



Robotic Process Automation: Impact and Best Practices in Portuguese Banks

Gonçalo Pires de Carvalho Mota Carmo

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Abstract

Title : Robotic Process Automation: Impact and Best Practices in Portuguese Banks

Author : Gonçalo Mota Carmo

Robotic Process automation is the technology that allows companies to configure software to emulate the interaction of an employee with digital systems. This software is also known as “robots” and they have the innate ability to perform tasks faster, more accurately and to work 24 hours a day.

In banks, most support functions are located in back-offices and the tasks performed there are mainly repetitive tasks that follow a set of rules. These types of processes are a good candidate for RPA automation.

The Portuguese banking sector is still in an early stage of digitalization. In general, banks are innovating in their front-offices, however, apart from a few players in the industry, their back-offices still heavily rely on paper and currently have a low level of automation.

By conducting interviews with topical experts that have been present in RPA implementations in banks, this study determined the impacts of the technology in Portuguese bank’s back-offices and the best practices that should be followed in order for implementations to be successful in future endeavors.

The results show that RPA can have a significant impact in the industry, namely a reduction in operational costs. Furthermore, always considering scalability for future RPA projects and providing functional and technical documentation are among the resulting best practices.

Keywords : Automation ; Banking ; Robotics; Back-Office;

Sumário

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Autor : Gonçalo Mota Carmo

Automação Robótica de Processos é a tecnologia que permite às empresas configurar software com o objetivo de reproduzir a interação de um funcionário com sistemas digitais. Este tipo de software é também conhecido por “robots”. Estes têm a particular capacidade de executar tarefas em menos tempo, com maior precisão e de trabalhar 24 horas por dia. Nos bancos, a maioria das funções de suporte encontram-se no back-office. As tarefas relacionadas com estas funções são muitas vezes de natureza repetitiva e seguem regras estabelecidas. Este tipo de processos são bons candidatos para automação através de RPA. O sector bancário em Portugal ainda se encontra numa fase inicial da sua digitalização. De uma forma geral, os bancos estão a inovar serviços no seu front-office, mas, excluindo alguns bancos na indústria, os back-offices ainda funcionam muito à base de papel e têm um nível de automação baixo.

Através de entrevistas com especialistas em RPA que já integraram equipas em implementações da tecnologia em bancos, este estudo determinou os impactos da tecnologia nos back-offices dos bancos em Portugal e as melhores práticas a seguir para garantir o sucesso de futuras implementações.

Os resultados mostram que RPA pode ter um impacto significativo na indústria, nomeadamente a nível da redução de custos operacionais. Adicionalmente, ter sempre em consideração a hipótese de escalabilidade e entregar documentação técnica e funcional foram algumas das práticas reveladas no estudo.

Keywords : Automação ; Banca ; Robótica; Back-Office;

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1. Introduction

There is no denying that over the last few decades our world has been going through a massive digitization process. Companies, consumers and governments have all adopted some sort of new technology or digital service (Sabbagh, K. et al., 2013). In fact, digitization has become a global key economic driver, accelerating growth and creating a whole new plethora of jobs (Kotarba, M., 2017).

The banking industry is no stranger to this phenomenon and has been in the forefront of this digital disruption ever since the deployment of ATMs in the 1970's, electronic trades in the 1980's and online banking in the ninety's (Kelly, G., 2014). In more recent years, the sector has not shied away from this trend and keeps on innovating by taking advantage of new technologies. One technology that is worth mentioning in this specific industry is Robotic Process Automation, more commonly known as RPA (Crosman, P., 2018).

Robotic Process Automation encompasses all the technological tools that operate in the same way a human would. Its main purpose is to replace employees in simple, repetitive, time-consuming tasks (van der Aalst, W. M., 2018).

Bank's back office processes are comprised of a collection of mainly menial, systematic tasks, that even though simple to execute are very time consuming (Crosman, P., 2018). This makes this area an optimal candidate for the use of RPA.

RPA tools are emerging throughout every business sector. It is clear that these tools cannot substitute humans across the board, but they can without a doubt save a lot of time when it comes to simple, repetitive tasks, even if supervision is still required in most cases.

Despite this wide adoption, there isn't that much literature regarding the impacts of this trend in companies. This gap includes the impact in financial institutions and implicitly banks in Portugal, which is what this dissertation is looking to assess and report. More specifically, how RPA has impacted Portuguese banks who have implemented tools within its back-offices processes. In order to come to accurate results on this subject, this study will answer three research questions:

Research Question 1(RQ1): What is the potential impact of RPA in the Portuguese Banking Sector?

Research Question 2(RQ2): What are the best practices for RPA implementation in banks?

To answer these questions, previous implementation cases will be taken into consideration as well as the opinion of topical experts. Having said that, this study aims to come up with the best practices that can be used in future implementations in order to take full advantage of what RPA has to offer.

As of its relevance for business, this thesis intends to demonstrate how RPA can be used to create a competitive advantage whilst reducing the cost-to-income ratio. Early adopters of RPA software are starting to understand how it can have a big impact on bank's back-offices. While improving data quality, customer service, regulatory compliance and decreasing delivery times, RPA is also decreasing costs (Lacity, Willcocks & Craig, 2015). RPA is also possible answer to the growing number of regulations that have been imposed since the financial crisis (Weber, 2017).

2. Literature Review

2.1. The Banking Industry

The banking industry is still recovering from the global financial crisis of 2008, but shows promising signs for the future (Myles, D., 2018). The Banker’s Top 1000 World Banks Ranking of 2018 has reported that the industry’s global assets stand at \$124 trillion as of 2018. Even though this recovery is more significant in the United States, European banks are not that far behind and show positive indicators of growth over the last decade (Figure 1).

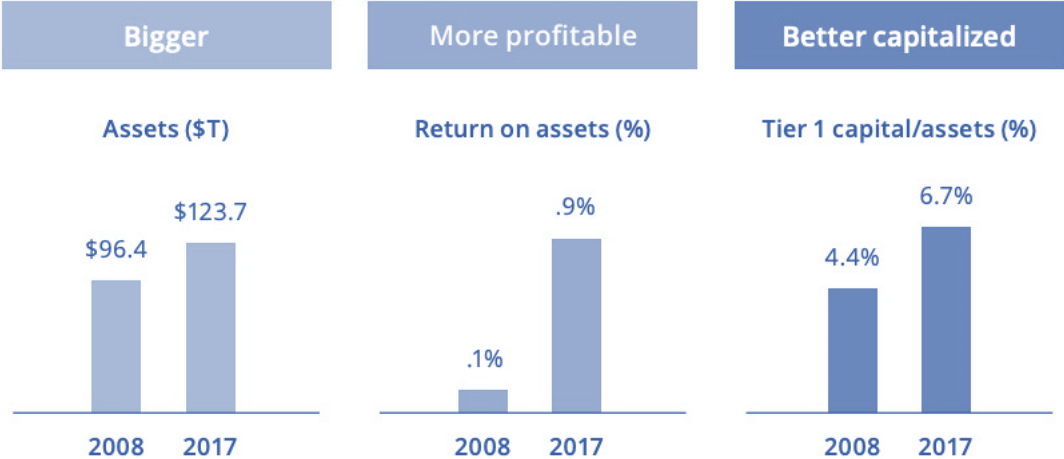


Figure 1 | Growth of the global top 1000 banks (APB, 2019)

Contextualizing the European recovery, the five biggest banks in Europe had profits of \$60 billion in 2007 before the financial crisis which despite the growth in recent years it stood at \$17,5 billion in 2017 (Arnold, M., 2018). Notwithstanding, the industry is definitely undergoing a recovery and growth process. This is corroborated by analyzing a few key performance indicators, such as ROE, which grew to 8,6% in 2017 from 5,5% in 2016 (Myles, D., 2018). Taking all of this into consideration, the overall picture is positive for the world’s banking sector.

2.1.1. Banking Industry in Portugal

As of 2019, there are 62 banks operating in Portugal with over 4000 branches. Based on assets, the five major players in the market are Millennium BCP, Banco Português de Investimento(BPI), Santander Totta, Caixa Geral de Depósitos(CGD) and Novo Banco. Together, these banks form a €400 billion market with upwards of 45000 employees. (Banco de Portugal, 2019).

Following the worldwide industry trend, the Portuguese banking sector also shows positive indicators and is in an even better position compared to the pre-crisis period. Profitability, solvency and efficiency have all grown over the last couple of years (APB, 2019).

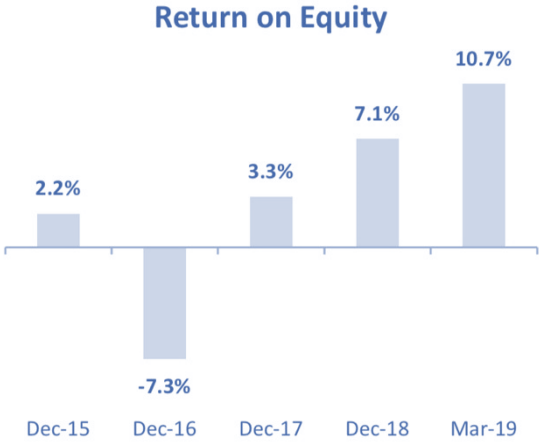


Figure 2 | Return on Equity 2016-2019 (APB, 2019)

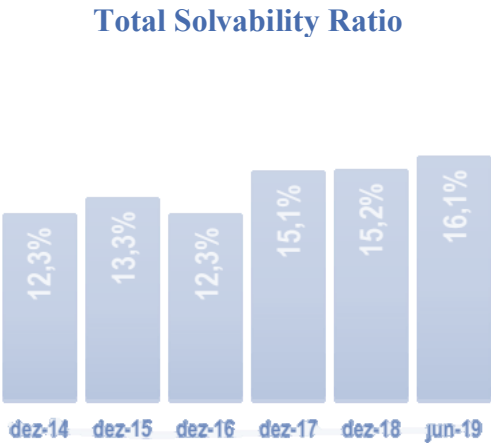


Figure 3 | Total Solvability Ratio 2014-2019 (APB, 2019)

The main source of funding in the Portuguese banking sector are customer deposits which have also increased in the last years. Since 2015, deposits have exceeded the total amount of credit granted by these institutions in Portugal. There was also an increase in the number of issued cards, as well as payments made with those same cards (APB, 2019).

Digital channels, such as home banking, smartphone apps have also been increasingly accepted and used by customers. In 2018, 57% of costumers were using some type of online banking (APB, 2019).

2.1.2. Banking Back-Office Processes

The term back-office within a bank generally means that there is no interaction with customers, they are not directly linked to generating revenue for the company, but they are a fundamental part of operations.

Typically, back-office encapsulates accounting and support functions. Invoicing, issuing purchase orders, receiving payables, shipping and ordering are a few examples of functions that can be found in back-offices. These tasks are usually manual and still involve handling large quantities of paper (Webber, 2000). A recent study conducted at an European bank uncovered that more than 70 percent of processes relied on paper which led to 30 to 40 percent of those to contain errors which required for them to be reviewed later (Dias, et al., 2012).

Even though these processes are mainly focused on processing and support functions, since the rest of the operations depend on back-office processes it is critical that these are as efficient as possible so that it doesn't become a bottleneck (Lacity, et al., 2015).

Banks have addressed and keep actively addressing their front-end operations with several different digital solutions, but their back-offices are still very dependable on paper and employees. Bigger banks have thousands of people handling customer requests. This not only gives way to human error, but it also amounts to a high expenditure cost and time wise (Dias, Patnaik, Scopa & Van Bommel, 2012). Despite the potential impacts in back-offices, the banking industry is still heavily focused on front-end processes and customer experience, since that is what directly attracts and increases loyalty among its clients (Lacity, et al., 2015).

Most banks are institutions that have been established for a long time and therefore, their systems have suffered numerous modifications to keep up with new technologies. Unfortunately, not always are these modifications well integrated with the old system, in fact they most often are simply added on top of the existing system. Over the time, this has led to very complex IT infrastructures. In turn, this makes the automation of processes in these systems also complex (Deloitte, 2015).

Due to the nature of the majority of tasks performed in a back office and the fact that they still require a high percentage of human interaction supports the fact that back office processes need an improvement (Deloitte, 2015).

2.2. Automation

Robotic Process Automation (RPA) couples basic Artificial Intelligence (AI) concepts with process automation. These include Natural Language Processing (NLP) and Machine Learning (ML). In order to define RPA, a few key concepts must first be defined.

2.2.1. Machine Learning

It is now possible for machines to recognize faces in photos or understand voices for example. Machine learning is partially responsible for these breakthroughs. Machine's automatic improvement through experience is called Machine Learning (Mullainathan & Spiess, 2017). It is at the core of Artificial Intelligence and it is a rapidly growing field since it helps bridge data science and AI. Machine Learning has seen great progresses in the last decades and it has come a long way from A. L. Samuel's early milestone with the game of checkers in 1959 and is now used commercially across a lot of industries (Jordan & Mitchell, 2015).

By using Machine Learning, systems can autonomously learn from data and run specific algorithms that in turn can be used for web searches, advertisement placement and even stock trading (Domingos, 2012).

Taking face recognition algorithms as an example, they are not manually constructed rules that can scan pixels in an image and understand where a face is. These algorithms take large amounts of images/photos where some have faces and others don't. This information regarding the existence of a face in the image is available to the machine and from these it is able to predict the presence of a face in said images. The more data is given, the more accurate the machine becomes (Domingos, 2012).

2.2.2. Natural Language Processing

Natural Language Processing (NLP) is the area within AI that studies how machines can be used to work with natural language, may that be in written text or speech. The main aim of these type of tools is to allow computers to understand natural languages and interpret them the same way a human would. That information will then be used to perform specific tasks that require the machine to manipulate natural language (Choudhury, 2003).

NLP is the bridge between linguistics and Artificial Intelligence, but it relies on various different scientific fields such as mathematics, psychology, engineering as it is an incredibly complex field (Nadkarni, Ohno-Machado & Chapman, 2011).

With NLP machines can perform tasks that involve natural language comprehension, from text translations to dialogue systems (Young, Hazarika, Poria & Cambria, 2018).

2.2.3. Robotic Process Automation

Despite its denomination, Robotic Process Automation does not refer to physical robots performing human tasks. RPA concerns software that is programmed to perform specific tasks that were previously conducted by humans (Lacity, et al., 2015). However, RPA software is also designated by "robots"(not to be mixed up with physical robots). These robots perform in the same interface people would and operate them in the same way a human would, always following a specific, previously programmed logic.

For an RPA tool to exist, a process must be mapped in one of the available software so that the robot can then follow the logic and execute user actions accordingly, these include mouse clicks, keystrokes, among others (Tornbohm, 2017).

RPA is the automation of simple, repetitive, rule-based processes through the use of software to capture, interpret and execute in an existing IT application environment (Deloitte, 2015). Most of the software used to create RPA robots already has other technologies incorporated, such as Optical Character Recognition (OCR) software which allows robots to recognize characters in a digital document. By leveraging these machine learning tools, natural language processing and other technological recent developments, employees in a company can program computer RPA software to extract data or insert data, allowing them to perform routine tasks and operations that would usually require humans to be performed. The tool interacts with existing applications, processing it which in turn triggers specific coded responses, replicating an employee's action (Laurent, 2015).

The type of software that fall under this category can perform repetitive and routine tasks. But it does not only mimic people's behavior within a specific process, as it also does it much faster, without errors and above all tirelessly. A robot can run 24 hours a day, unlike employees. This allows people who would perform these tasks to be used in a more efficient way in tasks that truly require human touch, tasks that involve emotional intelligence (Lhuer, 2016).

These robots are also versatile and can be used in tasks from automatic emails to handling millions of requests in a management system. They are used across numerous industries, from financial services to healthcare.

In general terms, 60% of a company's processes can be automated in some way (Duncan & Lundy, 2019). Among the best candidates for automation are high-volume processes, monotonous tasks, tasks with multiple levels of complexity, tasks that involve multiple technological environments (Enterprise Resource Planning systems, etc.) and tasks that show high potential improvement of efficiency and accuracy from automation (Duncan & Lundy, 2019).

There are some general characteristics that processes should have in order to be eligible for the beneficial application of RPA. These processes should be composed of a high volume of tasks, have the need to interact with several applications, low cognitive skills required, clear rational rules for a robot to follow and should also be susceptible to human error (Fung, 2014; Slaby, 2012). If all of these characteristics are met, a product is more than likely eligible for the use of RPA. However, not all of the characteristics have to be met for a process to be eligible. As the number of criteria met increases so does the probability of it being a good candidate for RPA. There are endless business use-cases for RPA. Companies have the ability to automate processes in several areas such as sales, finance, human resources and many others. To name a

few tasks that can be automated by using RPA, from data entry, data validation to automatic periodic reports, invoicing and software installation.

Among others, one of RPA's benefits is cost reduction (Aguirre & Rodriguez, 2017). It is common for companies to outsource routine repetitive tasks that would otherwise require a high number of FTEs (Full-Time Equivalents). It is true that this could result in cost reduction, but there is some complexity associated with outsourcing, such as added management and agency problems. On the other hand, RPA eliminates this added complexity whilst still resulting in high cost reduction. Depending on the situation and process being automated the reduction varies, but RPA based robots can result in cost reduction equivalent to 0,1 FTEs to 0,19 FTEs for local employees and from 0,33 FTEs to 0,5 FTEs outsourced employees (Asatiani & Penttinen, 2016; Prangell & Wright, 2015; Slaby, 2012).

RPA tools can be built on top of the existing IT backbone, unlike other types of automation where back-end integration and changes to the existing systems are necessary (Asatiani et al., 2016). RPA software only requires access to the user interface, the presentation layer and it interacts with it in the exact same way a user would. This means there is minimal to no technical integration required (Lamberton, Brigo & Hoy, 2017).

Robots follow clear rules, step by step and won't deviate from the path on their own. Since these tools have built-in audit logs that monitor every action performed by the robots, if any unforeseen error is encountered the responsible person can be immediately notified so that the situation is handled appropriately. Not only does this make them reliable, it also improves compliance. It eliminates fraud and improves transparency (Devarajan, 2018).

Another major benefit is the improved accuracy accomplished from the use of these robots. Unlike humans, robots don't make mistakes. Robots follow a specific set of rules, meaning they don't insert data in the wrong place or mistype values, which is normal and will eventually happen with humans (Hallikainen, Bekkhus, & Pan, 2018). Ultimately, this leads to improved quality as error rate and associated risk is lower.

Robots have the unique ability to work 24 hours a day, 7 days a week. This allows for an increased output and decreased response time (Alberth & Mattern, 2017). This means, that it is highly scalable and can support a very high volume of data (Lamberton, et al., 2017). This increased productivity allows a higher input and therefore possibly higher sales amount. The result is a very quick return on investment (ROI), very often within the first year (Willcocks, Lacity & Craig, 2017).

Adding to this, companies who implement RPA have the ability to scale their digital workforce with minimal effort and time expenditure. Depending on the workload, companies can choose

to scale their workforce accordingly, simply by replicating existing robots or downscale when they are not needed (Barnett, 2015)

Possibly one of the less addressed benefits of RPA is the increase in employee morale. By handling all the repetitive, generally less interesting tasks, employees don't have to do them and are allowed to focus on more challenging and interesting tasks, boosting their morale and happiness at work (Lhuer, 2016).

Notwithstanding, along with this last benefit a controversial topic arises. Some companies have the ability and need to place employees who oversaw these respective tasks in other areas or in other positions within that same company. However, other companies don't have the need for employees in other positions and jobs are eventually lost. Although this possibly translates into cost reduction for the company, employees are obviously not happy with this, even those who are able to keep their jobs (Alberth, et al., 2017).

However, in most cases, employees welcome RPA usage since they also benefit directly from it. Most of the tasks performed by robots are tasks that employees don't enjoy as they are mainly repetitive in nature (Lhuer, 2016). It also relieves their workload and allows them to focus on more interesting tasks. In the long term, jobs as a whole will not be lost. The commonly less interesting and repetitive parts of those jobs will be lost. Moving forward, people and technology must maintain a better relationship and if companies are able to absorb that change and transform it into productivity the result will be very positive (Lhuer, 2016).

Everything considered, the correct RPA implementation can result in 25-50% cost reduction in manual operations. Furthermore, it is able to provide this result while improving customer service, ensuring regulatory compliance and a fast return on investment (Lamberton, et al., 2017).

Given these results, the market for RPA software and solutions has been increasing at a fast pace. The RPA market was valued at \$1,1 billion in 2019 and is expected to grow to \$10,7 billion by 2027. The Banking Financial Services and Insurance segment have the biggest percentage of implemented applications (Grand View Research, 2020). Currently more than 50 software providers are present in the market, from which Automation Anywhere, Blueprism and UiPath are market leaders. Prices for each robot differ based on complexity and provider, but average between \$5000 dollars and \$10000 (Le Clair, Cullen & King, 2017).

Telefónica O2, a Telecommunications company applied RPA in 15 of their core processes, which amounts to 35% of the company's back office. This allowed Telefónica O2 to scale their operations immensely and to achieve over a period of three years an ROI of 650% to 800% (Rutaganda, Bergstrom, Jayashekhar, Jayasinghe & Ahmed, 2017; Lacity, et al. 2015)

2.3. RPA in banks back office

Banks are a clear candidate for the use of RPA, more specifically their back-offices. Most of the processes in these offices are focused on routine tasks, require a low cognitive function and are very prone to human error (Laurent, Chollet & Herzberg, 2015).

Moreover, banks deal with very high volumes of sensitive data every day. Through the use of RPA, they can take advantage of all the benefits RPA can provide, including eliminating processing errors and decreasing delivery time, crucial to bank's business models.

Some use cases in the banking industry are described in Table 1.

Task	Description	Source
Fraud Detection	An analysis on client's transactions can be quickly performed through RPA to quickly detect any anomalies that point to fraud.	Lamberton, et al., 2017
Sales Invoicing and Ordering	Automatic preparation of sales invoices, sales information entry in ERP system, customer details update.	EY, 2017
Report Generation	Data can be extracted from several different sources, validated and organized in a specific format, so that a report can be automatically generated.	Devarajan, 2018
Consumer Loan Processing	For a bank to determine the eligibility of a client to a loan credit, background and employment checks are required. These processes can easily be automated as they follow a rule structure.	Rutaganda, et al., 2017
Credit Card Request Process	RPA can help with Credit Card requests by automating the involved processes such as documentation collection and credit/background checks.	Madakam, Holmukhe & Jaiswal, 2019
Account Opening/Closing	Opening/Closing accounts follow a logical path that is consisted by a predefined set of rules for which a robot can be configured to follow.	Barnett, 2015

Journal entries Accounting	Collection and entry of financial data, such as assets, liabilities, expenses and revenue that can automatically be updated.	Accenture, 2020
Accounts Payable	Still a mainly manual and paper-intensive process that can take much advantage from RPA software. Invoice processing, payment, validation and reconciliation can all be automated.	Oracle, 2015

Table 1 | Banking Industry RPA Uses Cases Examples

Barclays, a world-renowned bank, is a wide adopter of RPA in its back-offices. The bank has automated numerous processes that illustrate the technology’s potential, from risk monitoring to fraud detection and even the automation of accounts opening. Because of this adoption, Barclays can adapt to customer demand and the respective number of customer requests by scaling their digital workforce to meet demand (Barnett, 2015).

The Co-Operative Banking Group has also adopted RPA in their back office processes. With over 130 processes automated, such as VISA chargeback processing and complex CHAPs payment processing, the company has had many benefits including an 80% cost reduction in processing and a significant ROI. Usually, a CHAPs payment process would take 10 minutes to be completed, it now takes them less than 20 seconds to complete the same request (Rutaganda, et al., 2017).

As a smaller bank, Eurobank felt the need to reduce costs as its cost-to-income ratio was above average when compared to more established banks. By 2017, they decided to implement RPA solutions within their processes as an effort to reduce costs.

As a test, Eurobank focused on five processes focused on asset sales and collections. Before the implementation process began, an assessment to each of the processes in question was made. From the number of employees involved, the time it took for the process to completed, its frequency and mapping the steps involved. Some key requirements the bank was looking for were processes that saved a minimum of 1 FTE, additional security or faster response time. Four of these processes met the requirements set by the bank.

From these solutions, the bank was able to save more than 20 FTE’s monthly, equivalent to almost 30000 hours of human work, allocate 20% of a single department to robots and ultimately provide a better customer service (UiPath, 2019).

After their first successful implementation, a Centre of Excellence was founded within the bank to better manage the implementation and management of the solutions. Nowadays, the bank has over 14 robots allocated to processes such as changing loan repayment schedules, card activations, card restrictions, automatic emails, online sales, overdraft and collecting consent from customers. These robots work with more than ten different sub-systems (UiPath, 2019). Although RPA shows much promise for banks, there have been failed projects. Implementations are simple and straight forward, but they still require a well thought plan of execution prior to entering the development stage. Existing processes must be assessed in order to identify potential gaps and improvements or even potential changes. Some companies have rushed RPA implementations without thoroughly evaluating the “as is” state of their processes which can lead to failure to meet expectations. It is important to note that RPA cannot be applied blindly to every existing process, use cases must be selected carefully (Hallikainen, et al., 2018; Rutaganda, et al., 2017).

Furthermore, whenever a company decides not to develop RPA internally but to buy the service to another entity, the internal IT team should always be prepared and involved in the whole implementation process to make sure the project is successful. However, there are also steps that should be taken when the technology is being developed internally. For example, concerns about employment losses should be addressed right away since developers will need to work with the technical experts who need to accept robots in order for them to succeed (Hallikainen, et al., 2018). The software architecture should take into account the possibility of scalability, added functionalities and security (Barnett, 2015).

Change management is also key for RPA projects. Convincing organizations to change and adopt automation is essential, especially top management. The latter should be completely committed to change and RPA in order for it to be successfully deployed, they should be educated on the potential impacts of the technology and exactly what to expect from the implementation (Lhuer, 2016).

2.4. RPA in Portuguese Banks

Most of the major banks in Portugal are aware of RPA, but are not actually implementing it in their back-offices. The majority includes automation in their core strategy for the future, but has not yet started its implementation (CGD, 2019; Millenium, 2019).

A few banks have started their automation adoption, but are still in their early stages, there is still a lot left to automate (Montepio, 2019; Santander 2019).

There is not much literature on what exactly has been implemented so far in Portuguese banks. Annual reports show that the front-office has seen more digital innovation than back-offices. However, RPA has more potential in back-offices than in front-offices due to the nature of tasks in each of them. The repetitive tasks present in back-offices is where RPA shows promising results and can improve banks services.

3. Methodology

3.1. Research Design

Firstly, through the research of existing literature and other secondary sources of data an overview of the banking industry in Portugal is given. The current level of automation in Portuguese banks and some potential benefits of RPA are also presented as a foundation for the study.

Following this, primary data was collected through interviews with industry and topical experts that have experience in RPA implementation projects. These interviews followed a semi-structured approach. With these interviews it was possible to create a better understanding of the current state of banks in Portugal, how RPA is being implemented in the industry and what have been its impacts, as well as what experts considered fundamental for a successful implementation.

Then, taking both primary and secondary data into account a quantitative analysis with multiple alternatives and different weighted criteria was conducted to first determine the potential impacts of RPA in the Portuguese banking sector and then the best practices to follow for a successful RPA implementation in banks.

3.2. Data Collection

Primary data was collected through semi-structured interviews. For each of these interviews a set of several questions was used as a guideline. These questions were sufficiently open and unbiased in order to leave to the interviewees the possibility to elaborate and explain their opinions, as well as mention other relevant related topics.

The structure followed in each interview started with the interviewee's experience in RPA projects and potential use cases for this type of technology in bank's back-offices. Next, their view on the current state of automation in Portuguese banks is given. Following this, potential benefits and observed impacts throughout the interviewee's experience were mentioned. Finally, best practices for RPA implementations were discussed.

Nine industry experts were interviewed for the purpose of this dissertation. These experts have significant experience in RPA projects and their profiles are described below (Table 2). Regarding the years of experience, it is noteworthy that the technology is still in an early stage in Portugal. A unique code, the years of experience with RPA projects, the revenue of the company for which the interviewee works for and their specialization are all detailed for each of the conducted interviews.

Interview Code	Years of Experience (with RPA projects)	Company Range of Revenues(million €)	Specialization	Date
ITV 1	11	90 - 120	Tax Technology	10/01/2020
ITV 2	5	5 - 7	RPA	19/02/2020
ITV 3	7	90 - 120	Financial Services	03/12/2019
ITV 4	3	5 - 7	Web-based Apps	21/02/2020
ITV 5	4	90 -120	RPA	09/12/2019
ITV 6	3	5 - 7	Information Systems	28/02/2020
ITV 7	2	5 - 7	RPA	28/02/2020
ITV 8	4	4 - 6	RPA	03/03/2020
ITV 9	1,5	5 - 7	RPA	21/02/2020

Table 2 | Description of interviewed industry Experts

Regarding secondary data, a review of existing academic literature was conducted, as well as a consolidation of information reports was made to build an industry foundation and introduction to the technology and its benefits.

3.3. Quantitative Analysis

In order to determine the potential impacts of RPA in banks and also the best practices for RPA implementations in banks, the qualitative data gathered during the interviews was translated into quantitative data so that two separate analysis could be conducted. Both of these followed the same framework.

All the alternatives (impacts and best practices) were collected from the interviews, by reviewing the literature review and consolidating other secondary sources. Different weights were attributed to each type of sources (Table 3).

Source	Individual Weight	Number of Sources	Total Weight
Expert Interviews	8%	9	72%
Literature Review	20%	1	20%
Other Secondary Sources	8%	1	8%

Table 3 | Sources Weight Distribution

Then, each of the sources is analyzed to check if each alternative is mentioned within them. If mentioned, a quantitative level is attributed based on the qualitative data collected during the

expert’s interview. The level of importance for the impacts (Table 4) and for the best practices (Table 5) is attributed following a specific framework described below.

Level	Description
0	Not mentioned.
1	Minor impact
2	Low impact
3	Moderate impact
4	Significant impact
5	High impact

Table 5 | Quantitative level of impact

Level	Description
0	Not mentioned.
1	Minor importance
2	Low importance
3	Moderate importance
4	Significant importance
5	High importance

Table 4 | Quantitative level of importance for best practices

A total result, from 0 (zero) to (five) is obtained for each of the alternatives, allowing for a ranking to be created in each of the analysis. This individual result is calculated as follows:

$$Individual\ Result = \sum_{i=0}^n l_i \cdot w_i$$

Where l_i regards the level of impact or importance (depending on the analysis) given to the specific impact or best practice by source i and w_i the weight of that source.

4. Analysis and Discussion

Robotic process automation is still in its infancy in most of the Portuguese Banks. Apart from a few banks, most banks lack any sort of automation in their processes. Some already have a simple type of automation through the use of routines, IT procedures and macros, but not using RPA software (ITV 2, 2020).

Although still in its early stages, the major players in the industry are becoming more and more aware of RPA and its possible benefits and are starting some RPA implementations in their back-offices. Despite that, when compared to banks in the United Kingdom, for example, they are very far behind in the “automation journey” (ITV 5, 2019).

Many back-offices continue to rely on physical documents when most of these could be turned into digital documents that could then be handled by robots (ITV 4, 2020). There still are many processes in the majority of Banks in Portugal that could benefit from Robotic Process Automation.

Most of the times, the lack of automation derives from a lack of knowledge on either the subject or the potential benefits of RPA. Many managers are unaware about how RPA could benefit their companies. However, the potential impacts appear to be very positive and promising (Table 6).

4.1. Potential Impacts

From the data collected, six different impacts were studied. The table below (Table 6) is the result of the conducted analysis.

Source	Weight	Impact					
		Cost Reduction	Production Increase	Quality Increase	Talent Retention	Resource Increase	Dematerialization
Interview 1	8%	5	4	4	4	5	4
Interview 2	8%	5	4	4	3	0	0
Interview 3	8%	5	5	4	4	0	4
Interview 4	8%	5	5	0	4	4	4
Interview 5	8%	5	4	4	5	4	4
Interview 6	8%	4	4	0	0	0	0
Interview 7	8%	5	4	5	0	0	0
Interview 8	8%	4	4	4	0	0	0
Interview 9	8%	5	5	0	0	0	0
Literature R.	20%	5	4	4	4	3	0
Other Sources	8%	5	4	4	3	4	0
Total	100%	4,84	4,24	3,12	2,64	1,96	1,28

Table 6 | Quantitative Analysis : Potential RPA Impacts in banks

The most evident potential impact of the implementation of this technology seems to be related to cost reduction, which had a total result of 4,84 and was present in every source used for the analysis. This reduction will most likely be linked with the no longer needed outsourcing services. A lot of banks have outsourced parts of their back office procedures, especially the ones that involve many repetitive tasks. RPA allows them to return those services to their own offices where robots will be in charge of them.

Recently, due to the automation of the process related to the closing of customer accounts in one of the major banks in Portugal upwards of costs equivalent to 30 FTEs were reduced and those employees reallocated (ITV 5, 2019). A process that had upwards of 35 FTEs allocated is now handled by 6 FTEs that provide support and overview to the respective robots.

This will obviously depend on the size and cost of each specific process, but on average, between 70% to 80% of costs related to each back office process can be decreased (ITV 3, 2019; ITV 5, 2019 ; Rutaganda, et al., 2017). The bank as a whole has the potential of decreasing its total costs by 10% and some entire areas can decrease their costs by 25% (ITV 3, 2019). Also, most of these projects achieve their breakeven point before the first year, the majority gets to this point by the ninth month (ITV 3, 2019 ; UiPath, 2019).

At a European level, the industry margins are getting continuously lower, but these margins can be generated by reducing internal costs, which makes RPA a fundamental tool for the entire industry.

Next, the level of production is also heavily impacted, reaching a result of 4,24. Robots have the innate ability of operating 24 hours a day, 7 days a week. Some systems shut down entirely during some hours of day, for example, but even in those conditions, robots can gather data during the time the system is online and then process that data while the system is offline is correctly configured (ITV 1, 2020). This means that if correctly designed a robot can always be more efficient in these types of tasks simply due to their ability to constantly work.

Adding to this, robots are faster than humans in certain types of tasks. Gathering data from an internal or external system, inserting data into a system and numerical operations are a few examples where robots are faster and more efficient than humans. In fact, more often than not, if a certain task is feasibly executed by a robot, than the robot can most likely execute it faster than a person.

In one of the banks where RPA was implemented, an example of productivity increase was due to the elimination of process bottlenecks. Some tasks depend on other tasks to be triggered or completed. If tasks in general are take less time to be executed, the time between each of these

tasks is also less and when configured properly, most bottlenecks can be eliminated (ITV 6, 2020).

By increasing production, more data or more requests can be handled in the same amount of time, there is an increase in capacity and respectively in output. This will allow the bank to handle more customer requests faster.

Not only that, but the quality of data/output is also increased, having reached a result of 3,12 in the quantitative analysis. One of the problems banks face is the inconsistency of data across several systems. This data is inserted by employees and no matter how careful an employee is, an error will eventually be made as it is only natural. However, if designed correctly, a robot will create a level of reliability that is hardly achievable through humans. Even if the insertion of data is partially dependent on reading physical documents, these documents can be scanned and by using an integrated OCR, an RPA software can “read” documents and handle its data correctly (ITV 5, 2019). Notwithstanding, some exceptions can occur where the software is not able to properly extract data from physical documents, which is why a back-office team continues to be necessary in order for exceptions to be handled accordingly (ITV 1, 2020)

These increase in quality can even be found in areas not related to the automated process as employees previously allocated to that process can be distributed among other areas and increase the quality of the output in those new areas where the number of allocated employees was lower (ITV 8, 2020).

Increased quality coupled with increased production in back-offices will lead to an indirect increased customer satisfaction. Customers will see their requests fulfilled faster and more accurately.

Some employees show concerns about losing their jobs to robots (Lhuer, 2016). However, most of the times no job losses are registered due to RPA implementations (ITV6, 2020; ITV 7; ITV 9). Although it is true that tasks that required a certain number of FTEs now require far less, often just to supervise and intervene in specific situations, these employees do not lose their jobs. This results in an increase in resources available to the bank.

The employees that used to be allocated to the automated tasks can be reallocated to other areas where employees are needed, other areas can be explored and new services can be created. All of this contributes positively to banks operations (ITV 2, 2020).

By allocating more employees to certain tasks the quality of said tasks will most likely increase, as well as productivity and consequently revenue can potentially increase. Services that the bank did not have the capacity to offer before can now be considered as resources are now available to provide those new services.

The vast majority of the tasks involved in the processes where RPA will be implemented were repetitive and uninteresting tasks. Most employees executing these tasks did not enjoy it and will welcome robots once they realize they will not lose their jobs. By freeing these employees of the less wanted tasks and allocating them to more interesting and challenging ones, the company morale is being increased.

Employees will be happier executing tasks that are in nature more challenging and interesting. If employees are happier they are more likely to stay in their respective companies, contributing to talent retention (ITV 1, 2020; ITV 5, 2019).

According to the interviewed experts, most of the banks in Portugal still highly rely on physical documents. It is true that this is partially due to compliance issues, but some of these paper documents could be transformed into digital information.

The robots cannot work with physical, paper documents, so one of the solutions is to scan these documents and through Optical Character Recognition (OCR), a technology that is integrated in most RPA tools, such as UiPath and BluePrism, transform these documents into digital documents. When in digital format robots can read and handle the data on them. This will result in more digital documents being created by the robot, which will over time decrease the need for paper documents, allowing banks to dematerialize (ITV 5, 2019). Even though this impact was only found in four expert interviews, it presents a very inevitable and evident consequence of RPA in banks.

In sum, the main potential impacts of RPA implementations in banks are an up to 10% reduction of total costs and 80% reduction of costs for each automated process, an increase in production, both in quantity and execution time that when coupled with the reduction of error rate will offer an higher quality service for a reduced internal cost.

For the Portuguese banking sector, where total operational costs amount to € 3 886 million (APB, 2018), this would result in savings of up to € 388, 6 million.

4.2. Implementation best practices

For Portuguese banks to take advantage of these positive impacts the RPA implementations responsible for automating their back office processes must be successful. Some best practices should be followed to ensure its success (Table 7).

Source ¹	Weight	Best Practice						
		Allow scalability	Functional and Technical Documentation	Address job loss concerns	Detailed analysis	Management Commitment	Collaboration with IT team	Easily Maintained
ITV 1	8%	0	4	4	4	5	4	0
ITV 2	8%	5	5	0	0	0	3	4
ITV 3	8%	4	4	4	4	0	4	4
ITV 4	8%	0	5	0	0	3	0	4
ITV 5	8%	4	4	4	5	4	4	4
ITV 6	8%	3	4	3	0	0	0	0
ITV 7	8%	4	5	3	0	0	0	4
ITV 8	8%	4	5	3	3	3	0	3
ITV 9	8%	4	5	0	3	0	0	4
L.R.	20%	4	0	5	4	5	4	0
O.S.S	8%	4	0	5	4	4	4	0
Total	100%	3,36	3,28	3,08	2,64	2,52	2,32	2,16

Table 7 | Quantitative Analysis: Best Practices for RPA implementations

Every best practice studied in this analysis presented a score between 2,16 and 3,36, meaning there was not a significant disparity.

Notwithstanding, the best practice with a higher level of importance was preparing scalability with a total of 3,36. Over time, new functionalities will be necessary and thus experts believe that a major key to success is to design RPA software in such a way that allows for someone who wasn't in the original implementation to add functionality to the existing robot. Not only will this prevent software to be developed unnecessary as it will save a lot of time.

In order to prepare software for added functionalities it is important to follow standard programming best practices, such as commenting code, using general terms, using a single language and so on (ITV 2, 2020; ITV 7, 2020).

Secondly, preparing Functional and Technical Documentation was also deemed highly important by experts, with a result of 3,28. Documentation will help with the previously mentioned best practice as well as ease maintenance, which achieved a total score of 2,16).

It can be extremely difficult for someone outside the original development team to understand what was done and how to modify/maintain the software (ITV 6, 2020). Thus, having access to comments by the original team can save a lot of time and money to banks when more functionalities, simple adjustments or updates are required.

Thirdly, before the implementation starts, it is important to address concerns about job loss (total score of 3,08). It is natural that concerns among employees are risen when RPA is first

¹ ITV : Interview; L.R. : Literature Review; O.S.S: Other Secondary Sources

brought into the company, it is still a new technology in Portuguese banks and not everyone is familiarized with the concept and its impacts. Notwithstanding, a large portion of employees assume that RPA is always related with job loss, which more often than not is a false pretense (ITV 1, 2020).

As previously explained job loss isn't one of the common impacts of RPA implementations and as such it is important to address this concern as the concerned employees will be collaborating with the development team. If this issue is left unattended, employees might try to sabotage the implementation or delay it for as long as possible (ITV 2, 2020).

Next, with an importance score of 2,64, a detailed analysis of the process to be automated should always be conducted before entering the development stage.

Not all processes are good candidates for RPA, but apart from that, before deciding if a process is a good candidate, an analysis to its structure should be done as there are some simple adjustments that can be done that turn a process from a bad candidate to a good candidate. What this means is that sometimes processes don't seem like a good option for automation, but with some process reengineering it is possible to automate them (ITV 5, 2019).

Another important practice is getting bank management full commitment to the RPA implementation, amounting to a total result of 2,52. Projects where management was not fully committed or did not educate themselves enough about RPA have failed in the past or fall short of original expectations (ITV 3, 2019).

As such, it is extremely important to discuss what RPA can and cannot achieve within banks, which processes are good candidates, how long it will take for impacts to show and so on.

By having management committed to RPA and automating their back-offices it is much easier to conduct implementations. During the project, some key decisions must be made and if management is not motivated enough with the project it might take a long time before the development team receives the final decision or if management is not educated enough about RPA the final decision might not be the better option, compromising the benefits of the technology and possibly delaying future projects in the bank. This commitment can be achieved in several ways, but once the concept is proven within the bank it will most likely be replicated in as many processes as possible (ITV 5, 2019).

With a result of 2,32, but still highly important in some expert's opinions, collaboration with the internal IT team. According to the conducted research, none of the Portuguese banks have an internal team developing RPA solutions. As such, it is important that the development team and the internal IT team are able to coordinate during the implementation.

The development team will need access to the internal systems or punctual help with something within the bank's IT system. According to experts, one of the major obstacles during implementations is the excessive amount of time that it took for the internal IT department to grant the development team access to the internal systems (ITV 2, 2020; ITV 3, 2019; ITV 5, 2019). The lack of collaboration between the two teams will result in an unnecessary time delay. Also, collaboration is important with the team previously responsible for the process being automated (ITV 1, 2020). It is likely that during the development, some technical issues regarding the process will be met and the internal team would have the required expertise to resolve the issue in the least amount of time. Moreover, after the implementation the robot will probably require supervision which might be provided by one of the members in that same team. As such and in an effort to save time, the team is involved in the project from the start, making it easier to use and maintain the robot properly.

Lastly, with a total score of 2,16, an RPA software should be designed to be easily maintained. Apart from fully new functionalities, some small adjustments to the tool will inevitably be necessary. These adjustments should be easy to conduct as they can happen with some frequency. Hence, the importance of preparing documentation for the software. This maintenance should be covered in the documentation, but even then, the tool should be designed taking into account that maintenance should be easy to conduct.

4.3. Typical Bottlenecks

The interviewed experts reported some obstacles found during previous RPA implementations in banks. Most of the major Portuguese banks have very complex IT systems that are not easy to use, result of continuous development over the years without any integration with previous versions. This system must be used by the RPA development team which might need some help of the internal IT team in order to do so. Not only must the IT team grant them security access, but they are the ones who could allow the process of navigating and using the internal to be much easier. However, just as important as the IT team is the team allocated to the process to be automated as they can also allow for the implementation process to be much easier and will allow the robot to function properly after the implementation as explained before.

Furthermore, as the technology its still relatively new to banks in Portugal, employees and even management have some lack of knowledge about what RPA really is and what it does.

For these reasons, experts believe that an implementation should start by addressing concerns about RPA, explaining and discussing exactly what is going to be done and what to expect as a result.

In one of the Portuguese banks where RPA is being widely adopted the second step was to choose a single process to be used as a Proof of Concept (POC). This is the easiest way to show the possible impacts of RPA (ITV 5, 2019). This process should be carefully chosen and analyzed to assure that it is a good candidate and that the full potential of RPA can be demonstrated.

Since the POC was a success, top management recognized the potential of RPA in their back-offices and decided to continue its automation journey with more processes. The next and already ongoing stage is to create an internal excellence center to allow implementations to continue at an even faster rate.

Since banks still find themselves in such an early stage of automation, there is still a lot to be done in the area. Around 70% to 80% of processes can be automated (ITV 5, 2020). Seeing as most of the banks are far from that percentage of automation, there is still a very big potential for RPA in the banking industry in Portugal.

5. Conclusion

5.1. Main Findings

This study reveals that Robotic Process Automation is still a new concept among Portuguese banks. However, that allows potential impacts to be more significant.

RPA can result in reduction of costs by eliminating the need of outsourcing back office tasks, an increase in productivity by allowing banks to process more data in a smaller amount of time, an improved data quality as the error rate is nullified and an increase in resource availability as employees can be reallocated to other areas or tasks. This ultimately, results in a better and faster customer service.

Furthermore, RPA also contributes to talent retention as most of the tasks performed by robots are very repetitive and thus not interesting to employees with are happier executing more meaningful and challenging tasks.

Finally, most of the Portuguese banks still highly rely on physical documents, this can be a disadvantage as physical documents can be lost or destroyed, for example. Though, this dependence can be decreased by using robots that transform these paper documents into digital documents.

In order to facilitate RPA implementations to have these positive impacts on banks a few general rules should be followed, best practices.

Among the studied practices, the most important is preparing the developed software to be scalable, meaning it should be prepared to have new functionalities added and small adjustments throughout its use. Creating and providing a functional and technical documentation was found to be an important practice as it allows employees outside of the original development team to modify and maintain the software as needed. One other important best practice discovered was to address concerns about job loss as early as possible in the implementation process. Employees that are unfamiliar with RPA might believe that it will create job loss and thus they might try to delay and jeopardize the implementation.

In sum, RPA can very positively impact banks back-offices if applied in the correct way and to the proper processes. There is a lot that can still be done in banks back-offices. A high percentage of processes can be automated, which means that there is still a lot of potential for RPA to grow and benefit banks in Portugal. The estimated savings potential for the industry as a whole if RPA is fully adopted and successfully implemented is € 388,6 million.

5.2. Limitations and potential for future research

Despite the fact that among the experts interviewed there have been interactions or implementations with several banks in Portugal, the experts all work in three different companies. Furthermore, none of these three companies is a bank. Having the opinion of someone on the bank's side would be a good addition to the study and should be considered for future studies.

The number of experts interviewed could have been higher in order to present more accurate results.

A comparison with other countries banking industries could also be conducted to show how RPA is impacting banks in other countries and the different level of automation across these different countries.

Moreover, the analysis conducted in this study was the result of an approximation using the collected qualitative data. Future research with more specific quantitative data could show interesting results.

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7. Appendices

Appendix I – Expert Interview : Interview 1 (ITV 1), January 2020

The interviewee has more than 10 years of experience in the Technology Industry and has been in several RPA implementation projects.

In his opinion there is a vast number of possible use cases for RPA in banks, but a few examples are the automation of pricing validation procedures in billing systems, most of the back office processes related with account management and even customer support.

From his experience, banks in Portugal have very little automation within their back-offices.

The main obstacle during projects has been the complex IT system architecture found in most of these banks due to continuous development with little to no integration. Also, sensitive data management can also become an inconvenient during some of these projects.

However, if correctly applied, RPA could bring benefits such as decrease in time expenditure related to routine tasks, increase in resource availability, increased team morale and many other, but in sum reduced opportunity cost derived from increased resource availability. Output quality was also mentioned as the error rate will be nullified with the use of robots.

An RPA implementation project typically starts with a functional analysis and specification and identification of possible use cases. Secondly, the infrastructure is installed, followed by the solution development and integration. Before the Go-live phase there is a testing stage to make sure everything is working as intended and to make the necessary adjustments.

As the main best practices for RPA projects, the interviewee mentions the commitment of top managers to the project and technology, the availability of the client-side team from the area in which the implementation is taking place, appointing a project leader and constant communication to the stakeholders of the project progress.

Appendix II – Expert Interview : Interview 2 (ITV 2), February 2020

Having been in more than five different projects ranging from 1 to 6 months and two projects that lasted for more than 6 months Interviewee 2, hereby ITV 2, has five years of experience in RPA projects.

For possible use cases in banks back-offices, ITV 2 mentioned Credit approval processes, the insertion of data into partner entities, such as VISA, MasterCard, SIBS and so on and also partial processing of working documents allocated to outsourcing companies.

Banks in Portugal are, in his experience, not at all automated. Only one of his clients had some of their processes somewhat automated, but even then they were automated through routines and IT processes and not RPA software.

Even though all of these projects were successful, the addition of the developed RPA software to the existing IT system was not always easy, sometimes the development time of some necessary internal IT adjustments necessary to maximize automation benefits took much longer than the development of the RPA software and some stakeholders in the client side sometimes do not have any technical background.

The implemented solutions highly reduced the costs associated with the automated processes, increased productivity. In terms of employees, no changes were made, just reallocation of tasks.

In order to assess which processes should be automated the structure of the task/input, the overall process cost and the development time were taken into consideration.

As best practices for RPA implementations, ITV 2 mentioned that the software should be easily maintained, Functional and Technical Documentation should be created and delivered to the client, a close relation should be kept with the internal IT team/department and the software should always consider the ability to scale and to be reusable.

Overall benefits of RPA mentioned are the decrease of error rate in repetitive tasks, higher team morale, decrease in costs with outsourcing companies and creation of value and competitive advantage in the current market.

Appendix III – Expert Interview : Interview 3 (ITV 3), December 2019

This expert has a vast experience, including with major players in the industry.

Linear processes with clearly established rules that use digital information are always candidates for RPA. Compliance procedures and some accounting processes may have these characteristics. Closing bank accounts, some ATM operations, credit requests and many others. Before their implementations, banks back-offices automation was very basic, based on a few macros, never actual RPA software.

Apart from one project where the client wasn't properly educated about RPA and had false expectations about it and chose a process which was too complex, all the projects were successful and met client's expectations. By choosing a process that is too complex the impact wasn't as strong for many more rules and exceptions were associated with the procedure lowering performance.

For the successful projects productivity was increased, with a robots working 24 hours a day, resources were increased as a robot is usually equivalent to 3 to 4 full-time employees and costs reduced. Costs were reduced for as much as the equivalent to 10 FTEs and some projects hit their break even after 9 months.

As for best practices, the expert mentioned that the implementation strategy must be clearly defined before entering the development stage, an initial awareness program is important to make sure employees understand the benefits of RPA, internal IT department should always be involved, but shouldn't be the project owners. Maintenance and scalability should always be considered for the future and a center of excellence could be built internally to help with future automations.

Appendix IV – Expert Interview : Interview 4 (ITV 4), February 2020

With almost 3 years of experience in RPA projects, Interviewee 4, mentioned as possible use cases in banks back-offices the transformation of physical documents into a digital format, the automatic sharing of documents with partner entities and data insertion into several user interfaces.

Banks in Portugal are, in his experience, not at all automated. And not only that, they're knowledge on the subject is also very low.

All of the implementations were successful, but in some of them the interviewee found some teams who didn't accept the benefits of RPA right away, mainly because they're knowledge on the subject was very low. Sometimes, teams on the client side needed to be involved in the implementation process which caused some time constraints for the project.

The implemented solutions reduced the costs regarding these processes, increased the level of production.

Processes that involve a high quantity of data, a clear structure, high costs and return are ideal candidates for RPA implementations. Development time and the resources required for projects are also taken into account to measure its feasibility.

ITV 4 describes the typical stages of an RPA project as a functional analysis, the procedure review, development, testing, adjustments and final delivery.

As best practices for RPA implementations, ITV 4 mentioned that the software should be easily maintained and Functional and Technical Documentation should be created and delivered to the client, team constant communication and collaboration, access to data and some knowledge or desire to understand from the client.

Overall benefits of RPA mentioned are the decrease in costs due to the no longer necessary outsourcing services, several of the existing processes in banks in Portugal still involve physical paper documents and these could all be transformed into digital documents and handled by robots which would lead to a reduction of response time to their clients and overall higher throughput.

Appendix V – Expert Interview : Interview 5 (ITV 5), December 2019

More than 3 years experience and upwards of 30 processes automated.

This interviewee believes that any repetitive task can be automated as long as it follows a defined logic. Some examples for banks are closing customer bank accounts, password updates, retrieve or insert data into internal database or external platforms and creating automatic reports for various situations.

Despite the years of experience, this expert has worked in/with only one of the Portuguese banks and before he started there the bank already had some sort of automation, but nothing very sophisticated. Notwithstanding, the interviewee knows what other players in the industry are doing regarding RPA and believes that banks in Portugal are investing more and more on RPA and some are still a little bit behind. In general, all the banks now know RPA exists and that it can be helpful for them, some already are beginning implementations and some are almost there. If the first automation project is successful, more often than not the banks will implement it in many other processes.

However, in a broader view, Portuguese banks are very behind other industry players in other countries, in the United Kingdom, for example, banks have accepted RPA long ago and have implemented it widely in their back-offices.

Since his arrival at the bank, they have automated more than 30 back office processes and he would classify the bank's back office as mostly automated now. Top management has recognized how important their work has been which has allowed for many other processes to be automated.

There were however some obstacles along the way. At first, the bank wasn't ready for implementing right away, they weren't educated enough. Another big issue was the creation of users for the internal systems, that took a long time for security reasons.

In terms of impacts, RPA has allowed a high reduction of costs with outsourcing and faster production. As an example, in the process of closing bank accounts there were 30+ FTEs involved in the original process and after the automation implementation only 6 FTEs are necessary for support and overview. It can also help with talent retention as employees usually don't enjoy the type of work a robot can do, such as processing emails. Error reduction was the last impact mentioned as the robot does not make mistakes as long as it is correctly designed.

As for best practices, clearly defining a methodology prior to starting the development stage and make it known and clear to all the stakeholders was mentioned. Designing the robot to be scalable to new functionalities and easily maintained, delivering a functional and technical

manual and having ease of access to internal systems was also mentioned. It is important to define a project manager on the client side that is well informed about RPA and finally to align and collaborate with the IT department.

Appendix VI – Expert Interview : Interview 6 (ITV 6), February 2020

The interviewee has close to 3 years of experience in RPA projects.

As use cases in banks, processes that are related to the analysis, validation and handling of client documentation were the ones mainly mentioned.

In all of the projects the interviewee took part, the clients had no automation or robots in their back-offices.

For the main obstacle found during implementations, the excessive amount of time clients took to give the RPA team access to internal applications/interfaces was appointed.

After the successful projects some of the impacts on the client side were the elimination of bottlenecks which lead to a better and more efficient flow of information, resource availability was increased which allowed clients to allocate more people to tasks the required “human touch”, execution times were heavily decreased and the ability to work day and night allowed for faster delivery and higher capacity.

As for the best practices, the interview finds that the most important measures that allow for successful implementations are adapting information and data to the structure and workflow of the process, utilizing a good error handling, develop the software with the possibility of further development in mind, researching efficient algorithms, creation of high quality functional documentation, good communication between teams and strict task schedule.

Appendix VII – Expert Interview : Interview 7 (ITV 7), February 2020

From the 2 years of experience with RPA projects, the interviewee has been in contact with a few banks in Portugal and states that most of them had almost no automation in their back-offices, apart from one of these banks that already had some automation but with room for a lot more.

All repetitive, subject to human error and costly processes have potential to be automated, a few examples given were the spread analysis in various credit types.

Client's low flexibility, legacy systems with a complex and difficult interaction, excessive time spent regarding access permission and lack/difficult communication were some of the examples mentioned for obstacles found during some of these projects.

One of the projects that the interviewee participated in did not present the expected results because the client was not fully committed to the project , but all the other projects were successful and had positive impacts in the banks. Costs were lowered, error rate was reduced and productivity was increased.

When it comes to best practices, functional documentation was the most important one in the eyes of the interviewee. Adding to that, a maintenance plan should also be delivered as well as clean and simple code to allow that same maintenance and possible improvements or upgrades even to people outside of the original project. Also, clear communication is a key success factor in these projects.

Appendix VIII – Expert Interview : Interview 8 (ITV 8), March 2020

Four years of experience and participation in over ten RPA projects allowed interaction with many different banks in Portugal. From these interactions, the interviewee reports that apart from a few basic automations in the form of Excel macros or batch routines, banks have no automation prior to his projects.

Most highly repetitive back office processes with clear and scalable business rules are good candidates for RPA, but some examples were given, such as the filling of forms, database data insertion/retrieval, analysis and validation of manual work and dematerialization (reduction of physical documents). Processes that are very extensive, complex and involve many hours of analysis should be carefully assessed on a case-to-case basis.

The main obstacle found has been in the bigger banks where there are many operational and managerial layers that result in implementation delays due to the excessive time spent taking decisions. In some cases the interviewee has found resistance from employees that believe their jobs could be threatened and so they try to make the RPA team job harder and take as much time as possible.

As for the impacts of these projects on banks, decrease in costs with operations and employees, increase in productivity for the automated processes, increased output quality not only in the automated processes but also in other areas where resources are reallocated to, mitigation of human error culminating in a competitive advantage.

Functional and technical documentation, measures to allow scalability, easily maintained, alignment with client IT team, detailed analysis of the process to be automated, commitment from client and a well thought architecture that allows for punctual adjustments.

Appendix IX – Expert Interview : Interview 9 (ITV 9), February 2020

With almost two years of experience in the area of RPA, this interviewee gave as a few examples of use cases in banks the automatic insertion of data into internal or external applications and the validation of digital information following a strict set of rules.

Some of the difficulties he has found during his projects are the lack of technical expertise on the client side, extensive wait time for permissions in client's applications/interfaces needed to start the development stage and lack of testing environment before sending the software into the production environment.

From his experience, banks in Portugal do not have any type of real automation/robotization in their back-offices.

Clients reported reduction of costs and improved productivity derived from the projects the interviewee took part.

Functional and technical documentation should be produced, during the development of the software annotations should be made to allow for an easy maintenance and conscious development to allow possible functionalities to be added to the robot. Communication should be clear throughout the implementation and a clear assessment of the “as is” and “to be” state of the process should be discussed, presented and accepted by the client. These are the main best practices appointed by the interviewee.

Appendix X – Quantitative Level of impact detailed description

Level	Description	Detail
0	Not mentioned.	Not mentioned by the expert during the interview.
1	Minor impact	Briefly mentioned during the interview, was only evident in a small percentage (less than 10%) of the implementations.
2	Low impact	Briefly mentioned during the interview, was not very common (less than 30%) in the implementations.
3	Moderate impact	Mentioned during the interview. Reported impact in around half the implementations.
4	Significant impact	Mentioned and discussed at length during the interview. Impact was reported in most implementations (above 80%).
5	High impact	Mentioned and discussed at length. Reported impact for every implementation

Appendix XI – Quantitative Level of impact detailed description

Level	Description	Detail
0	Not mentioned.	Not mentioned by the expert during the interview.
1	Minor importance	Briefly mentioned during the interview, was only relevant in a small percentage (less than 10%) of the implementations.
2	Low importance	Briefly mentioned during the interview, was not very relevant in the implementations (less than 30%).
3	Moderate importance	Mentioned during the interview. Important practice in around half the implementations.
4	Significant importance	Mentioned and discussed at length during the interview. Very relevant practice in most implementations (above 80%).
5	High importance	Mentioned and discussed at length. Mandatory practice for every implementation