automation

IS – Information System

BPM – Business Process Management

Abstract

Title The impact of performance communication on process efficiency – A RPA implementation project

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How can you use an effective and reproducible process to incentivise executives of one of Portugal's largest companies to prioritise a repetitive task? This question led to our main goal of the project, which is documented in the following and supported by fundamental literature research, how to design and implement effective performance-based communication through the technological mapping of Robotic Process Automation. The problem of the Master Thesis was brought to the author's attention by the research partnership of the Portuguese Postal Service CTT with the Catolica Lisbon School of Business and Economics and was attempted to be solved in an implementation project with the help of the already existing RPA capabilities of CTT. In a first step, the processes affected by the problem were documented and subsequently restructured with the help of the CTT project management framework in order to integrate them into the architecture of the organisation using the RPA technology. In order to solve the problem of incentivising higher prioritisation of the task, the nudging method of communication was identified. By applying this, personalised ranking-based notifications were sent to solve the problem. In summary, the underlying work should provide the reader with documentation to apply the described process in a replicable way to comparable problems.

Keywords Robotic Process Automation - Performance Communication – Nudging - Agile Project Management

Abstrato

Título O impacto da comunicação de desempenho na eficiência dos processos - Um projecto de implementação de RPA

Autor Franz-Jakob Morfeld

Como pode utilizar um processo eficaz e reprodutível para incentivar os executivos de uma das maiores empresas portuguesas a darem prioridade a uma tarefa repetitiva? Esta pergunta conduziu ao nosso principal objectivo do projecto, documentado no seguinte e apoiado por investigação bibliográfica fundamental, como conceber e implementar uma comunicação eficaz baseada no desempenho através do mapeamento tecnológico da Automação de Processos Robóticos. O problema da tese de mestrado foi trazido à atenção do autor pela parceria de investigação do Serviço Postal Português CTT com a Escola de Negócios e Economia Católica de Lisboa e foi tentado ser resolvido num projecto de implementação com a ajuda das capacidades de RPA já existentes dos CTT. Numa primeira fase, os processos afectados pelo problema foram documentados e subsequentemente reestruturados com a ajuda do quadro de gestão do projecto dos CTT, a fim de os integrar na arquitectura da organização utilizando a tecnologia RPA. A fim de resolver o problema de incentivar a atribuição de maior prioridade à tarefa, foi identificado o método de comunicação de incentivo. Ao aplicar este método, foram enviadas notificações personalizadas baseadas na classificação para resolver o problema. Em resumo, o trabalho subjacente deveria fornecer ao leitor documentação para aplicar o processo descrito de uma forma replicável a problemas comparáveis.

Palavras-chave Automação Robótica de Processos - Comunicação de Desempenho - Nudging - Gestão Ágil de Projectos

1. Introduction

How do you convince leaders at one of Portugal's top companies to prioritize a repetitive task?

To answer this question, we partnered with the Portuguese Postal Service CTT on a project to employ Robotic Process Automation (RPA) to transmit executive-level performance updates automatically. In the underlying research, we sought to build an effective and adaptable form of internal communication and implement it using RPA. Performance communication in this context includes both informative and motivating content.

Due to the fact that we wanted to leverage data to provide managers with motivated information in order to boost process efficiency, we decided to employ the nudging methodology in our study project. Without utilizing prohibitions or payments, nudging is a behavioural intervention that seeks to affect the decisions and actions of individuals in a predictable manner.

This concept has been for roughly as long as humanity has lived, but in the recent decade it has become increasingly significant due to Thaler (2008) book Nudge: Improving decisions about health, wealth, and happiness and the Nobel Prize awarded in conjunction with it.

The primary rationale for this strategy was that the decision to give validation a greater priority is not subject to a mechanism for immediate feedback. This less enticing choice architecture was bridged by means of nudging. Specifically, the goal was to use selective transparency to process information accessible to all in a tailored and rewarded manner.

To this end, validators who processed this selective transparency using the nudging method received personalized emails.

Finally, we made preparations to validate our research method of communicating performance-based rankings using the nudging methodology after successful implementation by means of a block randomised experiment.

1.1. Context and Motivation

CTT is the Portuguese national postal service, and its group includes companies including a bank and several delivery services. Together with CTT - Correios de Portugal, SA, the RPA implementation project was developed and implemented.

CTT, which was founded in 1520, has witnessed and survived all industrial revolutions.

As part of its digital initiative, CTT has been researching and deploying robotic process automation since 2020.

As the largest postal service provider on the market, CTT focuses on discovering and releasing automation potential across departments in order to save costs by increasing the efficiency of operations through automation. In doing so, they adhere to a methodical strategy that is reflected in the CTT framework for automation on the one hand and a road plan for the next years on the other.

I was also given an introduction to the CTT framework for automation at the start of my work, which is designed to establish efficient and reproducible automation across the organization.

This plan also includes a cooperation initiative with institutions that allows students to conduct research on a process that will be recognized, automated, and recorded by CTT. This occurred during my master's thesis writing at Catolica Lisbon School of Business and Economics.

1.2. The Project at CTT

The four-month-long project team included my thesis advisor from the university, the head of processes and transformations for B2C, and me as the project manager.

In addition, one additional student wrote a master's thesis in the RPA topic within the scope of the relationship between CTT and our university. The partnership with CTT began with an introduction to CTT's automation platform (UiPath). Particular emphasis was focused on CTT's technique for building automation in order to identify a process, automate and integrate it, and then make it reproducible. The administrative and technical onboarding of CTT's networks, processes, and applications followed. Subsequently, the project partner CTT took the initiative to automate the procedure.

A significant component of the project was also the management of stakeholders and the procurement of internal information and documentation from CTT in order to comprehend the process and finally integrate it inside the organization.

Regular meetings were held with the project team for the purpose of sharing new information and presenting and validating improvements to the automation process and design.

The whole course of the project was conducted remotely, with all communication and planning taking place via email and video conferences.

1.3.Project Objective

The overall goal of the automation project for CTT is to validate invoices that could not be automatically captured and paid by the business process management system. They face the problem of the duration of manual validation by employees, which we wanted to shorten by automatically sending motivating reminder emails using the nudging methodology.

1.4. Methodology

The first phase of the underlying technique was familiarizing oneself with the proven RPA concepts. Special emphasis was placed on the advantages of adopting RPA, how to discover its potential in existing processes, and how to deploy it during the project.

The next stage was to establish the project implementation framework and apply it practically to the planning and operations components.

The last step consisted of introducing and defining the technique and reasoning for the design of the automated process.

Once the CTT side of the process was established, it was a matter of describing it step by step and generating and testing the design down to the level of mouse clicks.

This was required so that the process steps could be implemented in the automation software in the subsequent stage. Following this was the primary emphasis of our work.

The investigation and development of an incentive communication mechanism for invoice validators. We chose a strategy that has gained popularity over the past decade, particularly in the context of policy and business: nudging.

The final objective was to construct a set of KPIs using the SMART-goal methodology for measuring the increase in automation efficiency and the overall proof of concept.

2. Related Work

To build the theoretical foundation for our RPA integration project report we have undertaken a literature review by collecting, reviewing, and assessing the relevant academic literature on different approaches to defining RPA. In addition, we focused the search on criteria's indicating a high potential for improvement for RPA and to how to plan, design, and implement a software development project. With regard to our communication method Nudge, a big focus was on the book by Thaler (2008). In addition, the search went on for project reports and methods to effectively design and apply this communication method in our context. To find relevant literature two databases were used: EBSCOHost and Google Scholar.

2.1. Robotic Process Automation

Prior to standardization, optimization, relocation to low-cost areas, and the adoption of enabling technologies, RPA was hailed as the next transformational lever (Mary Lacity, 2016). A lot has happened up to this point, and automation—often referred to as robotic process automation—has made its way into the bulk of all digitalization agendas. The pleasure brought on by no-code and self-serving development procedures is accompanied by dissatisfaction brought on by constraints imposed on by incompatible databases or processes.

The term automation has Greek origins and can apply to either the driving force behind an autonomously moving object or to the object itself. This phrase has received a lot of attention for decades. Both in the sense that people are liberated from the restrictions of manual labor and are able to concentrate on creative work and intellectual pursuits. As well as in the negative sense, where people are losing their riches and jobs as a result of the advancement of automation.

Since a little while ago, another robot has been teaming up with this buzzword to form a new one: robotic process automation. The field of information systems can be credited with the creation of automation, and the business world is where it is most commonly used. The goal of the underlying work is to respond to these concerns using the experiences detailed in the following project report rather than by using quantitative or qualitative research methods. The goal of the level of detail in this report is to preserve a smooth reading experience while giving future RPA initiatives the best possible insight and replicability for what was learned and experienced during the project. The evaluation and selection of the automation software and the identification of the process to be automated are two aspects that are crucial for future work but have not been addressed because of CTT's pre-selection.

2.1.1. Characteristics

Robotic process automation automates manual and repetitive tasks previously done by human with no intervention. Characterizing the traits of RPA four main were found by P. Hofmann (2018). To start with the process form (see Figure 1), RPAs are orchestrated inside of a choreography with technological modules and control flow operators while operating within IT ecosystems and using established applications. The ease-of use and adaptability allow

organizations to implement the software robot inside of agile projects. RPA can operate across multiple platforms and applications, making it a flexible and versatile solution for companies with complex IT environments. With growing and changing demand, RPA is scalable, so companies can easily adjust their automation efforts as their needs change. This allows them to quickly respond to changes in the market and adapt to new business requirements (Plattfaut, 2022). When implementing RPAs organizations should think of the direct impact on the automated process but moreover about second order effects on the enterprise architecture, governance, and management systems following the nature of RPAs is closely related to business processes.

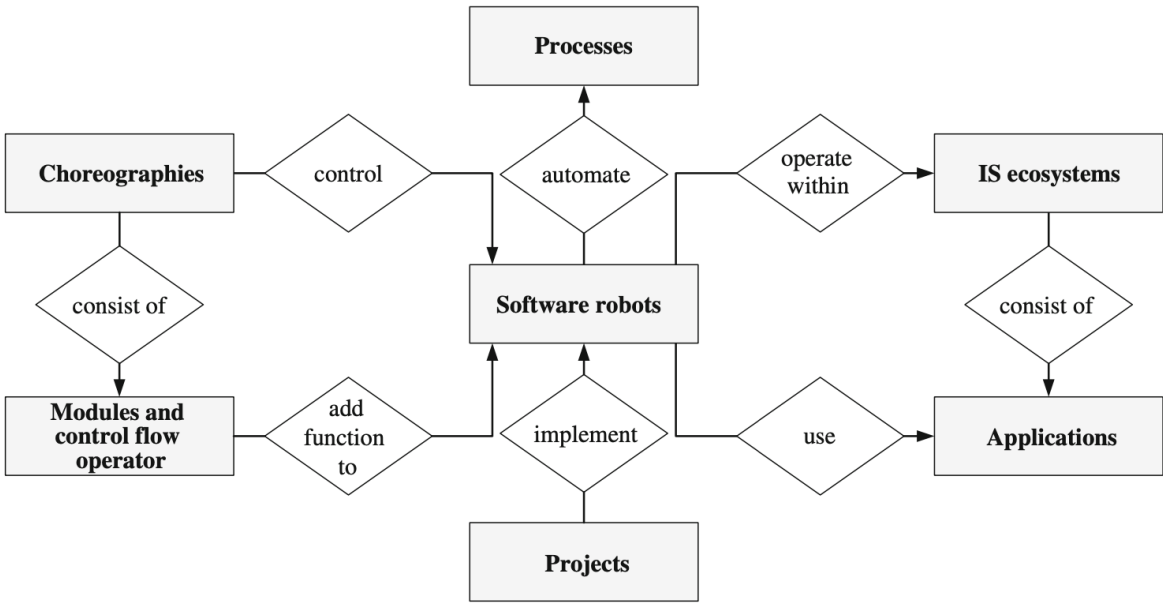

Figure 1: The nature of robotic process automation (P. Hofmann, 2018)

2.1.2. Technology

Following the official definition of the Institute for RPA (IRPA) states that the robot automating a process is not part of the information system of an organization but sits on top of it (Aguirre, 2017). This robot is a piece of software, in this case UiPath, that lays an intuitive and accessible user interface over the information system, enabling the user to access applications and the data processed in them using a variety of operators.

It is essential to note that the majority of RPA's capability is based on interoperability, which is the ability to link and facilitate communication across multiple applications inside a single architecture.

The intuitive nature is a result of the robots' propensity to follow the same workflow as humans, which makes it easy to model the workflow within the software application.

The majority of tools in this domain are designed to adhere to a business logic that resides on the data access layer. Using functions of individual applications to access the data layer and control flow operators to manipulate the data is one example. (P. Hofmann, 2018).

2.1.3. SWOT-Analysis

For the purpose of summing up the theoretical input on Robotic Process Automation and providing a peek of future potential, a SWOT analysis is presented below.

Strengths: Economically speaking, it is in the nature of robots to work 168 hours per week in an operating cycle without a manual intervention in productivity, whereas humans can only work 40 hours per week. Additionally, the elimination of human intervention reduces human errors. This indicates a great potential for cost savings and efficiency gains. Another feature is the documentation of all completed activities. This results in the potential for increased compliance standards.

Weaknesses: Since RPA-eligible processes require a high level of standardization, they are vulnerable in dynamic environments where procedures are constantly changing.

Another weakness is that firms that outsource services via automations lose knowledge over time. This shortcoming will be compounded by the possibility of artificial intelligence automating processes without human interaction.

Opportunities: With the emergence of artificial intelligence, intelligent process automation is the new word for automated process mining to find, validate, and enhance.

In contrast to the manual configuration of RPA, these applications currently provide the user with recommendations or autonomous implementation of automated processes based on self-learning algorithms running on business architecture. As a result of the decreased need for implementation resources, this advancement could result in a significant increase in RPA adoption.

Threats: As outsourcing processes is a weakness in terms of outsourcing expertise, it also entails a dependence on the future development of the platform employed and migrating from one system to another incurs substantial transaction costs. A further threat is the lack of employee participation in the successful adoption of RPA, as there is a public perception that people would lose their jobs to robots.

2.2. Business Process Management

During the RPA implementation project, as already described, the first step was to identify the process, then design, validate and finally optimize it for efficiency and RPA implementation. This approach is used in the context of process description in a business context and can be found under the term Business Process Management. Business Process Management (BPM) is the systematic approach to designing, analysing, implementing, and monitoring an organization's business processes. It involves identifying and documenting the steps that are involved in a particular process, analysing the efficiency and effectiveness of the process, and implementing changes to improve the process as needed (Hammer, 2014).

BPM is a holistic approach that considers the entire organization and all of its processes, rather than focusing on individual tasks or departments. It involves the collaboration of various departments and stakeholders to ensure that all processes are aligned with the organization's overall goals and objectives.

A new evolution stage of BPM is software of the same name that allows the diagrammed processes to be transformed into customized applications depending on the functionality, to discover process optimizations through artificial intelligence, or to automate them as in our project (Giudice, 2018). In addition to the automation software, the project partner also uses BPM software, which is also part of the workflow.

2.2.1. Business Process Modelling

The state of the process found at the time of the analysis is called the As-Is. This process modelling represents the current state of a company's operations.

During this phase, each task that must be completed in order to attain the desired process outcome is identified. There are other elements that must be taken into account. The process's effectiveness and efficiency: This includes analysing how well the process is accomplishing its goals and objectives and identifying areas where it could be enhanced.

The level of automation is especially significant for our project: This includes assessing how much of the process is presently automated and whether there are chances to automate more of the process in order to increase its efficiency. (Hammer, 2014).

To make implement the process and adapt it through successful change management the identification of involvement of different departments and stakeholders is crucial. Therefore, it is significantly important, identifying which departments and stakeholders are involved in the process and how their roles and responsibilities intersect with one another. Especially for a company like CTT with high standards and requirements on compliance and privacy, evaluating whether the process is in compliance with any relevant regulations and laws and identifying any potential risks or issues is another key factor for a successful implementation

The use of technology: This includes evaluating the technology currently being used in the process and identifying potential opportunities for improving the process through the use of technology (P. Hofmann, 2018).

After the design and validation of this process by the involved actors, the analysis of the process takes place, leading in the To-Be state. To optimize the process in the triangle between time, cost, and quality of the desired outcome, some considerations must be made.

Detail is one of the most well-known challenges of diagramming. On the one hand, it should provide external actors with a clear and concise picture of the underlying process, while on the other, it should be sufficiently thorough to permit technical implementation. This was a key consideration in our decision to add an extra layer for the automation software inside our process design. Technical spoken it is correct to say that all actions are triggered but not executed inside of UiPath. Functionality-wise it was the single application where the task happened and was therefore only designed inside of the certain application.

Important to the design of the To-Be was its interoperability with the automation software being utilized. This challenge is resolved in the section entitled Technological Mapping. Across all workflows, a multilevel strategy is employed. This helped us show the process to be automated to the various process-working units.

2.2.2. Business Process Modelling Notation

Business Process Modelling Notation (BPMN) is a graphical representation used to represent business processes within an organization, in this case CTT.

It is a standard notation that provides stakeholders within an organization with a shared language for describing the steps of a business process. The notation we employed is based on the flowcharting technique and uses a standard set of symbols to describe the various aspects of a business process. A rectangle, for instance, represents an activity, a diamond, a decision, and an arrow, the movement of control from one element to another. (Hammer, 2014).

BPMN allows for the visualization of a business process and enables different stakeholders to understand and discuss the process in a common language. In the project, we attached importance to keeping this as small as possible but as extensive as necessary.

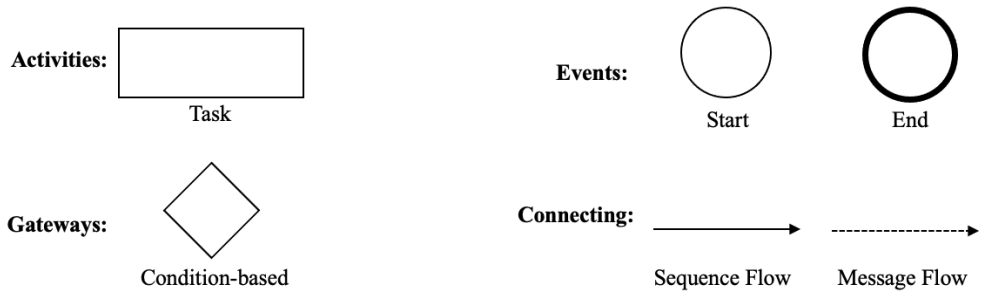

Figure 2: Business Process Modelling Notation

2.3. Agile Project Management

The critical success factor of any software implementation is proven project management. In software development, agile project management is a popular approach because it allows teams to be flexible and responsive to change. The difference between traditional and modern project management is coming from hierarchical approach to a more collaborative one. This is motivated by the fact that innovation cycles especially in the tech industry are shorten and in a globalized market there is more competition than ever (Fernandez, 2016). In an agile environment, teams work in short, iterative cycles and prioritize delivering working software

quickly. This approach allows us to gather feedback early and often, which can help us make course corrections and ensure that the final automation meets the needs of CTT. Additionally, agile project management emphasizes collaboration, communication, and the ability to adapt to changing circumstances, which can help teams to be more effective and efficient (Bergmann, 2018). During our project phase it helped as a lot to get fast and direct feedback and to build up on that by iterative testing in the test environment.

2.3.1. Automation Software Development Cycle

Building on the theoretical introduction, we were provided with CTT's Automation Roadmap (see Figure 2) at the beginning of the project, which includes the Automation Development Cycle based on the Agile method with SCRUM components specifically developed for automation projects. In the following, we describe the individual phases based on the development cycle presented with the respective objective and deliverable. Clean and well-founded preparation before development is crucial for the success of the automation.

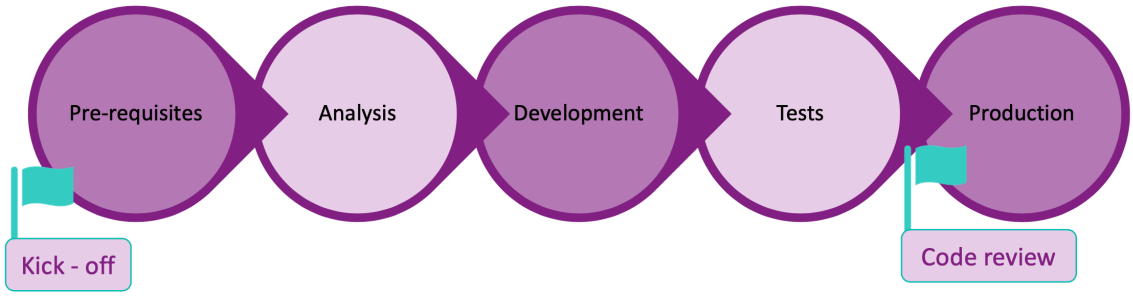

Figure 3: Automation Software Development Cycle from CTT

Pre-requisites: The aim of the initial phase is to find out whether the identified business case is suitable for automation and secondly to estimate the economic parameters in terms of implementation costs and potential savings.

Analysis: Once the feasibility and economic parameters have been positively assessed, the next step is to translate the identified potential of the business case into detailed requirements for implementation. A critical analysis of the current situation is made, and re-engineering necessities are identified. Another important aspect of this phase is the stakeholder analysis, both for the development and implementation of the automation and the use and maintenance

afterwards It is important to include what the required input for the process is and what desired output should be optimized on in the development. The most accurate measure of this aspect to be covered is the alignment of the reporting needs of all stakeholders involved. The deliverable that arises from this is to obtain confirmation from each stakeholder for the identified automation process. As a concluding but just as important aspect, all administrative requirements regarding installations to all relevant systems and APIs and user credentials must be in place.

Development: At the beginning of the development phase, the aim is to diagram the identified automation process. Particular attention is paid to identifying shared activities across different departments, as these often have a certain discrepancy in execution. In addition, this is highly relevant to the second special focus, the automation potential. These go hand in hand with the interfaces of the applications involved in the diagrammed process. The phase also includes an explanatory process description that details the individual steps. In preparation for the following test and production phase, a metrics report is developed with the scheduling of the execution and finally the start of the automation.

Tests: Starting with this phase, the development of test cases goes hand in hand. These should take place in a quality environment that is as close to reality as possible. Based on the results and error reports, a code review and quality assurance of the Center of Excellence will follow. To summarise, a presentation is made to stakeholders with the possible validation of change compared to the As-Is process.

Production: After the tests outside the real environment, the implementation takes place in the final phase with tests inside the real-time architecture. By doing so, the unpacking and switching on of packages, triggers, assets and queues takes place. Finally, the project is handed over to the departments involved and outlook rules are set up. Finally, the documentation is published according to the rules.

3. Performance Communication

Performance communication is a broad field that deals with the effective communication of specific metrics or assessments of the performance of individuals or an entire organization. It can involve setting goals, providing feedback on progress towards those goals, discussing challenges and constraints, and identifying improvement opportunities. Performance communication can take place in various contexts, including the workplace, educational institutions, sports teams, and other groups. Effective performance communication can support individuals and organizations in comprehending what is expected of them, identifying areas for growth, and cooperating to reach their objectives. Clear and defined goals, regular and timely feedback, and open and honest communication are critical components of good performance communication.

3.1. Nudging

As long as there have been people, there has been the idea of "nudging" each other. Nudging is any aspect in the choice architecture of an individual with the objective to influence the decisions and actions of individuals in a predictable way, without using mandates or economic incentives (Thaler, 2008) .

We continuously influence, persuade, or inspire those around us to act in their best interests or those of others. Researchers even believe that the intricate patterns of influence that characterized early humans, hominids, and other social groups were responsible for much of human evolution, including their oversized powerful brains (Halpern, 2019).

Nudge, a book written by Cass Sunstein and Richard Thaler, was released in 2008 (Thaler, 2008). Their research builds on advances in behavioural and social sciences to support and enhance the efficacy and efficiency of governmental policies and to assist people in achieving their goals without imposing any requirements or coercing anyone to do anything (Thaler, 2015). The book discusses a number of real-world instances of nudging techniques that are utilized as an effective substitute for legislation, mandates, and spending a lot of money to solve issues.

The word "liberal paternalism"—which at first glance appears to combine two seemingly at odds ideas—is the foundation of the nudging notion. The liberal component of the strategy is

based on the belief that everyone should have the freedom to do anything they want and to leave bad situations whenever they desire (Halpern, 2019).
The term's paternalistic component stems from the idea that it should be acceptable for choice architects to attempt to change people's behaviour in order to make their lives simpler, more enjoyable, and longer. They believe that a choice architect is a person who is in charge of setting up the environment in which individuals make decisions. In order to steer people's choices in a way that would improve their lives, self-aware endeavours by institutions in the business sector and by the government must be encouraged. In other words, decisions must be affected in a way that will improve people's lives as determined by them (Thaler, 2008).
Thaler and Sunstein drew on several recognized social science results where people made poor decisions on their own. Both contend that if they had paid close attention and been fully informed, these individuals would have made other decisions. Again, that would have required them to have unrestricted mental capacity and total restraint.

Eventually, the dual-process theory is also a foundation for nudging. The majority of the nudges they offered are designed to assist people in using their automatic system (system one) avoid making decisions that will negatively impact them (Dianoux, 2019).
Because decision-makers are not obstructed, caged in, or overly burdened, their conception of liberal paternalism is seen as a comparatively simple, lax, and nonintrusive sort of paternalism. However, choice architects haven't even tried to monitor or influence people's predicted choices prior to the publishing of Nudge (Thaler, 2008).

A nudge, in its simplest form, is any feature of the decision architecture that modifies people's behaviour predictably without restricting their options or materially altering their financial incentives. The intervention must be simple and inexpensive to avoid in order to qualify as a mere nudge. Fruit placed at eye level qualifies as a nudge. Completely outlawing junk food does not (Thaler, 2008)

3.2. Change Management with Nudging

In order to ensure a sustainable success of the implementation, we had to prepare a successful change management. This consists of the one hand of creating an awareness for the advantages of automation to business success and on the other hand of handing over a practicable documentation of the process steps in order to be able to build on these for future changes and optimizations. As described in the belonging part, the nudging methodology is a behavioural science-based approach that focuses on influencing people's decisions and actions through subtle cues and prompts. In the context of change management for shorter process time of manual invoice validation, this methodology can be used to communicate the need for change: Nudging can be used to present the need for change in a clear and compelling manner, highlighting the benefits of a shorter process time, such as improved efficiency, cost savings, and enhanced customer satisfaction. In our messages we pointed out the overall contribution to operational and business success but in future there could be a selection of dynamic specific KPI's being more granular on the business success contribution. Our clear expectations and goals: Nudging can be used to provide specific and measurable goals for the change, such as reducing the process time by X% within Y months. This can help employees understand what is expected of them and provide a sense of direction and purpose for their efforts.

This is something what we implemented but we left the historical lookback window within 1 month before. Otherwise, there was an expected disappointment because of aggregated uncatchable residues over time. Provide support and resources: Nudging can be used to offer support and resources that employees need to succeed, such as training programs, tools, and guidance. This can help employees feel more confident and capable of meeting the goals and achieving the desired outcomes. The result coming from our research and experience during our project is that something what could be built on in later phases of the RPA project since there is a reason for late validation. Offering resources for better time management, or feedback opportunities for capacity constraints is something to consider while sending out messages in the future. Monitor and track progress: Nudging can be used to regularly monitor and track progress, providing feedback and support as needed. This can help employees stay on track and identify areas for improvement, as well as celebrate their successes and achievements along the way. This could've been shown through potential improvements in the ranking through the notification for the next month. Recognize and reward success: Nudging can be used to recognize and reward employees who successfully contribute to the shorter process time, such

as through recognition programs, rewards, and incentives. This can motivate and engage employees, as well as encourage others to follow their example and therefore we send out rewarding messages and statements for the upper half of the validator ranking.

3.3. Nudging in Performance Communication

The basic concept for the project was to utilize nudging as an incentive to accelerate the standardization process.
We opted to employ nudging as a way of communication since monetary incentives were not acceptable nor rational in proportion to the work required, and a strictly enforced responsibility for executives to accomplish the assignment within a specified time frame did not make sense. Due to this, we have chosen to add a performance-based ranking in the performance communication, which does not reflect a comprehensive score for the sent communication but rather specific quantiles.

This has the benefit of eliminating the complexity and potential math plays associated with promotions inside a perfect table, which may also lead to reduced demotivation.
In the context of encouraging workers to complete a job more quickly, a nudge might comprise establishing a clear deadline and delivering frequent updates on the activity's progress.
However, it is essential to prevent infringing the privacy of workers while using this method.
During our study, we devised principles for applying the nudging technique in a manner that protects the privacy of employees: Ensure that the work and the deadline are specified and conveyed to every employee- This will guarantee that everyone knows what is expected of them and why completing the assignment swiftly is crucial.

Provide frequent updates on progress toward the deadline but avoid discussing the performance or development of specific individuals. Instead, concentrate on the overall success of the team or firm. Motivate staff to accomplish a job swiftly by using positive reinforcement. For instance, you may provide incentives or acknowledgement for completing the deadline or accomplishing other milestones.

Encourage workers to discuss any issues or hurdles they have in accomplishing the assignment and provide support and assistance to aid them in overcoming these barriers.

This may promote a feeling of cooperation and collaboration, which can drive staff to complete the assignment together.
Be open about the purpose of the assignment and the deadline and be receptive to employee input and concerns. This may help develop trust and promote a great working environment, which in turn can drive people to perform more quickly and efficiently. It was crucial that we did neither breach the privacy of people nor spiral into a demotivating downward spiral by adversely influencing comparisons.

3.4. Performance-based communication based on the Nudging-methodology

The guidelines described in the previous section resulted from the analysis of the nudging method combined with our focus of the CTT company, Robotic Process Automation opportunities, and internal constraints of data layers. Based on this, we divided the people responsible for validation into five different groups and wrote the following notifications, which are then sent automatically when the included criteria are met. These five different groups represent one block in the final validation methodology of the randomised experiment. We have chosen them in quantiles because, on the one hand, an accurate communication of the ranking raises privacy concerns in the organization and, on the other hand, we wanted to incentivize the lower-ranked validators with easier promotion opportunities.

Message Groups in performance-based ranking for CTT invoice validators

1) **First Group (Top 5%)**

Dear [Receiver], Congratulations on being part of the top 5% of CTT's manual invoice validators [this month]! Your hard work and dedication to keeping operations running smoothly has been essential to our success. We'd like to remind you to keep up this good work. To stay in the top 5%, please make sure to manually validate all invoices today.
Thank you for your continued commitment to CTT success.

2) **Second Group (Top 25%)**

Dear [Receiver], Congratulations on being part of the top 25% of CTT's manual invoice validators [this month]! Your hard work and dedication to keeping operations running smoothly has been essential to our success. We'd like to remind you to keep up this good work. To stay in the top 25%, please be sure to validate all manual invoices today.

Thank you for your continued commitment to CTT success.

3) Third Group (Top 50%)

Congratulations [Receiver]! Your hard work [this month] has paid off and you have achieved a place in the top half of the ranking for the validation of manual invoices. However, it is time to take it up a notch and strive to make it to the top. To do that, we need to reduce the process time of the validation. Let's work together to make this happen and show the world that we can be the best by validating all invoices by the end of the day!

4) Forth Group (Lower 50%)

Dear [Receiver],

We noticed that your processing time of manual invoice validation is in the lower half compared to your colleagues [this month] and therefore under average. In order to keep up with the 50%+ of your colleagues who are performing faster, it is necessary for you to increase your processing time. Keep your chance of rising into the top half of the table and validate your invoices today. We appreciate your hard work and commitment to the team and are confident that you can reach the same level of performance as your colleagues. Thank you for your understanding and continued effort.

5) Fifth Group (Last 25%)

Dear [Receiver], You are currently in the last 25% of manual invoice validators in [this month] and we think you should be aware of it. Over 75% of your colleagues have been performing faster but if you validate your invoices by today, you have the chance to rise in the ranking. Let's work together to ensure the operational success of CTT.
Thank you for your understanding and continued effort.

4. The Implementation of Robotic Process Automation at CTT

The process to be automated describes the validation of invoices that could not be automatically registered and paid due to incorrect or missing information. Validation is carried out by authorised people within the organization. The problem that arises is the average time it takes for validation to be carried out. The goal of automation is to identify the source of the problem and use performance communication to get them to complete the validation more rapidly. We will conclude the project by measuring the impact of communicating performance of a particular task in the invoice validation process. Therefore, we will randomly divide validators in three distinct groups to validate the impact. After successful implementation, the problem becomes how to make a human more "productive".

4.1. As-Is Purchase-to-pay Process

In order to create the To-Be process for the automation of the process, the As-Is designs of the two preparing processes were required. The first of the two procedures describes the workflow from Purchase to Pay. The second outlines the invoice processing procedure, with an emphasis on the automation project when automated invoice scanning and payment is not completed.
In parentheses, the ID number of each item in the flowchart shown in this report is indicated.

This begins with the Purchase to Pay Process and goes from the order placement through its settlement. It begins with a CTT employee submitting an order request to the buying department (1.0.). The receiving department then searches for the desired goods or service from qualified preferred vendors (2.0.). When eligible proposals are received (2.1), the ordering department conducts a technical review (1.1.). After completion, this technical assessment of the bids is submitted back to the buying department.
On the basis of the technical assessment and the extra pricing criteria, a purchase decision is taken (2.2.). This is then formed into a purchase agreement within the limits specified (2.3.).
The order is then put in the buying system and forwarded to the chosen supplier (2.4. & 2.5.).
The provider fulfils the order (3.0) and delivers the products together with the issue of an invoice (3.1.). This invoice is automatically scanned by the technical unit (4.0) and recorded in the buying system using optical character recognition (OCR) (4.1.).

Afterwards, a transfer was made automatically to the accounting department (5.0.), which processes and settles the invoice if it complies (5.1.).

With the acceptance of the invoice and receipt of payment, the procedure is complete.

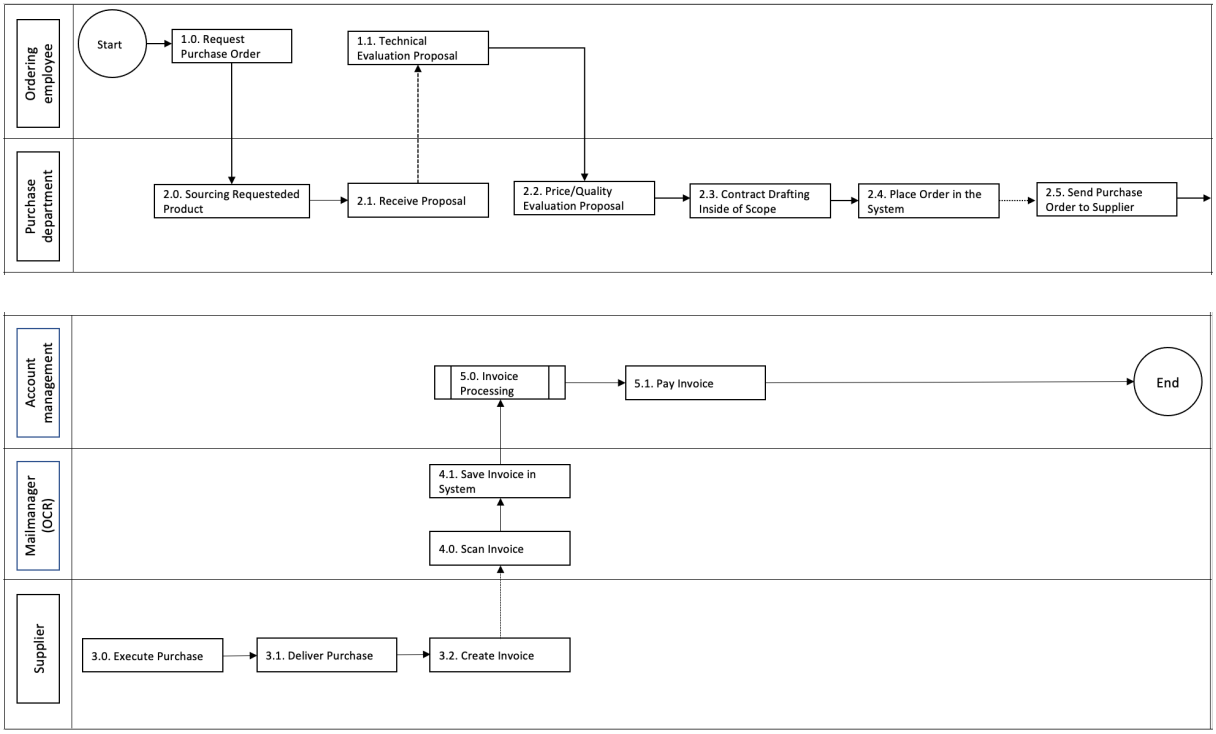

Figure 4: As-is Purchase-to-pay process

4.2.As-is Invoice Validation Process

Coming to the second process description that needs to be analysed and designed for automation. Beginning with the arrival of the supplier's invoice in the inbox where it will be processed by optical character recognition (1.0.). The "happy path" continues if the invoice has a purchase number that can be matched to a purchase order in the system.
Consequently, the invoice amount will be compared to the purchase order amount identified in the system (2.1.). If the invoice value plus/minus optional credit/debit values from previous transactions with the supplier equals the purchase order value, then the "happy path" is complete.

Returning to the 2.0 decision gateway. In the event that the Purchase Order Number could not be found, the invoice will be sent straight to the accounting department for validation (3.0). To determine the validator is a whole new process that my fellow colleague in the other RPA implementation project designed and implemented.

Moving forward to the decision gateway (2.1) and leaving the 'happy path' with the decision made, if the invoice value plus/minus potential credit/debit values does not match the purchase order value, the same action will be taken, namely sending the invoice to the accounting department to determine the validator (3.0), and the processing will be complete.
As previously stated, the process of determining the invoice validator is beyond the scope of this project. Therefore, the process design advances to the circumstance in which the validator has been identified (2.2.).

If the invoice is accurate (4.1), the ordering employee will forward the invoice to the management responsible for approval (4.2.). Assuming that the invoice has been authorized (4.3), it will be submitted to the accounting department and recorded (3.2.). This concludes the procedure along the "happy path". If the invoice meets the requirement of being incorrect, it is not processed as a valid invoice and the supplier is notified (5.0.). This concludes the process since the supplier must revise the invoice and resend it, which leads to the beginning of the process.

Returning to the gateway if the validated invoice is not accepted by the responsible management (4.3.). This will prompt the accounting department to determine if the invoice

amount is more or less than the purchase order value (3.1.). If the invoice amount exceeds the value of the purchase order, a credit note will be required (3.3.). If the invoice amount is less than the purchase order total, a supplier debit will be requested (3.4.). The procedure concludes with the supplier providing confirmation of the debit or credit note (5.1.).

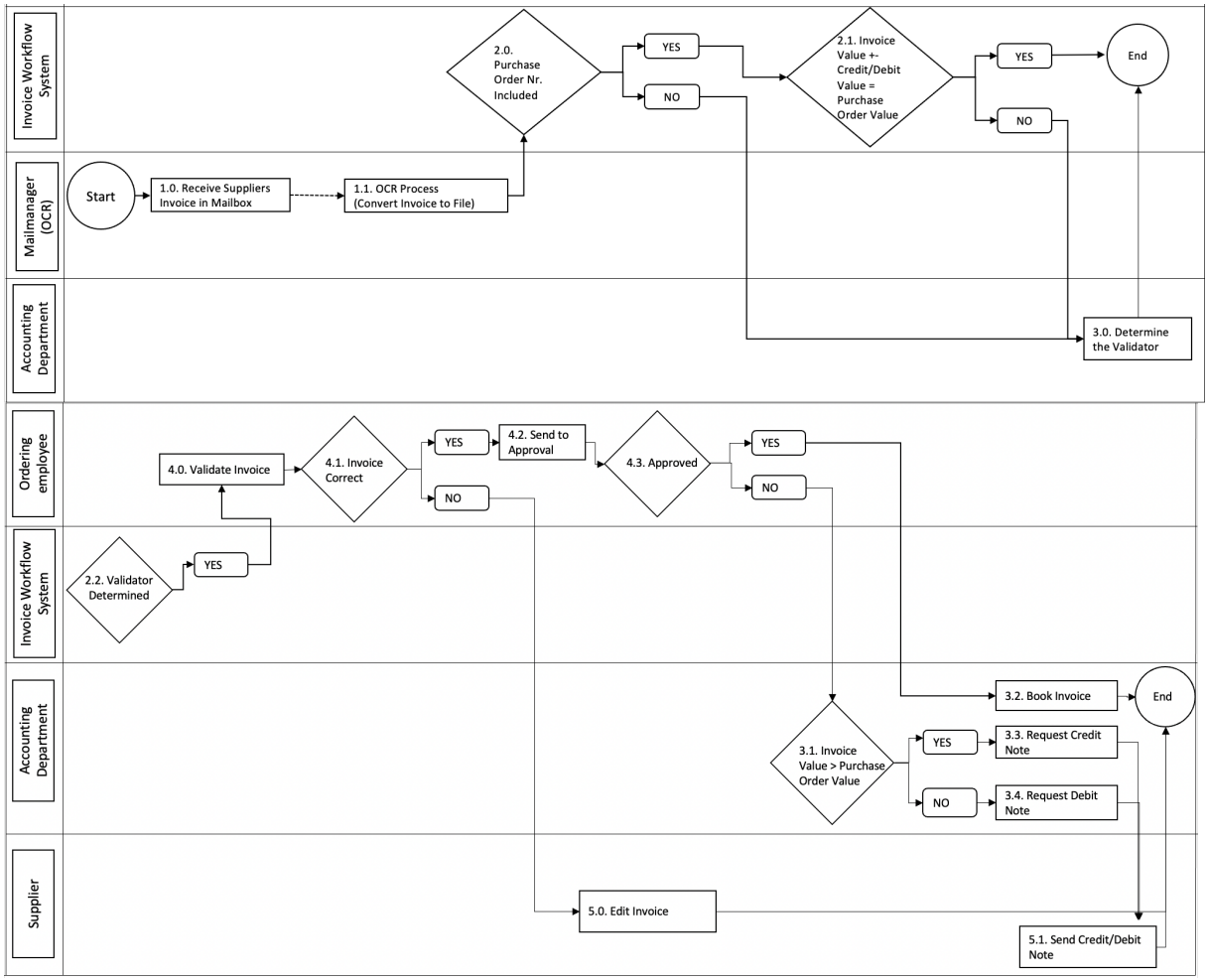

Figure 5: As-is Invoice Validation Process

5. To-Be

When creating a To-Be Design for a technology system, it's important to focus on a few key areas in order to ensure that the design will be effective and efficient.
First, we analysed the overall goals and objectives of the system, in our case UiPath and ensure that the design aligns with those goals. This will help to ensure that the system is designed in a way that meets the needs of the organization and its users. Since Ui Path is an automation system we focused on functionalities that can be automated and data in-and outputs that can be streamlined within the automation path.

Next, we wanted to think about the specific functional requirements of the system, and how the design will address those requirements. This will help to ensure that the system is able to perform the necessary tasks and functions in an effective and efficient manner.
It was also important to consider the technical architecture of the system, and how it will be built and implemented. This helped us to ensure that the system is scalable, reliable, and able to integrate with other systems and technologies as needed.

Finally, we considered the user experience of the system, and how it will be intuitive and easy for users to navigate and use. Following, we aligned our work with the CTT framework, introduced earlier in this report to allow future users to access and understand the path and evolve over time. This will help to ensure that the system is user-friendly and will be adopted and used by the organization's staff.

5.1. Technological Mapping

CTT's cloud-based business process management application was recognized as the primary application responsible for achieving our goal of sending performance-based communications to validators. Therefore, the automated path begins by opening a browser (1.0.). This is followed by the input of the URL leading to the business process management application outlined in the section with the same name (1.1.). The reason to visit the page is to download the report of validators which can be found within (1.2. & 1.3.). After the download, the next automated action is to launch the Excel application (2.0.). To identify the validators, a query is executed to identify them and link their email addresses (2.1.). This is followed by a second

query that determines the raking with the defined quantiles classified by the process time of manual invoice validation inside the one-month lookback window (2.2.).

If the validator is included in the ranking, indicating he or she has open invoices to validate (2.3), the data input will be processed to the e-mail application with the validator's Name, e-mail address, and position within the ranking (3.0.). With this data input, validators will receive e-mails (3.1.). This concludes the procedure, and the final step is to once again close each open application (2.4.).

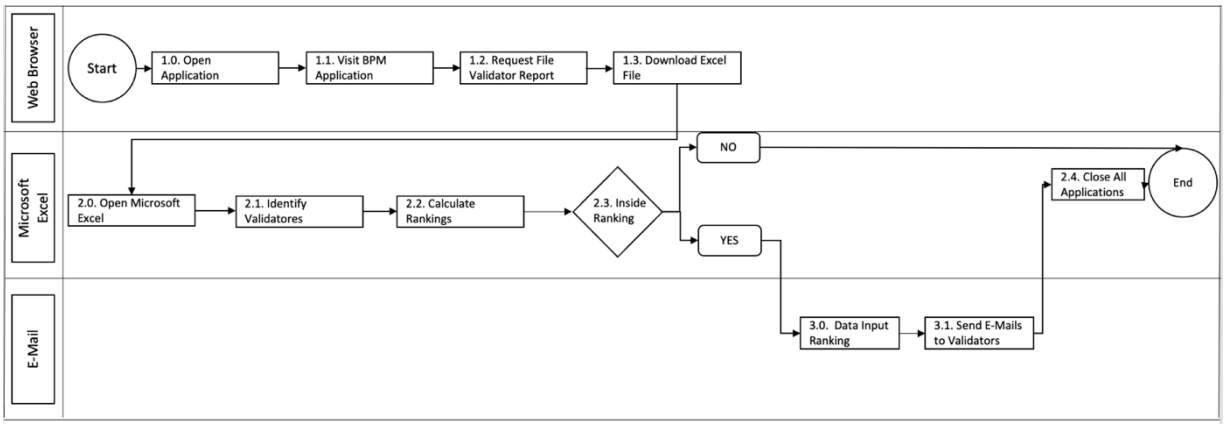

Figure 6: To-be RPA Technological Mapping

To develop and define key performance indicators and to make the success of our project measurable, we used the SMART methodology. The SMART goal theory is a framework for setting and evaluating objectives that are specific, measurable, attainable, relevant, and time bound. Following procedures, we defined to measure the effectiveness of ranking-based performance communication in accordance with the nudging methodology.

First, we set a specific goal to define precisely the objective of monitoring the effectiveness of ranking-based performance communication using the nudging method.
Afterwards, we need to create a measurable objective: Determine how the effectiveness of the ranking-based performance communication will be measured.

This could involve utilizing measures like as the number of employees who read the communication, the percentage of employees whose performance increased as a result of the communication, or the organization-wide performance improvement.
Focus by developing those goals is to make the objective attainable. Therefore, we establish achievable objectives within a fair time range and consider variables such as available

resources and the task's complexity. We wanted to make the objective relevant, align the goal, ensure that the aim is connected with the organization's broader objectives and will have a significant influence on performance can have a positive contribution to achieve the overall objectives (Weintraub, 2021).

To make it more efficient we set a time frame determine when the objective should be attained and develop interim benchmarks to monitor progress.

Specific: The goal is to implement a RPA solution to send out notifications using the nudge methodology to reduce the time spent on manual invoice validation.
Measurable: The success of the goal can be measured by the percentage reduction in time spent before processing the manual invoice validation, as well as the number of reminders sent out and the response rate from recipients. Following, we have set up a block randomized example to prove significance for our methodology and approach. The set-up is described in the next section.
Attainable: This goal is attainable if the necessary resources (such as funding, technical expertise, and support from stakeholders) are available and the RPA solution is properly designed and implemented.
Relevant: This goal is relevant to the organization’s objectives of improving the process efficiency and reducing costs.
Time-bound: The goal should be completed within a specific timeframe, such as within four months of the start of the project. This will help ensure that progress is being made and that the project stays on track.
Since the end of this project report means also the start of the automation the evaluation of the defined SMART-goal will be relevant for the master Defence presentation

6.1. Block Randomised Experiment

A randomized experiment is a form of scientific experiment in which participants are assigned randomly to various groups or treatment conditions.
This allowed us to account for other variables that could have affected the outcome of the performance-based message delivered, as well as evaluate the effects of the intervention being tested in order to reduce validation time. A researcher forms a control group, which receives no therapy or a placebo, and a treatment group, which receives the experimental treatment, in a randomized experiment (Suresh, 2011).

The groups are subsequently compared to determine whether there are statistically significant differences in the outcome measures. Randomized experiments are regarded as the most rigorous and trustworthy method for assessing the effectiveness of a treatment or intervention. Since our sample size may be too small to demonstrate significance in a randomized experience, we intend to conduct a block-randomized experiment to demonstrate the effect following the installation of the RPA.

The purpose of block randomization in experimental design is to ensure that the groups being compared in an experiment share all important features and to eliminate bias in the assignment of individuals to treatment groups.
To apply block randomization to measure the effect of performance-based communication on the processing time of manual invoice validation, it is necessary to first identify the relevant characteristics of the population being studied, such as the experience level of the individuals performing the invoice validation, the type of invoices being validated, and the complexity of the validation process.

Next, we would divide the population into blocks based on these qualities, with each block having individuals with similar traits. For instance, if the population is composed of individuals with varied levels of experience, we may form blocks of persons with comparable levels of experience.

Individuals within each block would then be randomly assigned to either the treatment group (those who get the performance-based communication) or the control group (those who do not).

The third group would receive nothing more than a simple reminder. This assures that the groups being compared share all pertinent features and removes the potential of assigning individuals to treatment groups based on prejudice.

After assigning individuals to treatment groups, you would implement performance-based communication with the treatment group and collect statistics on the amount of time required for manual invoice validation for both the treatment and control groups. This information can then be utilized to determine the impact of performance-based communication on the time required for manual invoice validation.

6.2. Conclusion

Coming back to our initial research question how to convince leaders at one of Portugal's top companies to prioritize a repetitive task, we first analysed and evaluated the feasible technology to implement the process leading to our objective. This was done in the beginning because the decision for the technology was already determined in the beginning, meaning there was no selection process but analysis of capability and feasibility. The overall experience with the RPA process and software of UiPath was positive. Especially, the intuitive integration of tasks and decisions coming from the process design and mapping into the functionality was helpful. Also, the comprehensive visualisation inside of the software made the comparison with the process design easy. Only the restricted interoperability with MacOS had a negative impact on the project success.

Moving forward with the conclusion of the design for the automated process. This was a great achievement of the process in collaboration with the project lead from CTT to design and validate the As-is process with the flowchart in a fast and effective manner. Even if some perspective of the responsible department was missing, the overall comprehension of the two processes leading to our single process automated was given.

Coming to our research focus the methodology and creation of the performance communication to shorten the time before the manual invoice validation. The evaluation started with understanding of the incentives and responsibilities of the invoice validators. Since the validators belong to the higher management of CTT it wouldn’t be manageable down-managing with authority to force the immediate validation of invoices. Knowing the success

and popularity of the Nudge-methodology from classes, the next step was intuitive to execute the evaluation of the methodology for our ranking-based communication.

Based on our result of a missing immediate feedback mechanism to incentivise invoice validators for faster invoice validation the nudging methodology was used. The combination with our objective to implement ranking-based communication we communicated the current quantile of the validator with the potential rise in the ranking by immediate validation. This was concluded to establish a higher level of overall contribution to the organisational success.

Finalising our project and the underlying report with reaching measurability of the project success, we decided to use the proven SMART methodology. The methodology helped us to define specific and motivating goals that will have a foreseeable impact on the success of shortening the invoice validation. To prove the significance, we described and prepared the set-up to execute a block randomized example to control the potential of compounding variables while testing for significance. This decision was also based on the relatively small sample size.

All in all, we showed that the realisation inside of a complex organization like CTT is possible when there is a well-defined and executed project management, proactive collaboration from all stakeholders and an efficient set-up to measure the success of the project. Ending this report by highlighting two key factors for a sustainable success of RPA implementation: well-done documentation leasing to reproducibility and proactive communication for successful change management during and after the implementation.

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