AUTOMATION OF REPETITIVE MANUAL PROCESS WORK USING ROBOTIC PROCESS AUTOMATION AT A MOBILE NETWORK OPERATOR

By

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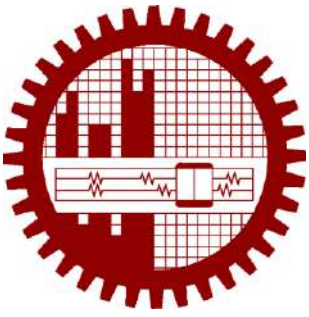

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This thesis titled, **"Automation Of Repetitive Manual Process Work Using Robotic Process Automation At a Mobile Network Operator"**, submitted by Md Sifat Hossain, Roll No.: 1017082126 Full, Session: October 2017, has been accepted as satisfactory in partial fulfillment of the requirement for the degree of MASTER OF ENGINEERING in Industrial and Production Engineering on 1st April, 2023.

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Declaration

It is hereby declared that neither this thesis nor any part thereof has been submitted anywhere else for the award of any degree, diploma, or other qualifications.

Md Sifat Hossain

This work is dedicated to my loving

'Father-Mother
&
Wife'

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Abstract

At present, all the enterprise businesses both from global and local perspective, especially telecommunication industry are facing challenge to keep pace with evolving technology. Thus, business organizations in today's world aim for better optimization of financial costs and knowledge resources. To improves efficiency and productivity Robotic Process Automation (RPA) is the crucial answer to unlock such openings of possibilities. About cost, an RPA software license may cost between 1/3 and 1/5 of the price of a full-time employee, even with many inherent advantages. Therefore, enterprises and businesses throughout different industries have already started adopting RPA for their optimization and scalability. For example, in Banking, Insurance, Software company, Retail, Manufacturing, Healthcare and even a few Telecom industries. With four major telecom operators in Bangladesh, something like Robotic Automation Process (RPA) has hardly been discovered to optimize man-hour costs. In this case study, one repetitive manual task has been selected from a sample size operational work to automate with UiPath. The outcome of this observation reflected that telecommunication industry may gain higher productivity and efficiency by using Robotic Process Automation (RPA) in regular day-to-to repetitive manual tasks. The findings can be extended to similar other telecommunication industries ie. mobile operators in a larger scale.

Chapter-1

Introduction

1.1 Introduction and Motivation

The technological frontier of humanity is ever expanding. In all areas of our society, researchers are constantly seeking new technological innovations in order to increase productivity and make human life easier. For over a hundred years, automation has been a major source for such innovations, a phenomenon that has enabled organizations to increase their productivity and gain competitive advantage. Automation has reduced the need for attention and effort from human employees, allowing a higher productivity per person. This, in turn, has allowed society in general to grow, both in financial and technological dimensions. At first, automation revolutionized industries relying on heavy physical efforts. For example, the upkeep of a farm used to require multiple people, but now with technological innovations and automation the human resources needed have decreased. Furthermore, while replacing human workers, automation has transformed the skill requirements: a farmer from a hundred years ago had done everything manually; today farmers mainly need to know machine maintenance. Another example of industries with completely revolutionized business processes is the car industry. Manufacturing cars was at first handcrafting. Then, first with the invention of the assembly line and further the introduction of robots has shaped the industry in ways few could predict based on where it all started.

In the last few decades, automation has revolutionized knowledge-based work. The invention of computers and later their widespread availability to organizations has changed the way people in knowledge-based industries work. From then on, the digital tools at workers' disposal have developed exponentially, from first text editors to fully automated complex business processes. There is still a lot left to discover when it comes to improving the degree of automation. Two key aspects that form the backbone of knowledge-based work are data

transfers and data manipulation. For example, in the payroll industry, payroll specialists use the input data of employment contracts as the basis to calculate the salaries for employees of an organization. Automation revolves mainly around these two aspects, and potential improvements in the degree of automation are a result of finding new ways to automate these tasks. For example, the data can be transferred and imported via automated file transfers and in some cases parts of the data manipulation can be performed automatically, by using e.g., macros in a spreadsheet to perform calculations. The main problem in increasing the degree of automation is not all systems are capable of importing or exporting files. Most often, such systems are old and no-longer-maintained legacy systems. These systems have once gained ground and a large enough user base that they cannot be simply replaced. One archetype of these systems are web and form-based applications, which rarely support file importing. Another equally important reason can be cost: the changes to enable these features are often additional, meaning they cost extra. Whatever the barrier may be, to be able to increase the use of automations with these outdated systems and further increase the level of automation, in a strive for increased productivity, a new solution is needed. Robotic Process Automation (RPA) is a form of digital process automation that uses robotic software, a type of program that can mimic a user's behavior. This type of software can be programmed to perform tasks just as a human would, only more quickly and precisely. It is possible to even see RPA perform the actions for the users, moving the cursor around as it interacts with applications. This type of interaction works well with legacy systems, because just like a human would be able to fill a form or a sheet, the robot is able to perform the same task. RPA can address this gap to progress automation and much more.

CRM, ERP, Self-care portal and similar business solutions are the heart of any enterprise business organization. For the technology to ensure value, knowledge workers must do all the pesky things like extract, copy, paste, merge to move massive amounts of data from one system to another [1]. Especially for the telecom industry, with McKinsey predicting the total cost of network ownership could double by 2025 [2]. Thus, business organizations in today's world aim for better optimization of financial costs and knowledge resources [3]. Robotic Process Automation (RPA) is the crucial answer to unlock such openings of

possibilities. Enterprises and businesses throughout different industries have already started adopting RPA for their optimization and scalability. For example, in Banking, Insurance, Software company, Retail, Manufacturing, Healthcare and even a few Telecom industries [4, 5, 6].

There is a lot of potential in implementing RPA in business processes that do not deal with legacy systems, as well. RPA can further the degree of automation, freeing up human resources to be used elsewhere or to plainly cut costs.

This efficiency improvement is why many companies are interested in this new concept and RPA is on the rise. However, as with any technology, to introduce RPA effectively, a proper way of implementing the technology in a form of process model must be determined. The following sections are examples –

1.2 Problem Statement

Any telecom operator with millions of subscribers and users has a vision, they are dedicated to empowering societies by providing the power of digital communication, enabling everyone to improve their lives, build societies and secure a better future for all. Their mission is to help their customers. They exist to help our customers get the full benefit of being connected. Their success is measured by how passionately they promote us. Maintaining a large number of subscribers and providing them proper service is a challenging factor. Sometimes new accounts registration, transferring large scale of documents or data, closing accounts and many other repetitive works are done manually. Repetitive tasks are a reason money drain for small, midsize, and large businesses but automation can help put your resources to much better use, and in terms of cost, Capgemini had indicated about an RPA software license price, that is between 1/3 and 1/5 of the price of a full-time employee [7]. Common manual processes, like using spreadsheets instead of accounting apps; using paper-based systems; and handwritten data, can cost a fortune [8]. A study found that 22% of an employee's time is spent on repetitive tasks [9]. Over the course of a year, imagine how much money is wasted by workers spending time on manual tasks that can now be automated. Exercising repetitive work have some crucial drawbacks found in many studies. Some of them are given below-

Human Error

Whether we like it or not, human error is a certainty in business processes. It does not matter how good an employee is, there will be mistakes from time to time. There may be a misread piece of data or a wrong key hit, humans are susceptible to lapses those automated systems simply are not. A whopping 50% of business processes will be fully automated by 2022, compared to around 30% today [10]. Human error is a persistent issue – a study indicated that common methods of verification, like visual checking, resulted in 2958% more errors than double entry [11]. Automation reduces the error count to virtually zero. When manually entering data into simple spreadsheets, the probability human error was between 18% and 40% [12].

Reduced Productivity

Put simply, if an employee is spending time doing a job that could easily be automated, it is money down the drain in today's world. While you are paying a full-time employee to input data into a spreadsheet, your competitor has already automated that process and is completing it quickly and at a reduced overall cost. Time spent on repetitive jobs would be better spent on more complex tasks where the worker is needed. An HR worker, for example, might be spending all day inputting employee benefit data manually. With automation, tedious jobs like these can be alleviated and HR staff can instead focus their energies on more skilled labor where they are needed like employee training or education. A survey of more than 6,000 knowledge workers by ServiceNow shows that that RPA boosts not only productivity but satisfaction [13]. 74% of employees in the most automated companies say automation improves job satisfaction, compared to 53% in highly manual companies. Professionals take 18 minutes on average to locate a document manually 20% to 40% of their time and spend 50% of their time searching for information.

Increase Labor Cost

This is number one for many small and midsize businesses. If there is a job that can be easily automated and you are paying a member of staff to complete it,

then you are wasting your money and their time. This is even more pertinent when you consider that mistakes can and will be made, which can mean that staff have to go back and re-do a task they have already spent time on. Automation allows you to reduce the necessary staff to a particular task, reducing cost and improving profitability. Low-level, automatable tasks eat up 30% of IT departments' time [14]. 47% of AP professionals consider manual data entry and the cost of subsequent inefficient processes are their biggest challenge. Automated time sheet and payroll processing to reduce the need for 1.5 full-time employees can allow business to reallocate personnel from data entry into more strategic roles. The time it takes to create and manage employee schedules can be reduced by 75% and the problem of paying for costly overtime hours can all but be eliminated due to automated warning.

Unpredictable workflows

Automating workflows creates a clear structure, a sense of routine within your business, and establishes accountability. Manual reporting processes have of course worked in the past, but for SMBs, especially midsize businesses, this can be difficult to monitor over time, and in any case manual reporting can be very time-consuming.

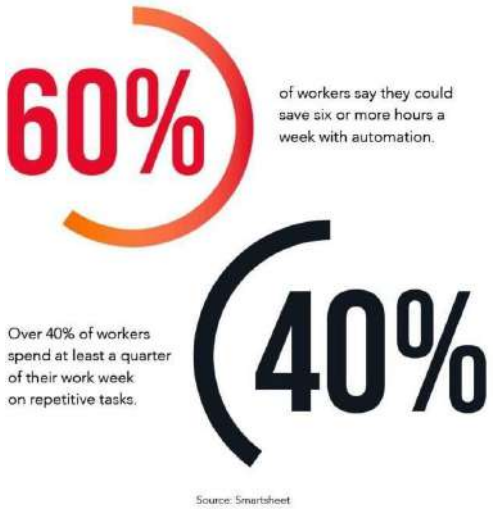

Figure 1.1: Employees' survey on RPA

Digitizing your workflows helps project managers use software to prioritize assignments within their teams far more quickly. Market research firm IDC says

that organizations lose 20 to 30% of revenue every year due to inefficient processes. CEOs spend almost 20% of their time on work that could be automated, such as analyzing operational data and reviewing status reports [15]. The workflow automation market was valued at $4.26 Billion in 2016 and is expected to reach USD 18.45 Billion by 2023, at a CAGR of 23.56% between 2017 and 2023 [16].

Compliance Risks

This would typically be considered as part of implementing digital solutions to remove human error, but compliance is such a huge issue for SMBs that it deserves its own mention. As any business owner will know, staying on the right side of compliance is crucial in order to steer clear of hefty fines [17]. This is particularly the case with certain industries, like healthcare or finance, where abiding by regulations is absolutely crucial. By removing manual tasks and utilizing automation, you can be safe in the knowledge that your employees will be following procedures that comply with industry standards and do not jeopardize your compliance needs.

Of organizations that are currently using Governance, Risk, and Compliance (GRC) technology, 61% of them plan to increase their spending on GRC platforms in the next three years [18]. Just 69% of businesses are utilizing technology to support their compliance programs. Only 18% of organizations have automated processes for IT risk data collection and reporting, despite it being the most effective way to mitigate risk [19].

Business agility

Business agility is one of the many buzzwords within the world of digital transformation that needs a little deciphering. In essence, what we are talking about is affording your staff the tools necessary to complete their jobs to the best of their ability. In addition, giving them the means and agency to boost the capability of your departments and workers is what business agility is all about.

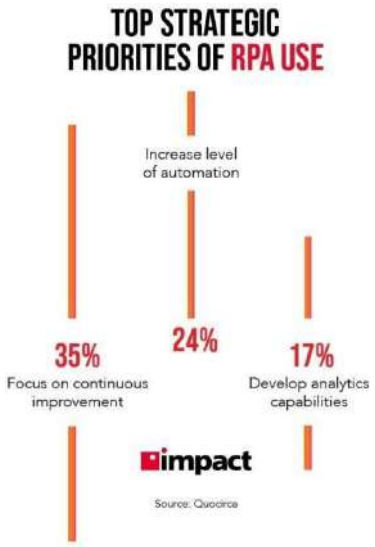

Figure 1.2: Top Strategic Priorities of RPA use

This can manifest in a few ways; most notably robotic process automation (RPA), which is used by many SMBs and typically consists of:

- RPA robot: Single piece of software to execute a specific task.
- RPA management software: Software that directs RPA bots (robots managing robots).
- RPA development tools: Software components that RPA developers use to design robots.

Cost savings as a result of improved business agility are estimated to range from 20 to 30% [20]. A survey by the Business Agility Institute indicates that just 27% of businesses have what can be considered high business agility maturity [21]. 74% of workers say that employers do not give them access to the latest technology to help them do their job more effectively and efficiently.

Lack of visibility into process

Now, we have a lack of visibility, one of the most important aspects of business today. There is so much data in the world today, and SMBs more frequently want to be able to leverage the data they are sitting on in order to gain actionable insights to improve their processes. Put simply, those manual repetitive tasks that

workers are slaving away doing; not only are they eating into your employee productivity amongst other things – they are also very difficult to keep track of. What this means in practice that it is extremely difficult for managers to have a clear overview of processes and how they can be improved. Also, consider your ability to better serve your customers without being able to use data to determine how to improve their experience. The more manual processes are digitized, the more you can build profiles and understanding about particular behaviors that can then be addressed.

Employees' health problems

Repetitive tasks can pose a risk to not only the physical health of a person but their mental health and general wellbeing. These tasks are not just something boring an operative need to do on any given day such as ticking off inventory, but instead, they are tasks where the employee has to do the same thing hour after hour, day after day and week after week [22].

As far as a worker's physical health is concerned, doing the same movements over such long periods of time can lead to conditions such as tendinitis, and carpal tunnel. If significant manual handling is involved in this work, they can suffer from other complaints including slipped discs and hernias. In this case, health and safety training which includes a significant amount of manual handling training may be required [23]. It can often be overlooked by managers who just see a job that needs doing and assign a worker to do it, but the effect of repetitive tasks on an employee's mental condition can be severe.

It can also make them extremely demoralized, unhappy, and desperate to leave the company which will result in recruitment costs and lost time as a new person is brought in and given all of the induction training necessary for a new starter, resulting in a continuous spiral of recruitment, wasted time and increasing costs.

Table 1.1: Recommendations for assessment in repetitive work

Body region	Type of exercise	Frequency of movement or contraction	Risk assessment	Risk modification - very high risk
Shoulder	Dynamic Intermittent, static	>2.5/minute	High	One of the following for any category. high external force, high speed, and high static load, extreme posture, lack of training high demands on output, monotony. lack of control, long duration of repetitive work
Upper arm, elbow	Dynamic Intermittent, static	>10/minute	High	
Forearm, wrist	Dynamic Intermittent, static	>10/minute	High	
Finger	Dynamic	>200/minute	High	

With four major telecom operators in Bangladesh, something like Robotic Automation Process (RPA) has hardly been discovered to optimize man-hour costs. A careful study of RPA using the UiPath tool to automate one repetitive manual process work at a local Mobile Network Operator (MNO) to save man-hour, will be the prime interest of this case study. We will be using a dummy name *ABC Telecom* as a mobile network operator in Bangladesh in this book.

1.3 Research Questions

In proposed study, key questions that have been identified for investigating overall performance of the company and their structure. The following questions to be answered by the study-

1. How *ABC Telecom* manage their customer satisfaction level?
2. What are the expectations of the capabilities and limitations of RPA in the telecom industry?

3. What was the resulting difference between the expectation and the result of the implementation?

1.4 Objective of this Research

Objectives with Specific aims:

i) To identify one customer-facing manual process work to simplify it with a Robotic Automation process.

ii) Man-hour cost savings with knowledge resource's less engagement in pesky day-to-day tasks.

1.5 Organization of the Thesis

Telecom industries play an important role in Bangladesh's economy and social Development [24]. As a leading service provider "*ABC Telecom*" provides innovative solutions and modern services to their subscribers since 2000. *ABC Telecom* is determined to help Bangladeshi people cope up with the 4th industrial revolution and also help to fulfill the government's dream [25].

The purpose of the work was to improve the productivity of a sample selected manual repetitive task using Robotic Process Automation (RPA). In this report, various types of relevant contents such as introduction, literature review, methodology, data collection and analysis, proposed system, discussion and experimental results and conclusion with scopes for future work are arranged chapter wise here.

Chapter 1 includes introduction part of the case study.

Chapter 2 covers literature review and global similar use-cases.

Chapter 3 includes outlines of the methodology.

Chapter 4 covers the proposed system choosing the right automaton tool for our RPA project.

Chapter 5 contains the necessary data collection and analysis, comparisons between before and after automation scenarios in terms of the selected manual task.

Chapter 6 contains the discussion and experimental results evaluating the RPA framework and overall result.

Chapter 7 conclusion part of the case study report which is followed by scopes and recommendations for future work.

Chapter-2

Literature Review

Overview

The structure of this literature review section is three-fold. First, a literature review on RPA is done to give a better indication of what it actually is about. Then, the review delves deeper in the implementation of projects. The purpose of this part is to discover what has been previously studied about IT projects and what has been deemed important in their implementation. The purpose of this half is to outline different elements that could be then used to form a process model for RPA implementations. Finally, the literature is summarized and synthesized into a RPA implementation model, which features the most applicable elements from the literature with the context of RPA in mind.

2.1 RPA Definition

Some call RPA a technology and some call it an approach. In fact, in the author's opinion, it is an approach to improve business processes, reduce costs and increase productivity. One of the most remarkable goals and results of this approach is to put human intelligence into the path of creativity. Thus, in general, RPA is an approach to improve business processes by deploying digital technology within an organization to perform high-volume, low-value, repetitive and time-consuming tasks and business processes currently performed by human workforces via interaction with different multiple IT systems (desktop and web-based applications or/and IT interfaces). An example of a pre-RPA and post-RPA scenario may better demonstrate in the RPA approach definition. The pre-RPA scenario is that human workforce (an employee) performs a routine and repeatable rule-based task using structured data. The task might be time-consuming due to the manual interaction with several IT systems and user

interfaces. It is very normal that an employee must log into different IT systems and databases to enter data and retrieve results. Collating and submitting data and waiting for system response and changing interfaces repeatedly are some parts of a typical routine business process [26]. The post-RPA illustration of the scenario is that the employee is replaced by a software robot. The RPA robot executes the task by simulating human workforce interactions with the same systems/interfaces in the same way. The robot is tireless and works 24/7 continuously. The aspects of the above RPA implementation use case are:

1. The automated process workflow stays almost or completely identical to the manual workflow because an RPA robot can simulate (imitate) the human workforce interactions with IT systems and user interfaces (see Figure 2.1)
2. Existing underlying IT environments stay almost or completely unchanged.

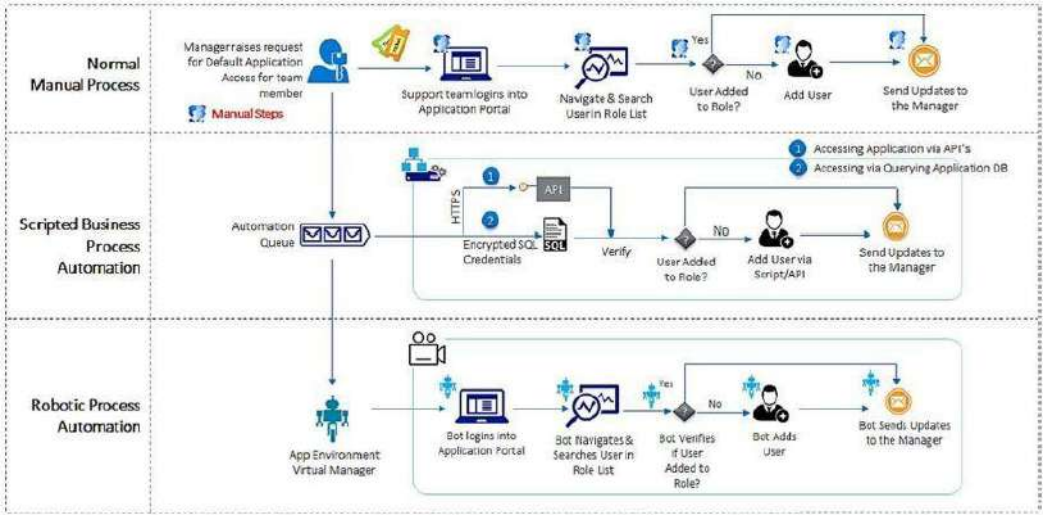

Figure 2.1: Manual, RPA, Scripted automation Workflow comparison.

2.2 RPA Software

The RPA software is composed of the following components: Robot's development tool is the component to develop/program RPA robots. Robot's control tool is the component that allows developers to build, run, schedule, monitor and manage RPA robots. Robot (RPA robot) is the component that

operates processes by simulating manual interactions with applications and interfaces. Build and design capabilities in Figure 2.2:

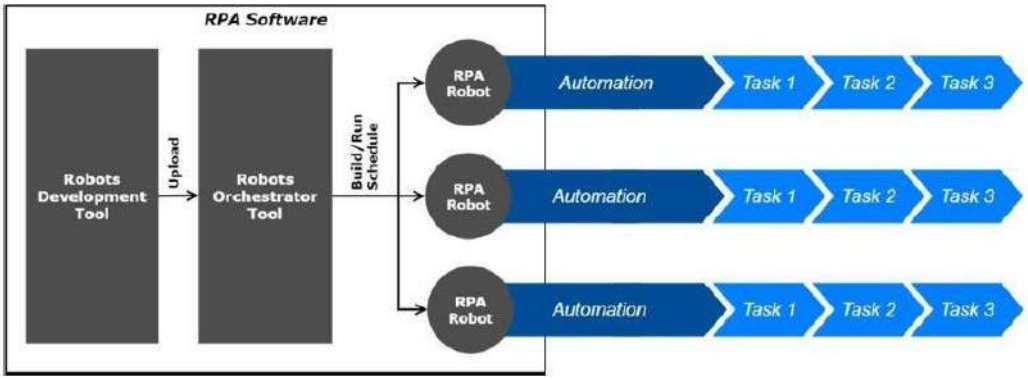

Figure 2.2: RPA Software Architecture

Building of interface scripts

This feature enables developers to build simulated user interactions with IT systems in two different methods, which is one of the most remarkable features of design and build components of RPA software. The first method is by drag-and-drop prescribed activities such as clicking, text entering and so on. Powerful tools enable RPA developers to access different elements within different interfaces. Developers can add formulas and conditions to achieve an accurate simulation of the user interactions with IT systems. The second method is the possibility to record the user interactions with interfaces directly.

Building of process scripts

This is another remarkable and distinctive build feature of RPA software product (depends on the software provider) is the possibility to simulate the algorithm of the manual process workflow in a totally graphical design environment by adding and managing user activities into flowcharts and/or sequences and adding rules and conditions.

Data access and data use

RPA software products with the help of simulation capabilities can search and collect data from various data sources such as internet web pages, local and

virtual files or restricted databases and APIs. RPA software is even very capable of getting data from chat bots or voice bots.

Integration

RPA software are remarkably capable to integrate RPA robots with a variety of different intelligent technologies such as AI (artificial intelligence), cognitive computing, analytics, and even IoT platforms in the production level.

Security

RPA software products come with security features such as access control and encryption technologies to enable secure access based on enterprise standards and security levels required for systems and databases. Since the robot simulates the human interactions and works as an assistance on behalf of the employee it requires the same access credentials perform the process.

Scheduling capabilities:

Robot scheduling

Control or governance tools (orchestrator tools) give the possibility of management (build, eliminate, run) of robots and processes in large scales to the enterprises and organizations. Scheduling or orchestrating robots to execute specified processes is a significant property of the RPA software.

Scheduling dashboard

The robots' runtime monitoring via dashboard, makes it possible for robot administrators to detect and troubleshooting exceptions and errors and fixing and rerunning the robots and processes.

2.3 RPA robots

RPA robots could be classified into two categories: Attended and Unattended robots. These two different automation concepts (based on the types of robots) are usually referred to as DPA (Desktop Process Automation) or RDA (Robotic

Desktop Automation) and Enterprise RPA (ERPA) robots. Each one covers a different concept and automation requirements.

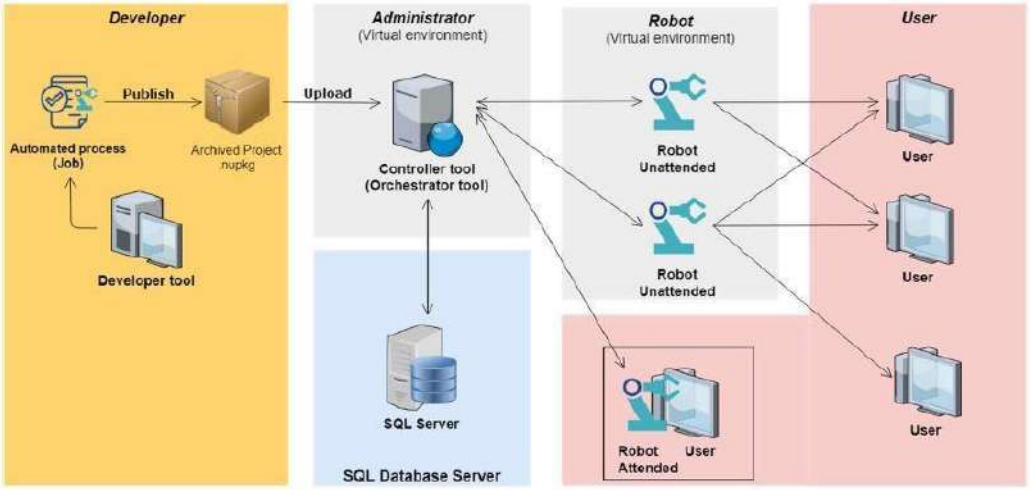

Figure 2.3: RPA Software Components and Infrastructure Setup

Attended robots (Desktop Process Automation)

Attended robots operate alongside a human workforce at the same local workstation. The robot assists the user in performing a certain part of a process and is triggered by user events. This is illustrated in Figure As it is illustrated in

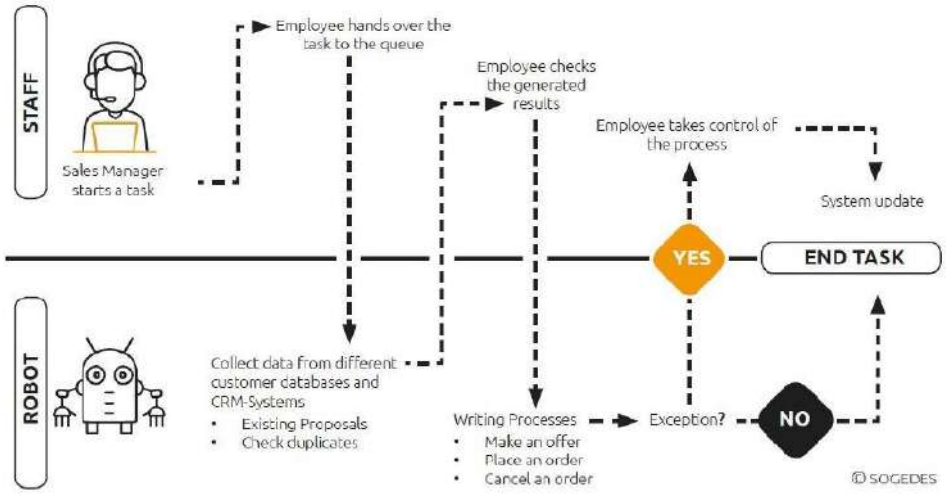

Figure 2.4: Attended RPA robots as an assistant.

Figure 2.5, the attended software robot could be conceived as an assistant who carries out the heavy part of a routine process and prepares everything for a human employee to make the final decision and then the robot carries out the last

part of the process. Figure 2.4 illustrates a partly automated process.

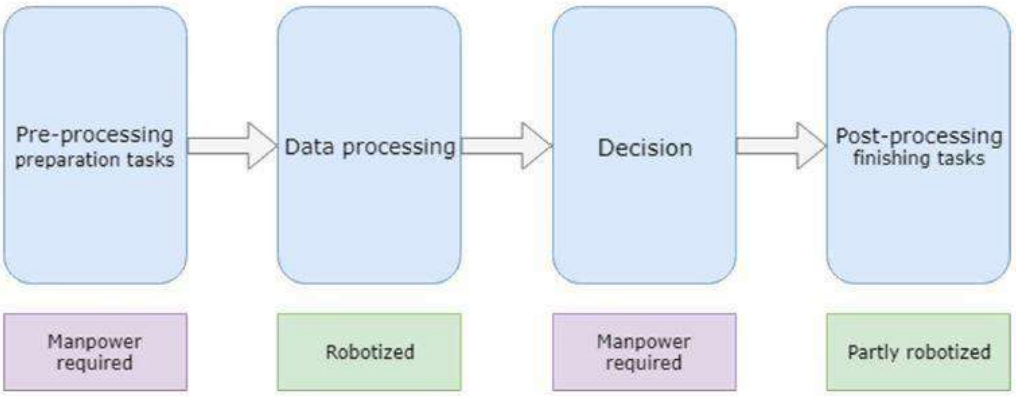

Figure 2.5: Illustration of a Partly automated process.

Unattended robots (Enterprise RPA)

Unattended robot runs autonomously in a virtual environment. It can automate any number of processes and is executed, monitored and scheduled remotely by robot administrator using a control tool.

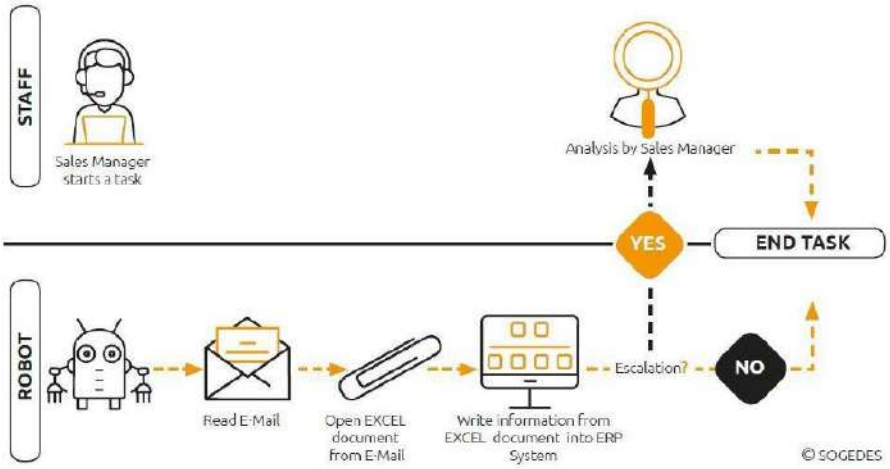

Figure 2.6: Unattended RPA robots.

1. Robot opens a web browser and starts a web-based application.
2. navigates to a specific page and enters some specific information (names, ID- number, customer number).
3. make several filters and locate useful data,
4. Copies/pastes retrieved data to another application
5. Analyses data by applying simple conditional statement (if/else/then statement)

6. Edits analyzed data using text editors (Notepad, word, excel) or in the background.
7. sends the result via emails and, so on.

Figure 2.6 illustrates an unattended robot performing tasks in the background and providing the processed data for the final decision to a human employee.

Table 2.1: Comparing RPA robot types and their specifications

Attended robot	**Unattended robot**
Operates alongside a human workforce on the same (his/her) local workstation	Runs unattended in a virtual environment.
Assist the user in performing certain part of a process	Can automate any number of processes.
Being triggered by user events and/or remotely using a robot control tool	Being executed, monitored and scheduled remotely using a robot control tool.

2.4 Characteristics of RPA

RPA and Customer Relationship Management (CRM)

RPA is all about replacing humans in performing repetitive tasks, and often implementing robots is associated with Full Time Equivalent (FTE) savings. Therefore, it is easy to understand why the media uses headlines that speak of humans losing their jobs to robots, and why people are scared and anxious about RPA. It is, however, only a misconception: in reality, robots are meant to replace humans only in the most tedious and repetitive parts of the process, and the saved FTE can be directed to other tasks which robots cannot handle. Introducing RPA means a shift in the content of work. Robots can be used to amplify and augment human strengths, meaning humans will do what they can do best: handle all the unstructured parts of processes, e.g., data that needs deduction beyond rudimentary logic, something only a human can do [27]. Lacity & Willcocks (2016) highlight this with an example of reporters:

Assignments that require linear and repetitive reporting, such as corporate

earnings, were disliked among reporters. Automating these tasks, the company was able to shift the focus of its reporters to covering more creative stories. Using robots, not only did the number of earning reports go up ten-fold, but it was done at no extra cost, customers were happy with sped up delivery and improved quality. All reporters kept their jobs and were able to concentrate on more appealing aspects of their jobs. Employees are wary about how automation will impact themselves, and it is imperative managers do not simply ignore this aspect of RPA. The shift will be visible especially in talent development. Considering how RPA can be developed and where those skills can be acquired is, naturally, important, but it is also important to keep in mind the shift in capabilities of the retained human workforce. For example, if robots perform all the repetitive tasks, the work content for humans will shift more towards creativity and problem solving, resolving error cases.

A plan must be made to redeploy these resources, otherwise possible FTE savings will not be realized properly, with nothing to do for the resources freed by RPA. As a novel technology with radical impacts on the life of employees, RPA is bound to encounter change resistance from the organization. The organization implementing RPA must be alert to see possible mismatches with the existing culture and structure of the organization. There are a number of barriers that have to be overcome. Organizations with more suitable culture, e.g., in terms of transformation capability, have an advantage and are more likely to perform well in the implementation phase, but with proper management these barriers for other organizations can be lowered significantly [28].

To strengthen the buy-in from the entire organization and properly enable strategic service automation, the automation project requires support from senior management. It is not only enough to develop strategies, but the management must also enable the execution. One way to do this is for the project to have a sponsor or a champion – a visible spokesperson who will actively try to sell RPA to the organization, not least by actively trying to battle obstacles and lower barriers that threaten the progress. Lacity & Willcocks (2016) gave an example, where in a hospital environment the process automation champion learned of a tedious and time-consuming task, searching product specification data online. He

proceeded to automate this task with first priority. By doing this, not only did the hospital save in terms of resources freed, but also by lifting a painful and visible task from the operations, the employees learned first-hand of the benefits RPA can offer. This created enthusiasm and helped further the automation a great deal. The sponsors are often people not from the IT department, but from the business side of operations [29].

It is necessary to pay attention to the internal communication surrounding the implementation of RPA. Willcocks et al. (2015A) describe how: in their communication strategy, the company planned and tactically countered the fear of RPA. The message management wanted to give was that RPA would allow people to shift their focus at work based on their own interests, promising that everyone would keep their jobs. Communication also ties in with the previously mentioned project champion; the role is an essential tool in conveying the message effectively. A strengthened buy-in does not only make the initial deployment more fluent, but it also helps in generating follow-up projects. To combat change resistance and help overcome their anxiety over RPA, the company should help employees understand the benefits service automation will bring. With employees knowing what process automation can achieve and what the benefits are, they will be happy to give further suggestions for possible target processes. An example of this from Willcocks et al. (2015A), shows that instead of fearing RPA, the team welcomed the robot as a team member, even giving it the name "Poppy". Eventually, they asked if "Poppy" could be trained to handle more work.

Skillset

A notable aspect of RPA is the ease of developing and modeling processes. Developers do not require programming skills, but rather need to be acquainted with knowledge about business processes. In practice, the developer does not program the robot, but rather teaches it the process logic to follow. This includes rules and instructions on what keys to press and how to handle certain exception cases. Since the skillset is not associated with traditional IT, it is not wise to locate the development to IT specialists, RPA must be managed as a business

and operations project. RPA can benefit more from a multi-functional team, involving the users from operations, IT, developers and even suppliers, working together on the development of both the process and the solution. While the skillset is different and somewhat "lighter", it does not mean training would not be required. People and their roles within the organization must be well-defined and appropriate training must be applied to ensure proper functionality. Operational responsibilities include exception handling, testing, system support, process support and product support. For each task, it must be clarified which role or function is responsible and each role must be properly trained. The need for teaching and learning is especially high right after implementation, but it is important to continue the support beyond implementation.

Target process selection

The first step of automation should not be automation itself; rather, care should be taken to select suitable processes. To this end, the implementation should begin with questions such as should this process exist in the first place. Process elimination, optimizing and simplifying should be the first steps; this is done to avoid automating redundant tasks and allow focusing on the tasks that benefit most from RPA. All in all, in the entire RPA implementation, there are three major phases on the way to production. First, the process is combed through for any parts that could be eliminated, improving the efficiency of the process. This way, all other gains in productivity are exhausted before relying on automation. Next, a proof-of-concept type of project is carried out, to see whether RPA actually works with all the required systems the organization needs. Finally, the rollout for RPA happens, covering everything from documenting the target process to handing the configured RPA solution over to the users. Lately, there have been significant advances in artificial intelligence (AI), which in long-term can further revolutionize business process automation, and change the selection criteria for which process to target with RPA. This is especially true with unstructured, shapeless data or processes without implicit logic for the robots to follow.

Scalability

An important aspect of RPA is its scalability. RPA is easy to develop compared

to traditional BPM tools, but on top of that, it is more easily scalable. This is crucial for BPO providers, who already in their business are seeking similar strategies in their business processes – the ability to define a process and reuse it for multiple customers. To enable scalability, it must be included in the implementation and development strategy. To get the maximum out of the robots, they must be multi-skilled. Internal infrastructure must grow in pace with automation, to keep up with the demand in terms of resources, and the internal technical architecture must make this possible. This way, the software can be easily scaled up and down to meet changes in workload. The scalability must be a culture and should be adopted throughout the organization.

Successful RPA Implementations

Lacity et al. (2015) and Willcocks et al. (2015) wrote two case studies, about RPA being implemented at Telef o'nica O2 and Xchanging, respectively [30].

Telef o'nica O2

One of the largest mobile communications providers in the United Kingdom. The company has been trying to optimize its back-office's processes since 2004. After outsourcing some processes from the UK to India and reducing labor headcount by 10% in the British offices, O2 began to remove non-value adding processes while simplifying and automating some others, using a Business Process Management System (BPMS). BPMS was being used by the IT team in O2, to automate processes as well, but when confronted with Blue Prism (the RPA tool used in this case study), it was more expensive, both to costs and time resources. "Our projections showed that RPA for 10 automated processes would pay back in 10 months. In contrast, the BPMS was going to take up to three years to pay back." - Wayne Butterfield, Former Head of Back Office services at Telefonica O2, retrieved from. The two processes that were chosen for the proof-of-concept (PoC) were of low-complexity, but of high-volume. The first was the progress of replacing a customer's existing SIM card to another one, without changing the existing number. The second consisted of the application of pre-calculated credit to a customer's account. The pilot projects were successfully completed within two weeks, by RPA experts. "Not only have we saved FTE in

the Back Office, but we are also now actually saving FTE in the front office as a result of those reduced calls." - Wayne Butterfield, retrieved from Kotlarsky and Willcocks. After the PoC, O2 started with 20 robots and 2 RPA developers, that were previously back-office employees. As the processes were being automated, the firm felt the need to get more 55 robots to fulfill the needs. In 2015, there were more than 160 robots, performing 15 core processes in the firm, as summarized in Table

Table 2.2: Summary of Telefonica O2's 2015 RPA Capabilities

***Being 1 Robot = 1 Blue Prism License**

No. of Processes Automated	No. of transactions per month	No. Of robots*	No. of FTEs saved or redeployed	Payback Period	3-year ROI
15	400k to 500k	> tr 160	> 100	12 months	650% - 800%

Xchanging

A provider of technology-enabled business processing, technology and procurement services internationally to customers across many industry sectors. Founded mainly to address the Business Process Outsourcing (BPO) market, working mostly with insurance companies. Stumbled upon being a firm focused on processes' continuous improvements, it felt the need to step into RPA itself. Succeeding the nomination of a person to be in charge of an RPA project, it was necessary to identify the processes that were suitable for automation and create business cases. Posterior to that, 20 employees were trained for Blue Prism - 10 from the insurance business, 10 from the group technology - so an RPA team could be assembled. The processes involved high volumes of data and extraction of data from Excel, Access, PDF and e-mails, for input to another system or used to generate reports. One example of an automated process is the validation and creation of London Premium Advice Notes (LPANs). Once an LPAN is created it needs to be uploaded to the central Insurers' Market Repository. The as-is model of the process is detailed in Figure 2.7 - it mainly consists of the customer

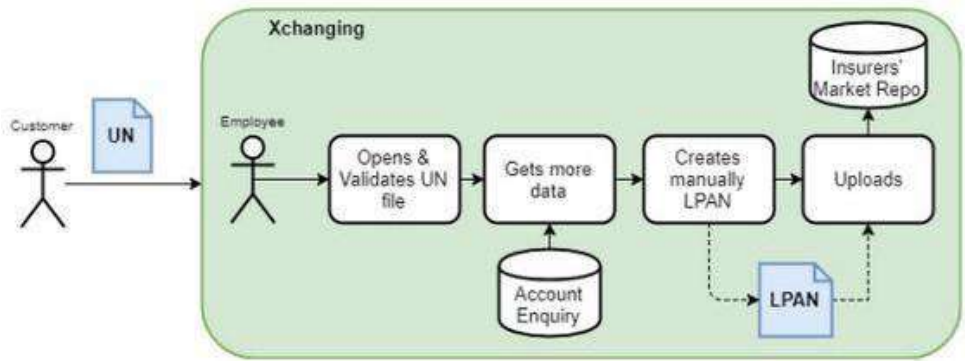

Figure 2.7: Original process in Xchanging.

sending Xchanging a file with unstructured data (UN), that a Xchanging employee needs to validate in order to get more information in the Account Enquiry system, so an LPAN can be created and submitted to the Insurers' Market Repository. Figure 2.7: Original process in Xchanging. After the RPA implementation, the automated process is as detailed in Figure 2.8. The customer continues to send the unstructured data (UN) and since robots cannot yet cope with unstructured documents, an employee needs to validate and standardize it, sending it to the robot that performs the rest of the work (detailed in Figure. 2.7) if the request is confirmed. If it is not and there is a problem, the robot sends an exception to an employee - like sending an email with the occurrence - and continues with other instances of the process, while the human part creates the complex LPAN manually. The latter situation is a minority. It is also referred that this process is of high-volume, and employees did not enjoy performing it, being the reason why Xchanging was contracted to optimize the process. At first, in an initial phase (no pilot phase is mentioned), it started with 10 robots, proceeding to 27, by 2015. Besides, it is also mentioned that while it took a few days for employees to create 500 LPANs, for example, a trained robot could do it in around 30 minutes, without errors. Table 2.3 summarizes the output RPA brought to Xchanging, in 2015.

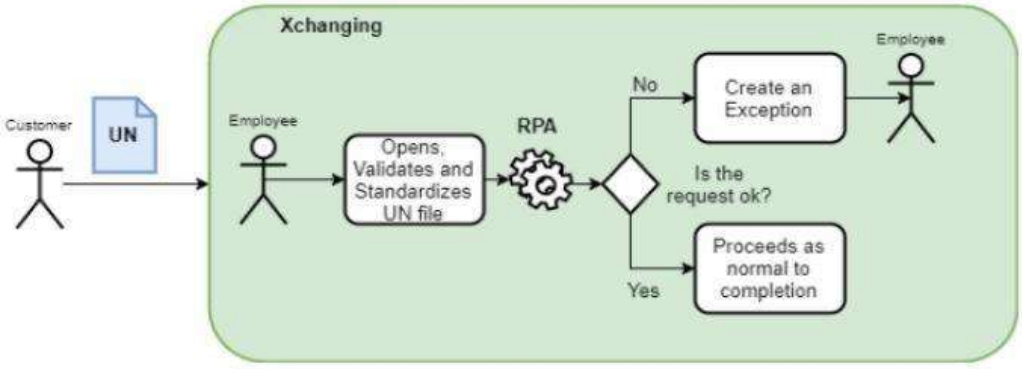

Figure 2.8: The final automated process in Xchanging.

Table 2.3: Summary of Xchanging's 2015 RPA Capabilities.

***Being 1 Robot = 1 Blue Prism License**

No. of Processes Automated	No. of transactions per month	No. Of robots*	Typical Cost Savings/process
14	Around 120,000	27	30%

2.5 Benefits

In the future, technological advances will play a major role in service industries. Service automation can deliver multiple benefits, some of which are summarized in Table 2.4.

These are not only financial benefits, but the robots also help in improving service speed and quality. The robots can work 24-hour days without tiring, further increasing service availability and delivery. Another benefit is a decrease in the number of errors, as robots can repeat tasks without lapses in concentration. For example, in the Telefo'nica O2 UK case the number of follow-ups calls due to mistakes and slow response times were reduced by over 80%. RPA can automate services, shortening the processes by 60% and increasing the accuracy. This, in turn, leads to higher customer satisfaction, while costs are also cut with

savings of 25-50% reported. A typical figure for return on investment during the first year of RPA is 30% or more Telefo´nica O2, as of April 2015, had deployed over 160 robots, which collectively process from 400000 to 500000 transactions monthly.

Table 2.4: RPA value delivered

Company	Automated processes	RPA transactions per month	Business Value	Return on Investment
Telefónica UK	35% of back office (15 processes)	400 000 to 500 000	• Faster delivery • Better service quality • Higher compliance • Unbeatable scalability • Strategic enablement • FTE avoidance • FTE redeployment • FTE savings	650 - 800 % 3 years
Utility	35% of back office	1 000 000		200% 1 year
Xchanging	14 core processes	120000		30% per process

This yielded a three-year return on investment between 650 and 800% While RPA is often considered a method for cost savings and diminishing head count, these cuts have not been realized in many projects. Successful implementations show evidence that while the robots do replace humans in areas they are implemented in, it is possible to redirect and refocus the human resources to other tasks, reusing the employees in other areas without the need to let anyone go.

2.6 Summary of literature review

We have shared about RPA basic and use-cases how it is used in CRM or Company management in this chapter. We have covered RPA implication scopes, where we can apply RPA and how to scale them, followed by RPA software types, their working procedure and lastly, benefits to use RPA in large, medium, small companies.

Chapter-3

Methodology

3.1 RPA Tool (UiPath) For Our Project

We have chosen Uipath for our project. UiPath project flows step by step are given below –

1. Developers build the process, test & debug pieces of it locally (Studio)

2. Once the automation development is completed, the process is published to the Development Orchestrator and tested again end-to-end.

3. The project folder is committed (not packaged) to a Master Library folder (on VCS).

4. The IT/ RPA Operations team creates the project package for QA. This step is intended to be an additional safety measure: the automation source code is inspected (by a different entity) before being packaged and run by robots. For example, the packaged process is stored in the Process Pckgs (QA) folder on VCS, from which it is deployed to the QA robots and executed.

5. If any issue is revealed during the tests, the steps above are repeated.

6. Once all QA tests are passed, the package is pushed to a Production environment

   - Process Pckgs (Prod).

7. When the Process goes live, the process package is deployed to the production Robots and executed. Reusable Content is created and deployed separately, as UiPath code (Reusable Code Library) and Invokes (Invokes Repository).

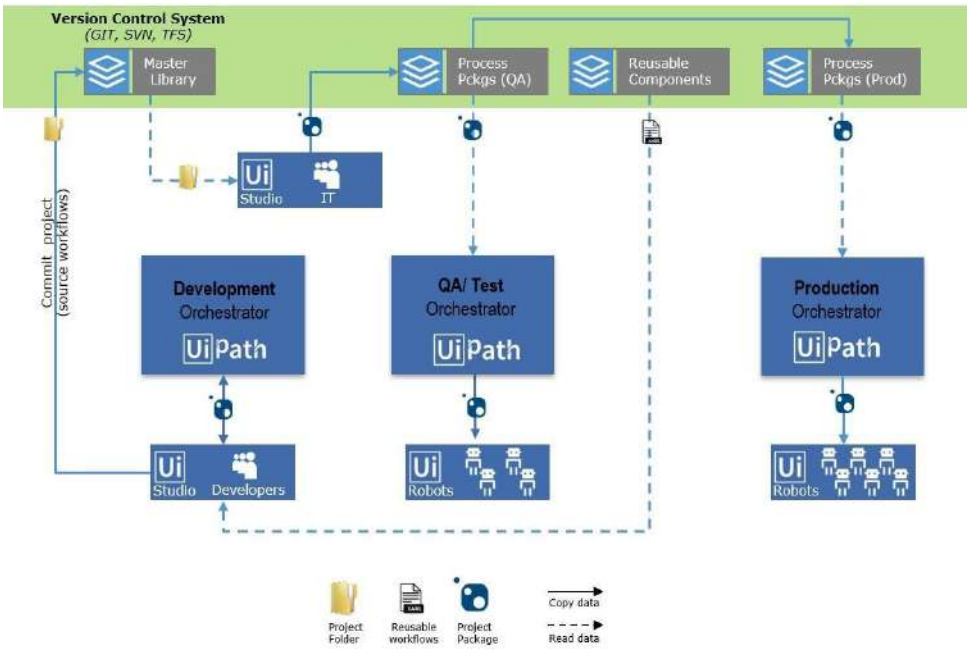

Figure 3.1: Project publishing flows through UiPath.

3.2 Operation & Execution Steps

As per the above project publish flow, for our project in *ABC Telecom,* we will run-through below operation & execution steps –

1. Identify and select one customer-facing manual task, where automating the task will improve conditions for both the executioner and the operational efficiency. In our project perspective we are trying to figure out which repetitive work we need to apply in Uipath. We discussed *ABC Telecom* business division Key Contact Person (KCP) account registration in this project, so we are trying to implement Key Contact Person (KCP) account registration process through Uipath.

2. Capture the executioner's manual process work steps and actions to record

all the regular and exception scenarios to automate this task. At first *ABC Telecom* IT operator login their CIMS account, then take necessary information for opening a KCP account from the requested email. After that step go to the new user registration page URL.

3. Use UiPath's Visual Basic (VB) coding language the automate the manual process work in required steps and actions.

4. Run the full simulation in local computer or testbed servers to oversee the robot's activities, error situations with runtime, and critical bug fixes for smooth operation, if required.

5. Discussion with the team and stakeholders (project managers, expert executioners) to capture their feedback and observations if any.

6. Deploy the automated robotic task in live server operations for execution.

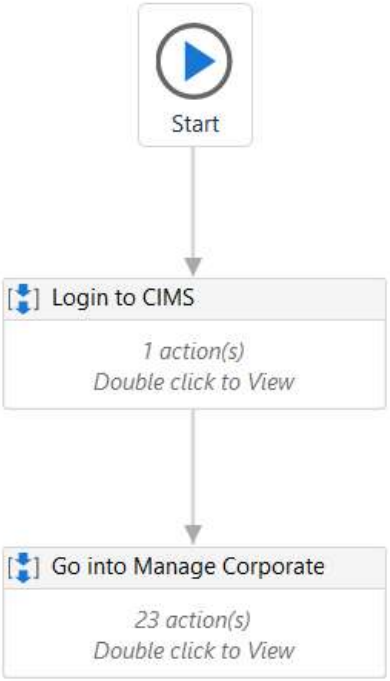

Figure 3.2: Illustrating KCP account opening algorithm using UiPath

Chapter-4

Proposed System

4.1 Proposed model

ABC Telecom serves both rural and urban customers across Bangladesh, where mobile telephony is a major driver of socioeconomic development. The company envisions to provide the power of digital communication, enabling everyone to improve their lives, build societies and secure a better future for all. The company also has always been a pioneer in introducing new products and services in the local telecom market.

To understand how business divisions work we need to discuss an example in detail. *ABC Telecom* provides services to Government accounts (for example, *XYZ Corporation*). *ABC Telecom* provides mobile phone SIM cards to staffs and correspondents of *XYZ Corporation.*

***ABC Telecom*'s Self-Service Portal**

Consumer of *ABC Telecom* faces some emergency problems like-

Bill Check program

Enhancing mobile phone data limit

Internet Activation-Deactivation program

If SIM card is lost, then suspend the account

ABC Telecom opens a self-service portal (SSP) for providing this kind of emergency services. SSP solves time latency for any emergency problems. In traditional way when any emergency comes then user send request to *ABC Telecom* to solve the issues and they need some time to investigate the emergency problem. When millions of users send same request to *ABC Telecom* then it is

more complicated for them to resolve the issues as users demand. To overcome this kind of problem Self Service Portal (SSP) is the best solution. Each institution has a self-service portal (SSP) and one or two of their IT/IICT team members have access to self-service portal (SSP). They operate SSP if their institution's any user wants emergency service then they contact the self-service portal (SSP) operator. Then the self-service portal (SSP) operator solves those emergency problems for the users. Thus, users do not need to send any request for emergency services. It helps that organization's users from time latency and unnecessary harassment. On the other hand, *ABC Telecom* does not get any investigative calls. As a result, *ABC Telecom* can save time and liabilities. Those who are responsible for maintaining the self-service portal (SSP) are known as Key Contact Person (KCP). For creating a KCP account some information are required. Required Information are enlisted below-

Table 4.1: Required information for opening KCP account of SSP

Required information for opening KCP account of Self-Service Portal
1.Institution's name
2.KCP name
3.KCP email address
4.KCP phone number

***ABC Telecom* Self-Service Portal (SSP) Time calculation**

There are more than 20 thousand KCP accounts created like *XYZ Corporation* KCP user accounts and day-by-day new accounts are also getting registered. Creating a KCP account based on table 3.1 information requires 15 minutes.

Table 4.2: Required Time for opening KCP account of SSP

Tasks	Required Time
Time requirement for creating a KCP account and Database	15 minutes
Time requirement for Creating 15 KCP accounts in a day (8 working hour)	15 × 15 minutes = 225 minutes = 4.15 hours
Time requirement for Creating accounts in a month (22days with 8 working hour daily)	225 × 22 minutes = 4950 minutes = 82.5 hours

Therefore, if we make an automated system to do this repetitive KCP account creating process, we can save 82.5 hours for a full time IT expert in a month. That means, we can save (82.5/8) = 10 working days in a month for a full time IT expert, where in *ABC Telecom* 1 working day = 8 working hours. This type of repetitive work done by an automated robotic system is known as Robotic Process Automation (RPA).

4.2 Project proposal objective

ABC Telecom is a leading telecom company which maintains millions of subscribers and business KCP accounts. Registering new accounts daily in database manually is a complex and boring job to do. Our objective is simple we want to replace this repetitive opening KCP account manually to automatic. Thus, company could focus on other technical critical jobs and distribute them to IT professionals. RPA can perform same work 24 hours a day where human cannot [31]. On the other hand, human can solve any critical problem faster than a robot. This is how companies can save time and increase their productivity [32].

4.3 RPA life cycle

The current RPA development model widely used is expressed in Figure 3.1, obtained from Anagnoste (2018) and Blue Prism's project life cycle

guide [33]. The maintenance phase is not represented.

Process Identification

Candidate Processes for Automation Usual RPA projects normally begin by gathering suitable processes for automation. Due to the nature of RPA concept and tools, it is necessary to choose a proper process to automate, especially in a beginning stage or for a proof of concept. Because RPA is nowadays a trending word inside the enterprise world and promises so many benefits while staying low-cost, it is very tempting to the processes' stakeholders to implement it in processes that take too much time, uses too many FTEs or are too complicated [34]. Thus, there exists guidelines to choose the correct processes to automate with RPA [35].

Figure 4.1: Currently most used RPA development model

Technical reports from consulting companies that provide RPA solutions typically comprise guidelines with steps to follow in order to choose a candidate process for automation. A specific RPA report from EY, enhances few key characteristics as below [36].

- The actions are consistent, with the same step being performed repeatedly.
- It is template driven, with data being entered into specific fields in a repetitive manner.
- It is rules-based, to allow decision flows to alter dynamically. The technical report from Symphony Ventures also states another characteristic [37].
- It is raw based, that does not require human judgment element to the way the work is conducted.

However, if it requires, it is still possible to automate until the point where

that judgment needs to be made, handed over to a human, and then passed back into automation. Yet, those exceptions in the flow need to be rare. At the moment, RPA is most used in the Finance, Supply Chain, People Management, in the IT sectors and back-office departments in general.

Process Assessment

After analyzing the suitable processes, the project proceeds with choosing one to automate - usually the one with higher benefits if automated using RPA. If those benefits surpass the investment cost, and the impact is positive (not just on the organization itself, but also on the employees and clients), it progresses onto Process Reengineering.

Process Reengineering

Normally, this is the phase where the developers and analysts get to see the process in action, the AS-IS process and generate an initial idea of the process and its critical steps, as well as to identify the key challenges that one will face during implementation. The goal of this stage is also to provide a high-level analysis of the process solution, the automation efficiency and estimation of effort. To proceed to the next stage, it is necessary to get the approval of the processes' stakeholders.

Process Detailed Study

Following the project approval, comes a detailed study, where the RPA developer gets in detail with the person (or people) responsible for the chosen process. This is where the errors and the exceptions to the normal workflow (that may or may not need human intervention) appear. Also, this in-depth analysis provides a quick checklist of required details, such as workload, alerts, and operating hours. To conclude, this phase is where an architecture solution is developed, and the project plan should be complete.

Process Automation and User Acceptance Testing

After having a functional documentation and the project plan defined, it is time to build the robot. This phase unrolls depending on the selected vendor. While building the robot, it is possible to go through simple testing, using simulations' data. At the end of the development phase, there is a specific step for load tests using real data and observing the performance in the real environment. The robot should meet all requirements and its performance must be satisfactory according to the composed plan in the previous steps. If any of these steps are not according to the objectives, the analysts and developers should recede to satisfy the requirements for each step. For instance, if, while testing the robot, its performance does not reach an absolute value or goes against the defined procedure, it is necessary to review the process again depending on the inconsistency degree. There is no average time for the total time of an RPA project since it depends on the selected processes and its business' complexity.

4.4 RPA Tools assessments

RPA tools are the software that helps users to configure various tasks to get automated. Most of the organizations have periodic and repetitive tasks such as data entry, data extraction, report generation, etc. These tasks are manually performed on the software by the employees. Such repetitive tasks can be easily automated with the help of bots. The software that utilizes bots for performing automation is called the RPA Tool.

Automation Anywhere (AA)

AA's primary processes targets are shared services like quote-to-cash, human resources' administration, procure-to-pay, etc. Primarily, 80% of AA's capabilities are to automate back-office processes, but there's also the possibility to automate front-office tasks (20%). Often selected for overall ease, duration and cost of deployment, it has one of the largest trained partner ecosystems and a vast internal support staff.

Blue Prism (BP)

it is mentioned that it was the first vendor to see RPA as a tool detached from BPM. It invented the concept Virtual Workforce to define the robots. The business grew from 124 to 448 customers in 2017 and its revenue exceeded $70 million. In the 2017 report it was stated that analytics should be present to maintain its innovation track record for RPA, and it has now partnered with Google's Machine Learning Workflow to bridge that gap [38]. Additionally, it is said to be very strict on certifications, and what the tool should do and should not do. Le Clair et al. considers BP as the safest bet for firms in financial services and audit, due to its security and encryption. The characteristics of Blue prism v6 are given below -

- **Functional Suitability:** Its diagrams are composed by a small number of symbols, which obligates the developer to be more precise. It is also possible to write code but does not possess the record functionality, which is crucial for early RPA developers or to code an easy and quick pilot.
- **Third-Party Integration:** It possesses a REST API ready to use but needs programming skills and distributed services knowledge since it is performed through pure coding. It already provides Microsoft API for Azure and Azure AI.
- **Time Behavior:** Robots perform the work very quickly, but every step is per- formed on screen. This means that the computer must be free so the robot can act.
- **Error-proofing Mechanisms:** It shows what and where are the errors in the project before running. It does not have automatic "wait stages" before and after certain activities that need it to work (and this is a crucial point since it is recommended in every official tutorial from the vendor).
- **Programming Skills:** Does not require programming skills at all - it does not even use the same data types as normal programming.

Nonetheless, it has one coding area (C#/J#/Visual Basic) so it can be easier to perform certain actions for programmers.

- **Overall Usability:** Needs improvement. Although it offers an end-to-end process view and a unique object view, the tool is not intuitive for the developer. However, the resulting diagrams are intuitive to everyone.
- **Training Courses:** Intensive training courses, such as one foundation training, queues training and screen scraping training (i.e., surface automation). The online community is small. Provides certification after exams.
- **Robustness:** Due to the precision of the development BP is considered very robust.
- **Scheduling:** Intuitive to deploy robots due to the integrated dashboard for that purpose.
- **Logs Quality:** Not only it generates .txt files with processes information, but also graphics for easier information visualization.
- **Re-usability:** Due to its object-oriented approach, reusing modules in other processes is straightforward.
- **Performance on Different IS:** Works well in virtual machines (VM) environment and e-mails. The robots work poorly in some Java applications and some websites (Flash websites).

UiPath

The last market leader, UiPath, is the fastest-growing RPA vendor. Le Clair et al. appraises that one of the reasons for that fact is because UiPath, as a vendor, does not do direct implementations - instead its success is based on appealing to integration partners and experienced end-users. It possesses constant updates, a free-trial period and community edition that is always free. It is also written that UiPath has 15 partners with natural language

processing (NLP), intelligent optical character reader (IOCR), machine learning (ML), and chatbots directly integrated with Orchestrator, the central control point, becoming a differentiator from the other vendors. Some characteristics of UiPath are given below

- **Functional Suitability:** It has a significant number of different actions/symbols which can be overwhelming. However, it redeems itself by having a record functionality, which is crucial for early RPA developers or to code an easy and quick pilot. It recently added the possibility to write code.
- **Third-Party Integration:** It already partnered with Google, Microsoft, and AB-BYY for unstructured data features. It also provides a ready to use REST API.
- **Time Behavior:** The UiRobot is not as fast as BP's robot, but some types of processes can be performed off-screen since the robot is a program itself. This allows users to use the computer while the robot is also using it on the background, as long as it is not the same application.
- **Error-proofing Mechanisms:** It provides automatic wait stages for certain activities to avoid errors. However, besides from basic errors warnings, it does not provide a full-on error/warnings area as BP does.
- **Programming Skills:** Not strictly necessary, but it is easier to develop one robot if used, to extend robotic automation using standard scripting and programming environments. It also uses the same data types as most programming languages and the same ideas (such as conditions If, cycles While and For, exceptions, etc). The design studio is based on Microsoft's Workflow Foundation, and it uses C# and Visual Basic.
- **Overall Usability:** Easy to the developer but not intuitive to everyone since it divides the diagrams into flowcharts and sequences and does not maintain a consistency at first sight.

- **Training Courses:** Has extensive free training courses, exercises, multiple choice quizzes, online certification and a big active online community of RPA developers.
- **Robustness:** Due to the record functionality that automatically creates the diagram based on recorded actions by the user, this tool is not very robust.
- **Scheduling:** Robots run on desktops but do not require a separate virtual machine. Its servers handle management and control task. The dashboard for deployment and maintenance is not integrated into the tool itself, but on a specific website (Orchestrator - costs apart).
- **Logs Quality:** It generates .txt files with processes information. Buying Orchestrator allows users to access graphics that contain easier information visualization (it is not directly integrated to the tool - costs apart).
- **Re-usability:** It is easy to reuse modules, but not as intuitive as BP since it does not differentiate between diagrams.
- **Performance on Different IS:** Works well in virtual machines (VM) environment, e-mails, and it is very effective on excel files. The robots work well on most websites (not Flash websites).

4.5 Choosing the right automation tool for Project RPA

There are approximately more than 50 different automation tools for RPA.

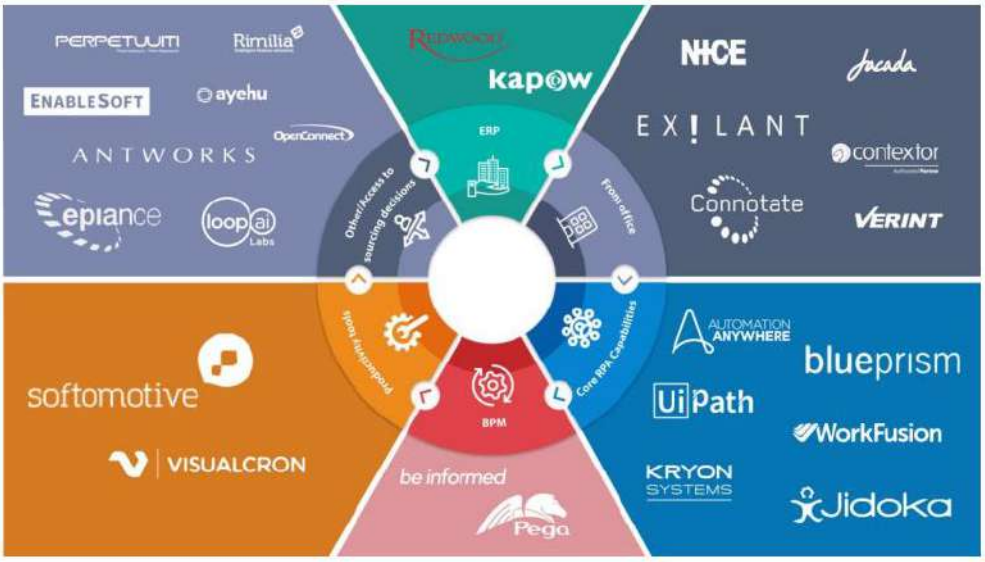

Figure 4.2: Different Automation tools for RPA

However, in the recent times UiPath has become the most popular one among all the enterprises for its stability, easy access and better community channels. Few industry reviews are provided below –

Figure 4.3: Comparison between Uipath and Other Tools in Market (Gartner peer insights)

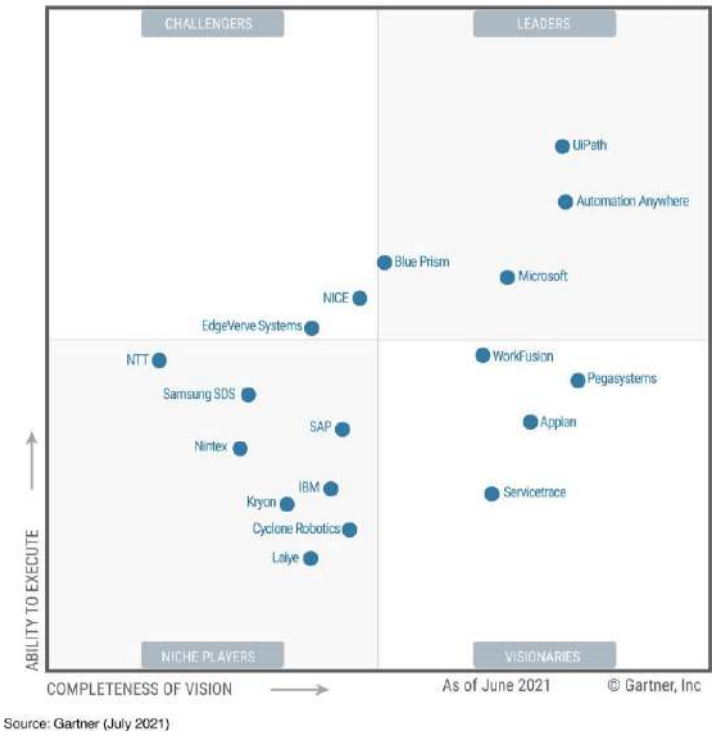

Figure 4.4: Comparison between Uipath and Other Tools in Market (Gartner magic quadrant for RPA, July 2021)

Figure 4.5: Comparison between Uipath and Other Tools in Market (Gartner magic quadrant for RPA, July 2022)

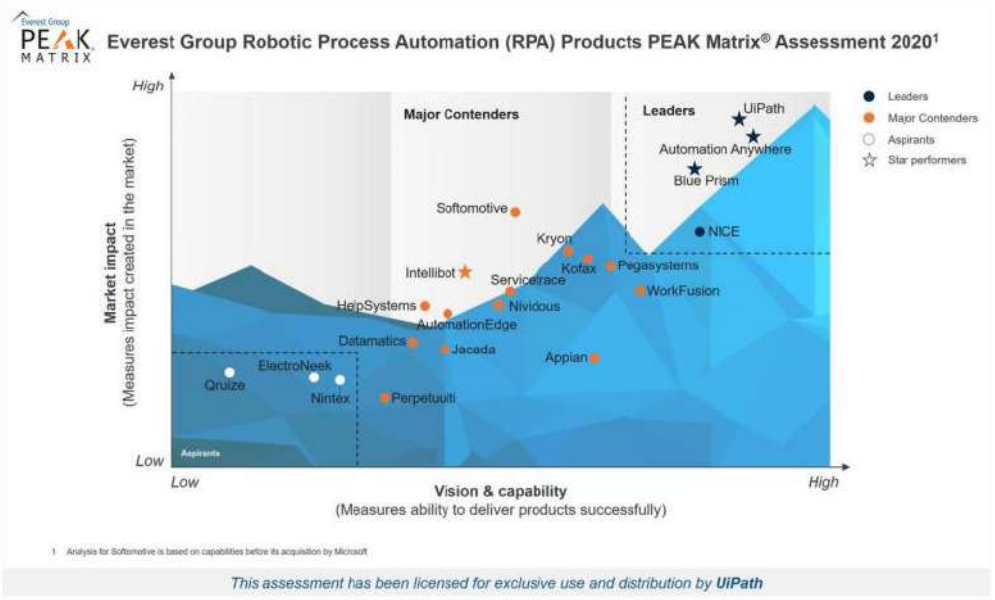

Figure 4.6: Comparison between Uipath and Other Tools in Market (PEAK Matrix assessment)

Chapter-5

Data Collection and Analysis

5.1 Data Collection

Data collection is the heart of this research project. Data collection methods are important, because how the information collected is used and what explanations it can generate are determined by the methodology and analytical approach applied by the researcher. This chapter have two parts. Firstly, we briefly discussed about before selecting tools what kind of data collection helps us to find a proper RPA model and tools for our project. Secondly, we will discuss our gaining outcome from using RPA models and tools. At the last we will analyze this data.

Before applying RPA

We collected the necessary data about this project from *ABC Telecom* company, RPA tools users, popular RPA models and tools, drawbacks of repetitive works, average rate of repetitive works in a company and many more. We discussed them in previous chapters. One survey was done with the operational level task executioners to capture their pain points mapping with the system outcomes keeping in mind the context and use-cases in *ABC Telecom* business division. **Appendix-A** is the survey questionnaire about our projects.

After applying RPA

In *ABC Telecom* IT team works for 8 hours a day. During that time one expert executioner can only create 15 KCP accounts. After implementing Uipath RPA tools we get the result, which is shown in table 5.1. Considering 22 working days in a calendar month and then analyzing this data, we can say that it is faster to open a KCP account using Uipath than manually. From table 5.1 we see that

traditional manual process an IT professional can open 3960 total accounts in a

Table 5.1: Time comparison between RPA and manual process

Task	Timeline	No. of accounts	Traditional Process (Manual work)	Using UiPath (RPA)
Creating one KCP Account	Unit	1	15 minutes	30 seconds
Creating one KCP Account	Daily	15	15 × 15 minutes = 225 minutes = 3.75 hours	15 × 30 = 450 seconds = 7.5 minutes
Creating one KCP Account	Monthly	15 × 22 =330	225 × 22 = 4950 minutes = 82.5 hours	7.5 × 22 = 165 minutes = 3.15 hours
Creating one KCP Account	Yearly	330 × 12 = 3960	4950 × 12 = 59400 minutes = 990 hours	165 × 12 = 1980 minutes = 33 hours

year after costing 990 hours. On the other hand, Uipath can create 118,800 accounts costing same amount of time (990 hours). From the data above we can say that the automation process can perform a better job than human effort and with highest accuracy, lowest human error. What UiPath robots can create accounts in a day humans can do it nearly 1 year. Moreover, an IT specialist can save (4.15hours – 7.5minutes) = 3.625 hours in a day if they replace their repetitive work with UiPath automation process.

5.2 Data Analysis

We have tried to follow the mouse cursor activities from an expert executioner. The full manual process work is segmented into 11 steps, that consists of 22 mouse clicks and 9 typing input fields. The detailed steps and mouse clicks are illustrated as below in figure 5.1 from a schematic diagram of CIMS (Customer Information Management System) tool.

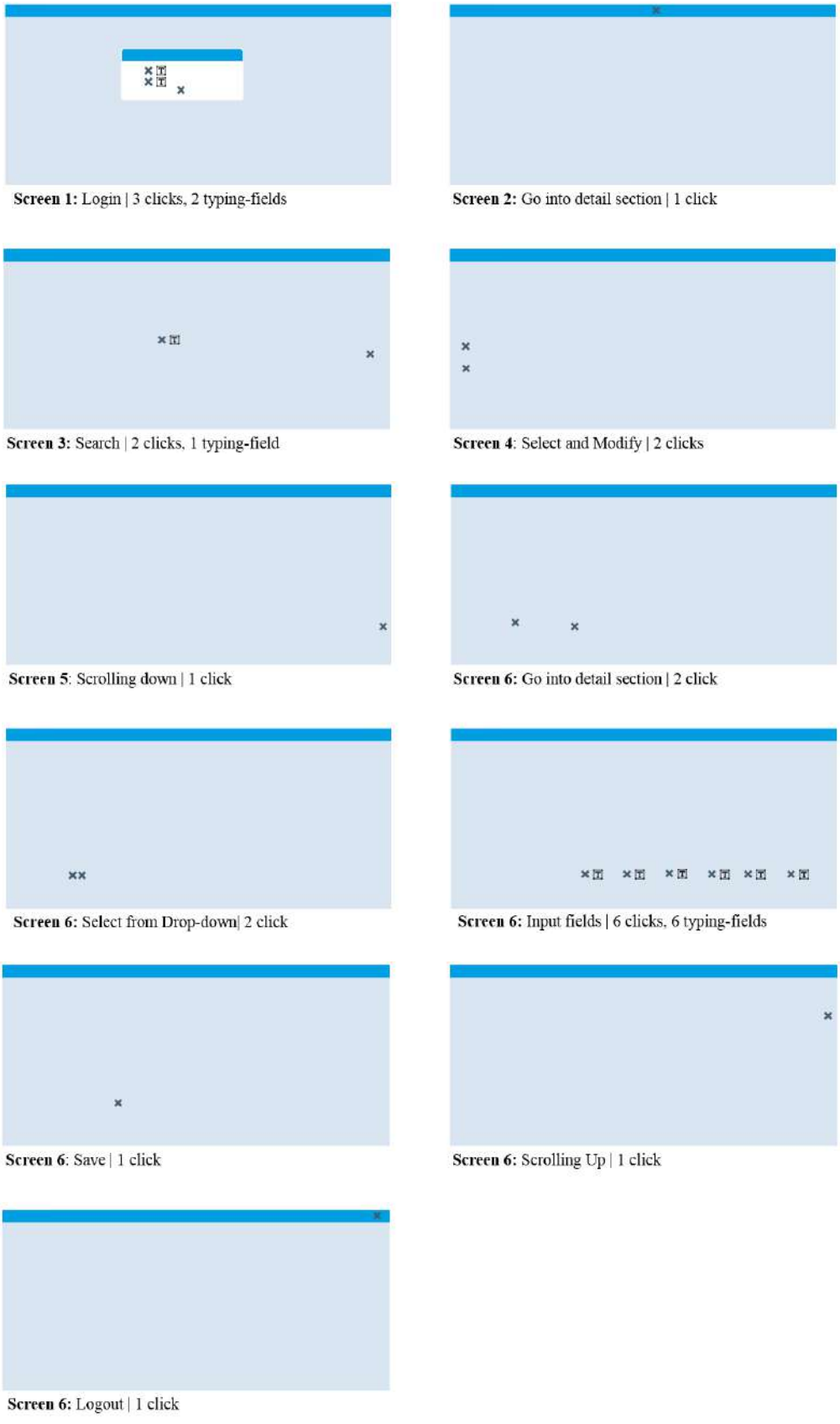

Figure 5.1: Before applying RPA (manual work effort illustration)

In summary, consolidating all the 11 steps, we get the below information to calculate our before applying RPA manual work effort.

Table 5.2: Before applying RPA (manual work effort analysis)

Before applying RPA					
Step No.	Interface Screen No.	Task Brief	Mouse Clicks	Typing Input fields	Task Sensitivity
Step 1	Screen 1	Login	3	2	**High**
Step 2	Screen 2	Go into detail section	1	0	Regular
Step 3	Screen 3	Search	2	1	Regular
Step 4	Screen 4	Select and modify	2	0	Regular
Step 5	Screen 5	Scrolling down	1	0	Regular
Step 6	Screen 6	Go into detail section	2	0	Regular
Step 7	Screen 6	Select from Drop-down	2	0	Regular
Step 8	Screen 6	Input fields	6	6	**High**
Step 9	Screen 6	Save	1	0	Regular
Step 10	Screen 6	Scrolling Up	1	0	Regular
Step 11	Screen 6	Logout	1	0	Regular
		Total	22	9	

Similarly, we can project the same illustration and analysis for RPA UiPath tool.

Figure 5.2: After applying RPA (manual work effort illustration)

In summary, consolidating all these 2 steps, we get the below information to calculate our after applying RPA manual work effort.

Table 5.3: After applying RPA (manual work effort analysis)

After applying RPA					
Step No.	Interface Screen No.	Task Brief	Mouse Clicks	Typing Input fields	Task Sensitivity
Step 1	Screen 1	Go to Debug File	1	0	Regular
Step 2	Screen 1	Select from Drop-Down	1	0	Regular
		Total	2	0	

From process perspective we can compare the “before applying RPA” vs “after applying RPA” scenarios as shown in figure 5.3.

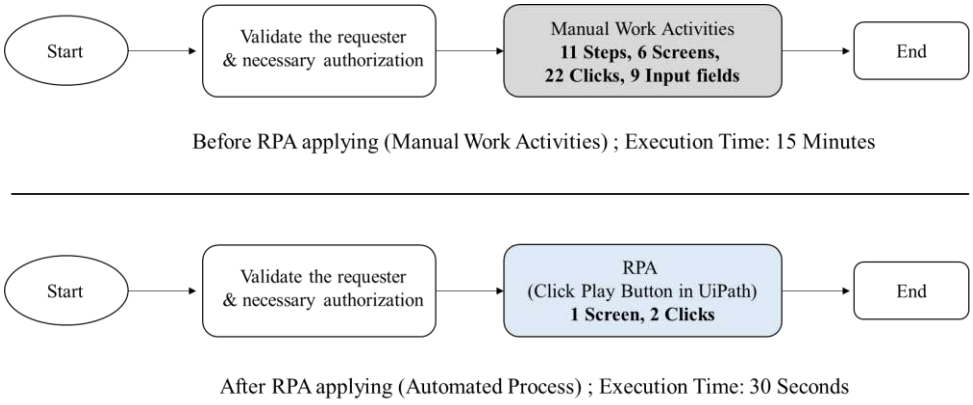

Figure 5.3: Comparison between before RPA vs after RPA scenarios

Chapter-6

Discussion on Experimental Results

This chapter is connected to the "Evaluation" activity of the Design Science Research Methodology. It describes how the research proposal functions to solve the research problem, using the results obtained from the demonstration. It also determines if the solution satisfies this thesis objective. The chapter is divided in four sections. The first one starts with a brief explanation of the used evaluation criteria. The second section evaluates the RPA Tools Assessment, the third evaluates the RPA framework which was followed by the *ABC Telecom* and the latter section is the overall evaluation, according to the primary objective.

6.1 Evaluation Criteria

This evaluation comprises the application in the field, defended by Arnott et al. (2010) as the most gainful method.

It defends that evaluation with actual fieldwork usually has significantly more quality, relevance, and organizational impact. It will follow some of the evaluation criteria as seen in Table 6.1.

6.2 RPA Tools Assessment

As referred in section 2.4 (Successful RPA Implementations), the bank had already started automating a few simple processes and because of that reason, it had already bought a license for an RPA tool. Thus, it is important to choose an RPA tool for project demonstration. However, the chosen tool by us correspond to the assessment made earlier. UiPath was decided to be the suitable tool for RPA beginners, due to its price and overall appropriateness and usability. Therefore, the assessment reaches the validity criteria.

Table 6.1: Used evaluation criteria and respective definition

System Dimension	Evaluation Criterion	Definition
Goal	Efficacy	The degree to which the artefact produces its desired effect.
	Generality	The broader the goal addressed by the artefact, the more general the artefact.
	Validity	The degree to which the artefact works correctly, i.e., correctly achieves its goal.
Environment	Consistency with organization Utility	Measures the quality of the artefact in practical use.
	Consistency with organization Fit with Organization	Characterizes the alignment of the is artefact with its organizational environment
	Consistency with technology Harnessing of Recent Technologies	Takes into account if the artefact is a new layer built on new IT artefacts

6.3 Evaluates the RPA framework

First time it is hard to understand how the Uipath RPA tool is operated. If we set up an algorithm or assignment flows in UiPath once, then it works automatically. Technical experts could easily learn it from guidelines. UiPath, being a powerful framework, its robots perform our project's task automatically faster than the traditional process (figure 5.3). We think this framework is a solution for large company's repetitive data entry jobs.

6.4 Overall result evaluation

From Appendix-1 we have got our survey which was taken before and after scenario of Uipath applied. Then we collect some data about time comparison between traditional KCP account opening and opening account through robots. Our study shows direct impact on 3 factors. We are discussing them below-

Time management

In a study conducted by Gartner in 2019, it was found that RPA has the potential to save over 25,000 hours in avoidable rework in financing departments [39]. This study of more than 150 chief accounting leaders, CAOs, and corporate controllers found that the average amount of avoidable rework in accounting amounted to roughly 30% of a full-time employee's hours, which translates to an estimated 25,000 hours a year at a cost of $878,000 for the average accounting team with 40 full-time employees.

In our case, we can see RPA helps to save 990 hours in a year. From table 5.1 we can see, manually an IT expert can open 15 accounts in a working day, and it costs 3.75 hours, but on the other hand RPA can create 15 accounts in 7.5 minutes in a working day.

Employee health

RPA allows telecom industries to automate different tasks across various systems, which are mostly repetitive, high-frequency, labor-intensive and time-consuming. Adopting RPA can help telecom businesses overcome several challenges to help their business operations and give them a competitive edge. It enhances an employee's stress, anxiety, lack of focus, human error rate and many more complications. As RPA saves an employee's valuable time and low error rate makes their job highly accurate. Low human error possibility and high accuracy rate makes employees confident and stress free. If employees of a company are healthier than the company's environment improves. Healthy company's production quantity and quality increases [40].

Company's Economy

Related to RPA successful implementation, we do not have any company level economic studies of *ABC Telecom*, but we can show a case study from Europe, a Spanish telecom company with 80,000 employees and 10 million subscribers. Their biggest obstacle was low levels of operational agility, insufficient information flows, and high operating cost and capital expenditures [41]. Highly customizable RPA provided the company with the power and tools to manage

their back-office workflow and deal more easily with large volumes of repetitive and rules based operational processes. The telecommunications provider experienced a 14% increase in productivity and was able to decrease the duration of data transfers to just a few minutes, which resulted in additional cost reduction totaling 3 million pounds (38.9 Crore BDT) annually. The company was also able to leverage RPA capabilities to drastically improve internal data communications as well as communications with customers. In support of the company's call center, more than 95% of communications were automated and average response time was reduced 1.5 minutes, allowing for a significant boost in customer service offering.

Chapter-7

Conclusions and Future Recommendations

7.1 Conclusions

Our primary objective was to find RPA impact on replacing repetitive tasks with automation and we can conclude the case study to the below points.

- RPA saves employees time for tedious tasks, giving them a healthy working environment
- By implementing RPA, an IT specialist can save 3.625 hours in a day if they replace their repetitive work with UiPath automation process.
- It significantly improves the employee's efficiency, execution time, makes the task error-free and sets the knowledge resource free from tedious low-order day-to-day tasks.

Also, one of the major problems faced in preparing this paper was the inadequacy and the lack of availability of required data.

- Difficulty in accessing the latest data of internal operation.
- It is difficult to provide customer related information regarding their service.
- Difficult to find information about how much repetitive work is done in this company.
- Could not implement large scale RPA tools implementation in the company, initial phase.

7.2 Future Recommendations

Telecommunications is a giant industry today where service providers are

struggling with massive volumes of operational processes such as managing data, increasing business agility, controlling costs, improving business efficiency, and developing new models or services. Operational services like customer support, billing, order fulfillment, and more have become increasingly complex and difficult to handle due to millions of subscribers, the clutter of customized plans, and customer segments. The repetitive processes prevent telecom service providers from focusing on other important tasks and their customers, making them compete with one another to provide affordable, fast, and cutting-edge solutions to their customers.

- RPA can bring revolution in telecom industries. The telecom industries are at a stage where they can take advantage of upcoming technologies of Robotic Process Automation (RPA) to help them streamline their business processes.

- Different model and tools might work better for different kinds of manual tasks and scenarios. If there arise any problems faced by the user, then it can be approached to resolve it and make a document to store the specific problem and solution. At last, the case study and account opening use-case can be implemented in other telecom companies automating the manual tasks to improve efficiency.

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Appendix-A: Questionnaire

Questionnaire for investigating the depth of manual repetitive work at a mobile network operator, *ABC Telecom*				
Industry Type				
Company Name			Address/Location:	
Company Contact Information	Tel:		Fax:	
Total Company Employee				
Name of the employee				
Educational qualification			Trainings:	
Sex	☐ Male		☐ Female	
Age (in years)	☐ 20-25	☐ 26-32	☐ 33-40	☐ > 40
Job designation	☐ Execution Expert	☐ Operator	☐ Manager/Supervisor	
Working duration (Daily hours)	☐ 0-3	☐ 4-6	☐ 7-9	☐ > 9
Skill level of the worker	☐ Skilled	☐ Semiskilled	☐ Unskilled	
Number of skillsets required for your job	☐ only 1	☐ 2-3	☐ 3-5	☐ > 5
Training facilities	☐ Yes		☐ No	
Repetitive tasks	☐ Yes		☐ No	
Have you ever faced execution mistakes in your job-task?	☐ Yes		☐ No	
Job experience (in years)	☐ below 2	☐ 2-3	☐ 3-5	☐ > 5
Salary (approximate range in BDT)	☐ below 25,000	☐ 26,000 - 35,000	☐ 36,000 - 50,000	☐ > 50,000
Job satisfaction	☐ Satisfied	☐ Neither satisfied nor dissatisfied		☐ Dissatisfied