NOVA IMS Information Management School

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Data Science and Advanced Analytics

THE ROLE OF RPA/LOW-CODE IN PROCESS TRANSFORMATION

How well-implemented RPA/Low-Code projects can help transform a company's process development?

Diogo Vargas Marques

Project Report

Presented as partial requirement for obtaining the master's degree in Data Science and Advanced Analytic

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação
Universidade Nova de Lisboa

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The role of RPA/Low-Code in process transformation

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por

Diogo Vargas Marques

Project report presented as partial requirement for obtaining the Master's degree in Advanced Analytics, with a specialization in Business Analytics

Orientador: Vítor Duarte Santos

July 2023

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I declare that I have carried out the present academic work with integrity. I confirm that I have not engaged in plagiarism or any other form of improper use of information or falsification of results during the process of elaborating this work. I also declare that I am aware of the Code of Conduct and the Code of Honor of the NOVA Information Management School.

Diogo Vargas Marques

Lisbon, 15th July 2023

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ABSTRACT

Over the past few years, the increasing global adoption of Robotic Process Automation (RPA) by companies has become more noticeable. However, at the national level, this trend has not yet gained significant relevance, making it an important factor for companies to distinguish themselves in their respective markets.

With this in mind, Worten decided last year to embark on a strategy focused on Digitalization and Process Automation. The goal was not only to strengthen its current market position but also to reaffirm its commitment as a digital company that keeps up with emerging market trends.

Therefore, the aim of the two projects developed was to assist Worten in this new phase of process change, particularly in the introduction of robotic process automation within the organization. The primary objective was to introduce the concept of automation in the most appropriate manner, starting with defining best practices for the successful implementation of RPA processes.

Additionally, apart from creating a guide of best practices, it was also important to raise awareness among employees about the changes and advantages that process automation can bring. Hence, the implementation of these best practices in practical cases within the organization was also requested.

KEYWORDS

Low Code; Robotic Process Automation; Digital Transformation; Process; Business Support; Power Platform; Power Automate

Sustainable Development Goals (SDG):

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LIST OF ABBREVIATIONS AND ACRONYMS

AI	Artificial Intelligence
API	Application Programming Interface
BI	Business Intelligence
BISE	Business and Information Systems Engineering
BPM	Business Process Management
BPMS	Business Process Management System
DIY	Do It Yourself
FTE	Full-Time Equivalent
HTML	Hypertext Markup Language
IPA	Intelligence Process Automation
iPaaS	Integration Platform as a Service
IT	Information Technology
ML	Machine Learning
NLP	Natural-language Processing
RPA	Robotic Process Automation
SLA	Service Level Agreement
STP	Straight Through Processing
TSC	Technical Service Center

1. INTRODUCTION

The first steps towards the new digital age were taken during the first industrial revolution, which primarily focused on advancements in production processes. These innovations not only transformed the way industries operated but also had a profound impact on society and various aspects of our world. For example, the steam engine revolutionized manual industries, making them more mechanized and efficient, while the introduction of electrification in workplaces further enhanced productivity (Maria Gonçalves Martins et al., 2018).

In the years that followed, the second and third industrial revolutions created a growing gap between technological development and its implementation in industries, necessitating the emergence of a new era known as Industry 4.0. The main objective of Industry 4.0 was to introduce mechanisms that would transform existing industry processes, bringing about greater autonomy, flexibility, and efficiency. Some examples of these mechanisms include the Internet of Things, Robotic Process Automation (RPA), Big Data and Analytics, and Collaborative Robotics (Jazdi, 2014; Vannella, 2018).

However, this transition cannot be solely characterized by its positive aspects, as increased competition and pressure for companies to perform better and more efficiently have also emerged. In this competitive environment, it is crucial to consider not only the latest technological advancements but also the human factor. The role of humans in organizations is essential, and thus, when undergoing digital transformation, organizations need to implement new mechanisms that do not exclude this factor. This is where RPA technology comes into play (Gradim & Teixeira, 2022).

RPA, with the primary objective of freeing workers from time-consuming, rule-based, and repetitive tasks, enables the automation of these processes, allowing employees to focus on value-generating and intellectually stimulating work. Studies suggest that this type of automation can bring benefits at three fundamental levels: Shareholder Value (increased scalability, agility, and compliance), Customer Value (enhanced services, greater availability, and quicker response to customer needs), and Employee Value (reducing routine tasks, increasing employee motivation, learning, and their ability to generate more value for companies) - (Willcocks & Craig, 2017).

Based on this initial idea, the proposal to undertake two projects for the company Worten emerged. Both projects aim to address the initial question of this report while also contributing to the company's digital transformation and transforming its external and internal reality.

1.1 ORGANIZATIONAL CONTEXT

Worten, a company founded in 1996, is one of Sonae's electronics retail brands. It positions itself as a digital company with physical stores and a human touch. As the market leader in its sector, Worten's mission is to provide the best technology and a wide range of products to all consumers. It currently offers over six million products and excels in home appliances, IT products, telecommunications, sound, image, and entertainment. In recent years, Worten has expanded its services to include repairs through Worten Resolve and has diversified its product offerings to include toys, beauty, well-being, health, sports, books, home and decoration, DIY, garden, and pet products.

With the largest e-commerce site in the country and more than 240 stores in Portugal and Spain, Worten strives to remain close to its customers by offering competitive prices, personalized service, and a diverse range of products and services tailored to their needs and expectations.

In order to maintain and further strengthen its leadership position, Worten recognizes the importance of staying up to date with new strategies and organizational resources. As a digital company with physical stores and a human touch, Worten must continuously seek ways to reinvent itself, both in terms of external customer experiences and internal processes.

To enhance its image as a modernized company that prioritizes digitalization throughout its value chain, Worten has identified areas for process optimization using technologies such as RPA and Low-Code platforms. The primary objective of these projects is to drive digital transformation within the organization. Worten aims to be recognized as a technology-driven brand, not just for its core products, but also for its organizational structure, employee DNA, and the tasks they perform. The goal is to streamline manual and time-consuming processes, enabling employees to focus their time on value-added tasks. By implementing digital automation processes through Low-Code and RPA technologies, Worten aims to achieve this transformation.

1.2 Project Goal

The goal of the project is to explore the capabilities of RPA and its potential benefits for a well-established company like Worten. To achieve this, the project proposes the development of a comprehensive set of guidelines for implementing RPA processes within the company. These guidelines will serve as a roadmap for initiating and implementing RPA initiatives. Additionally, the project includes sub-projects that will test and validate these guidelines by applying them to real processes at Worten. Furthermore, the company has requested the development of an RPA solution that proposes new processes to enhance the company's operations.

To accomplish the main objective, several intermediate objectives were defined:

- **Gain a detailed understanding of RPA platforms and software:** The project team will study and analyze the functionalities and workings of various RPA platforms and software available in the market.
- **Identify processes suitable for RPA implementation:** Through an assessment and requirements-gathering phase, the team will identify processes within Worten that are suitable for RPA intervention. These processes will be evaluated based on criteria such as volume, complexity, and potential benefits of automation.
- **Use RPA and Low-Code technology to map processes:** RPA and Low-Code technology will be employed to map and analyze the identified processes, identifying critical intervention points where automation can provide significant value.
- **Establish process monitoring mechanisms:** The team will establish mechanisms to monitor and maintain the automated processes effectively. This includes defining how the processes should be monitored and establishing a maintenance phase to ensure continuous improvement and efficiency.
- **Develop guidelines for successful RPA/Low-Code projects:** The project will result in the creation of comprehensive guidelines that provide best practices and recommendations for implementing RPA and Low-Code projects. These guidelines will serve as a reference for future RPA initiatives within Worten.

- **Validate the guidelines:** The proposed guidelines will be tested and validated through the implementation of sub-projects that apply them to real processes at Worten. This validation phase will ensure the effectiveness and practicality of the guidelines in a real-world scenario.

By achieving these intermediate objectives, the project aims to provide Worten with a solid foundation for implementing RPA, enabling the company to automate processes effectively and achieve the associated benefits.

1.3 Importance And Relevance

RPA has a significant and growing impact on a global scale, as evidenced by various studies and trends. For example, Makridakis predicts that in the coming years, RPA automation will not only outperform but also replace unnecessary human labor (Makridakis, 2017). In developed countries like the USA, it is estimated that approximately 50% of jobs are already amenable to automation (Yarlagadda, 2018).

The financial and banking sector is particularly affected by the impact of RPA. Financial institutions are investing in RPA and AI mechanisms to maintain stability and profitability in an increasingly competitive market, combining intelligence with automation (Siegel E, 2016). Retail banking, which focuses on managing customers' savings, has seen the introduction of automation to improve performance, reduce costs, and stay up to date with technological innovations, such as the implementation of services like mobile banking (Makkonen, 2017).

The future impact of RPA can also be seen in the profits of RPA providers, which have shown significant growth over the years. More and more companies, including small and medium-sized enterprises, are introducing and adapting to RPA due to its potential for streamlining processes and reducing costs (Marciniak & Fabok, 2016). While some jobs may become outdated, others will be transformed, and new jobs will be created. To ensure a smooth transition and minimize potential disparities between people and robots, education and monitoring of workers' job routine and satisfaction are crucial (Kirkwood, 2020).

Overall, RPA is expected to continue reshaping industries and the job market, with its adoption and impact extending to various sectors and organizations. It presents opportunities for increased efficiency, cost savings, and the creation of new roles, but it also requires careful consideration of the workforce's needs and well-being in the changing landscape of work.

2. WORK PLAN

In this phase the Work Plan will be defined, alongside all the activities it encompasses – these tasks will be defined, as all the tools that will support each one of them. Besides this, a chronogram with a development plan of these projects will also be available.

2.1 Project Management

This project is composed by five different phases, that will lead and support the projects to reach their final results and discussion phase, as shown in Figure 1. When reaching the project developments phase, the first one will take into consideration the BPMS lifecycle, that will be considered in the theoretical framework – the last two projects will not only take in consideration the themes in discussion in the theoretical framework, but also the guidelines produced in project one.

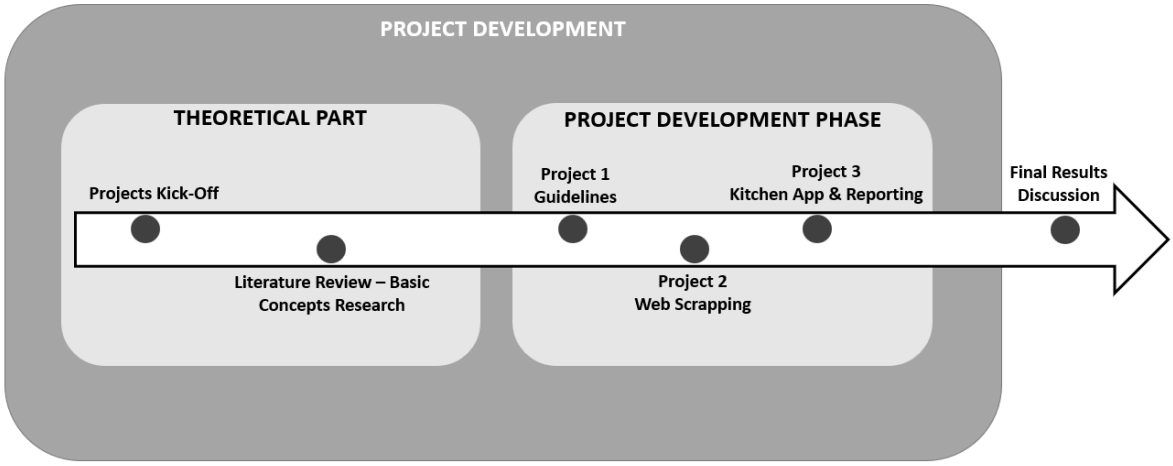


Figure 1: Project Management Stages

Source: Prepared by the author

2.2 Projects Kick-Off

This first step consists of initiating the projects to be carried out, and here the most important part will be to explore the entire context that surrounds this project – the company for which they will be developed (Worten Portugal), the importance and relevance that these projects may bring to the company, and also the main objectives to be achieved with these developments.

2.3 Theoretical Framework - Basic Concepts Research

In this phase, all fundamental concepts related to the field of Robotic Process Automation (RPA) will be explored:

1. What is its origin?
2. What are the main obstacles and opportunities for its implementation?
3. How can they be relevant to a company?

These are just a few of the questions that will be explored in order to build a theoretical background that supports all decisions to be made in the practical part of the projects. This research will be particularly important in the development of guidelines, which will be produced in the first project.

2.4 Project 1 Guidelines

After the entire research phase, it is necessary to initiate the practical phase. This first project becomes essential as it is through it that all automations requested by the company will be developed. Therefore, the first project will consist of a set of guidelines by which project developments should be governed.

These guidelines range from the evaluation of project potentials to rules for development, control, and maintenance of future automations. All guidelines will be drafted based on the theoretical foundation built earlier.

2.5 Project 2 Web Scraping

This first project will be put into practice following the entire set of guidelines previously developed. Therefore, the main objective will be to address an aspect of RPAs whose purpose is to replace an existing process.

In this case, the primary mechanism to be used will be the Power Automate tool with the assistance of some Python code.

2.6 Project 3 Kitchen App & Reporting

The last project will follow the same steps as the previous one, also adhering to the logic and structure defined by the guidelines. However, the main objective of this project is to demonstrate how RPA mechanisms can be used to build solutions from scratch to meet the company's needs.

In this case, through the Power Platform mechanisms, it will be possible to develop logical workflows for information management, thus building a new reporting solution for the company.

2.7 Results and Discussion

This phase will be conducted after all the Project Development stages are completed, in order to reflect the Results achieved by the Project and furthermore evaluate and discuss them.

2.8 Chronogram

The Figure 2 describes the planned chronogram associated with the project. The schedule is composed by six phases, three milestones and four deliverables.

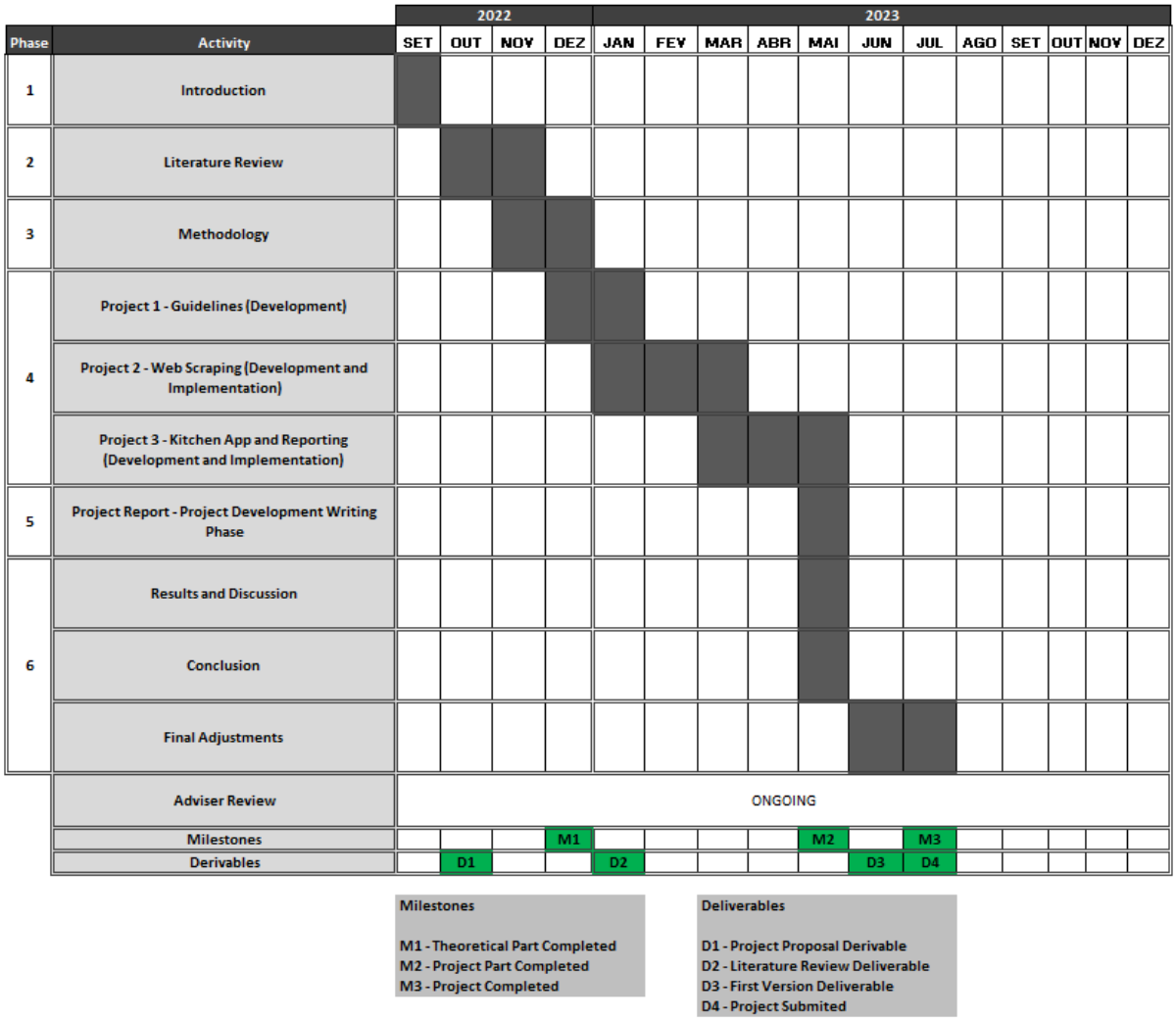


Figure 2: Project Chronogram

Source: Prepared by the author

3. THEORETICAL FRAMEWORK

3.1 Process Automation Concepts

Currently, the concept of automation (encompassed under the umbrella term RPA and an important term in the context of Business Process Management – BPM) – (Bichler & Heinzl, n.d.), is one of the most important pillars in the modernization and digitization of processes. In short, it refers to carrying out a process or task using technology without resorting to any kind of human intervention. Many questions arise when the topic of process automation is addressed (Fettke et al., n.d.):

- - "Which processes should be automated?"
- - "Which processes should continue to be carried out manually?"
- - "How should the automation potential of a process be evaluated?"

These are the questions that many BISE (Business and Information Systems Engineering) authors have been answering. For this, it was necessary to understand that process automation encompasses some essential concepts:

1) **Workflow Management:** The term refers to the whole coordination and organization of a set of tasks that lead to a certain result. In addition, it also includes all efforts to optimize and automate certain flows, eliminating repetitive steps or tasks that cause errors. To understand how a given workflow should be automated, it is important to understand its main components (Inputs, Transformation, and Outputs) – (Salemme, 2022)
2) **Business Process Management:** It is the method by which a company looks at its most critical and poorly managed processes, individually and as a whole picture – assessing its current performance, identifying potential critical areas and intervention points. This concept differs from task or project management, as it does not aim to look at individual tasks or projects that only take place for a short period of time. The objective is essentially to improve processes that lead to wasted time, high error rates, increased blame on workers, lack of data, or lack of motivation on the part of employees. All this analysis is done following the BPM life cycle, composed of the following phases: Design, Model, Execute, Monitor, and Optimize (*A Full Overview of Business Process Management (BPM)*, 2022)
3) **Straight Through Processing:** As will be mentioned in the following points, Straight Through Processing (STP) was a first approach to process automation. It is a term that refers to tasks that can be performed without the need for human intervention. It was first introduced in the financial industry to design mechanisms for automating operations, automating all existing processes, and relationships between industry players, making these operations and processes less interpersonal and more technologically dependent. (Team CFI, 2022)

All three of these concepts formed the basis for the development and research of the topic addressed in the next points of this report, namely for the entire description of process automation and the topic of RPA.

3.2 Robotic Process Automation

In the previous paragraph, the theme of developing mechanisms to support process automation was mentioned - thus, it is important to explore the central theme of this report a little further. RPA mechanisms are tools that allow actions on the user interface of other computer systems in the same way that a worker would do it manually (W. M. P. van der Aalst et al., 2018). Their main objective is to replace workers with automation, freeing them to create new ways to bring value to organizations (Aguirre & Rodriguez, 2017) . Some studies such as those carried out by the company Gartner clearly define RPA (Tornbohm Cathy, 2016):

‘‘RPA tools perform [if, then, else] statements on structured data, typically using a combination of user interface interactions, or by connecting to APIs to drive client servers, mainframes or HTML code. An RPA tool operates by mapping a process in the RPA tool language for the software robot to follow, with runtime allocated to execute the script by a control dashboard.’’

In Figure 3, it is possible to see the positioning of RPA mechanisms in relation to the "long tail of work" - on the x-axis, we can observe the number of different types of cases (two cases are of the same type if they can be solved or worked on in the same way), and on the y-axis, the frequency with which those cases can be observed is displayed. Process automation will always be more directed towards more frequent cases since tasks that occur less frequently have higher costs (the more systems involved in each process, the higher the costs). The remaining cases are often carried out manually, as they are more exceptional and must be carried out in an ad hoc manner (W. M. P. van der Aalst et al., 2018).

“Using RPA, it is possible to support the middle part by having agents that interact with the different information systems as if they were human. This is not always possible or economically viable. Therefore, the ‘‘end of the long tail’’ still needs to be handled by human workers” (W. M. P. van der Aalst et al., 2018)

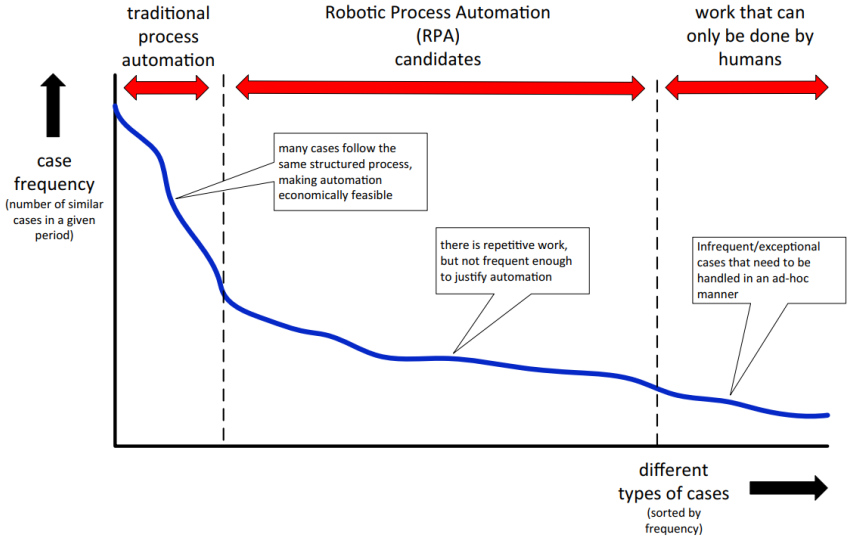


Figure 3: RPA Positioning in the “LONG TAIL OF WORK”

Source: (W. M. P. van der Aalst et al., 2018)

Still on the topic of RPA, it is necessary to distinguish it from the concept of STP (Straight Through Processing), since both concepts refer to processes that can be developed without the need for human intervention. In this way, RPA differs from STP essentially for two reasons: firstly, RPA uses an “outside-

in" approach, where information systems remain unaltered, unlike STP mechanisms where systems are often redesigned; secondly, RPA tools are more flexible solutions than STP, as they can adapt to any changes that systems may undergo (W. M. P. van der Aalst et al., 2018).It is also important to mention that the learning of RPA mechanisms comes from observing the worker performing the task. This RPA-worker relationship is really important, especially in cases where automation can encounter system errors, exceptional cases, irregular system behavior, and unexpected process changes (W. M. P. van der Aalst et al., 2018).

Figure 4 illustrates the evolution over the years of the importance of the BPM (Business Process Management) concept in modern business enterprises, and how the increasingly accentuated introduction of process automation is integrated into it. In the first image, it is possible to see how software systems have evolved since the 1960s, when they were based on a simple version of a single application, until the 2000s, where the developed application constitutes a small part of the system, which currently is already composed of sets of technologies, including the introduction of BPM mechanisms (W. van der Aalst et al., 2010). In the second image, it is possible to observe the same timeline until the year 2010, when the expansion of BPM grew, reaching the RPA mechanisms (Fettke et al., n.d.).

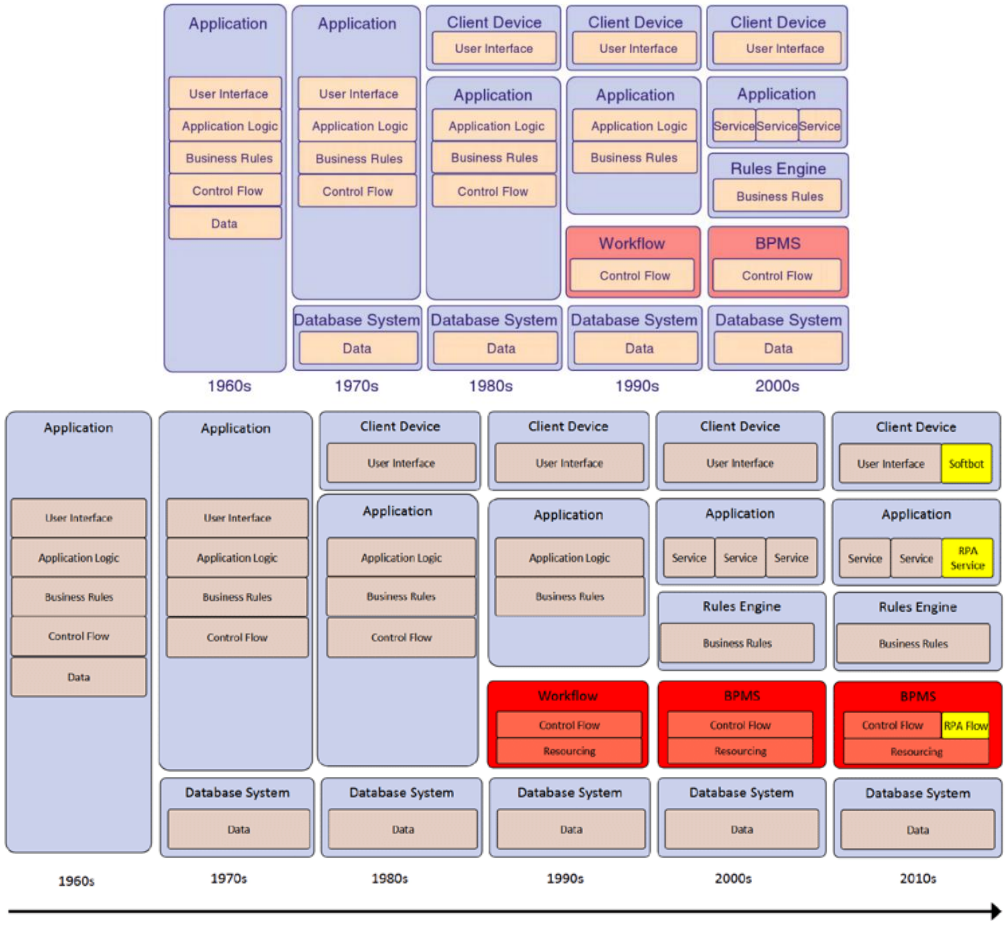


Figure 4: Evolution of BPMS Architectures Until the Introduction Of RPA

Source: (Fettke et al., n.d.)

3.3 RPA Low-Code projects

After developing the topic of RPA technologies, it is also important to address another central theme of this project report – Low Code – and understand how it can be used as a way to automate processes. Low-code platforms are sets of tools that aim to develop new solutions that are necessary and adapted to each business, with less complexity, being available to everyone, whether workers with a programming background or any other collaborators with no experience in the area (Salemme, 2022).

This more accessible level of complexity is essentially due to the simpler code language used, which translates into easier application development and implementation phase. Low code approaches and techniques are developed based on four essential aspects: Model-driven software development, rapid application, automatic code generation, and visual programming (Salemme, 2022).

In this way, low code tools can be used for the same purpose as RPA and can even be considered a sub-category of the latter. After analyzing the two central themes of this report, it is then possible to move on to the practical part of it - the development of RPA/Low Code projects. These automations will have as their main objective the replication of existing manual processes in organizations, identifying their main pain points and overcoming them through automation.

3.4 Challenges and Opportunities

As an emerging concept, RPA automation software currently presents a large set of challenges and opportunities, which also need to be explored.

Starting with the challenges, the first and main one that stands out is the fact that no process is static over time, and there are always new details and decisions that must be altered or adapted over the years. Just like a worker, the automation developed for the process must follow this evolution and encompass all the exceptions found since if this does not happen, it could lead to incorrect decisions that could affect the entire structure, affecting the process (Lamberton Chris et al., 2016).

In addition to this, there are still other important challenges to highlight (Lamberton Chris et al., 2016):

1) **Choose the right processes to automate:** As described in section 3.2, not all processes should be automated. If we target RPA automation for complex processes, this can lead to high automation costs, which could have been used to develop simpler processes. In this sense, it is more appropriate to automate several simple processes that consume time for workers, rather than a complex process that may even cost the same amount of time but incurs additional unnecessary costs;

2) **Process Monitoring:** When thinking about RPA, we often think that it only involves process development, however, this does not correspond to reality. It is increasingly important to ensure that the automation developed will contribute to the process development, not only in the present but also in a future logic. It is necessary to guarantee credible and functional process monitoring mechanisms so that, in the presence of an error, the problem is resolved immediately;

3) **Practical RPA knowledge:** The idea that advanced employee training is required to implement RPA process automation in an organization remains a fact that constitutes an obstacle to the implementation of RPA in companies. Typically, employees who develop this type of automation go through a period of training and supervision before being able to proceed with developments

autonomously, in order to collect all the key details and prepare developments correctly. As in any other position, training is essential for the proper performance of duties;

4) **Worker – RPA:** Another preconceived theory that often constitutes a barrier to the implementation of RPA technologies is that it will completely eliminate the role of workers in organizations. This statement is incorrect for two essential reasons: firstly, because the objective of process automation is precisely to perform time-consuming tasks, freeing up workers to add new value to the company and become more essential resources, and secondly, because in the majority of cases, processes are not completely eliminated from a manual point of view. However, the technology is not perfect, and many times a process may not be amenable to automation in its entirety. Additionally, there may be errors and exceptions where the role of the worker remains essential.

To have a clear view of the opportunities, it is important to reflect on the growth that the RPA market has undergone over the years and also on the expected future prospects for this sector. In Figure 5, we can see the evolution of the popularity of RPA in searches carried out by Google (Jovanović et al., 2019). According to these trends, it is possible to observe that until 2017, the level of interest in this topic was below the value of 50, indicating that the available data for discovering and developing the theme was scarce. However, from that same year onwards, this value almost tripled and is currently very close to the value of 100, which means that in recent years it has reached its peak of popularity.

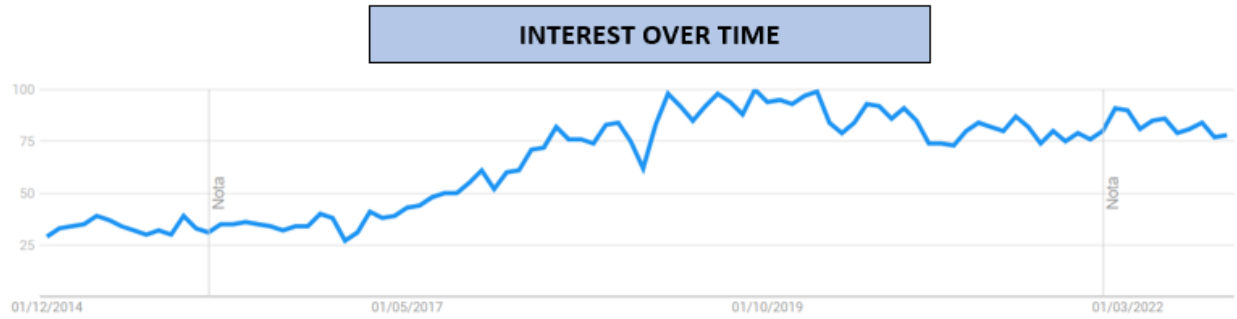


Figure 5: RPA Interest – Google Trends

Source: Adapted from (Jovanović et al., 2019)

Regarding the future growth of the RPA market, according to Gartner data, in 2022 spending on RPA software recorded an increasing trend, reaching a value of 2.9 billion in 2022 (+19.5% compared to 2021) – a trend which is expected to remain constant, with data from 2023 pointing to future growth of approximately 17.5%, as outlined in Table 1. According to some data from Gartner (Stamford Conn, 2022):

"By achieving a growth rate of 31% in 2021, the RPA market grew well above the average worldwide software market growth rate of 16%" and **"Organizations are leveraging RPA to accelerate business process automation initiatives and digital transformation plans, linking their legacy nightmares to their digital dreams to improve operational efficiency" –** (Tornbohm Cathy, 2016)

	2021	2022	2023
End-User Spending	2,389	2,854	3,352
Growth (%)	30.9	19.5	17.5

Source: Gartner (August 2022)

Table 1: Worldwide RPA Software End-User Spending Forecast (Millions of U.S. Dollars)

Source: Gartner, 2022

It is still expected that in 2024, there will be a continued commitment to tools and software that will lead to the development of "hyper-automation" of an organization's processes. In this way, growth opportunities in the RPA market are expected to increase, accompanied by the evolution of low-code application platforms, process mining, task mining, decision modeling, iPaaS, and computer vision tools, which are all RPA booster mechanisms. (Stamford Conn, 2022)

3.5 Intelligence Process Automation (IPA)

When reflecting on and explaining the topic of RPA, it is important to explore a concept that has been emerging in recent years: Intelligent Process Automation (IPA). From a first point of view, both concepts seem to have the same purpose - to replicate tasks produced by humans and make them more efficient, automating them - however, the IPA concept goes beyond that. In addition to encompassing all the fundamental technologies and mechanisms for the operation and development of automations, IPA combines them with AI tools - such as machine learning, structured data interaction, and natural language processing, among others. (Berruti et al., n.d.)

It is an extension of the RPA concept, both in terms of the basic objective of helping the common worker, through the execution of their most repetitive and monotonous tasks, as well as in their long-term objectives – improve the working routine of the employee by letting him have the opportunity of performing more valuable tasks, enhance efficiency, reduction of costs and operational risks as well as improve the customer experience. (Berruti et al., n.d.)

According to an article prepared by the research journal Sipotra, 5 main concepts make up the IPA mechanisms (Berruti et al., n.d.):

1) **Robotic Process Automation:** The concept that serves as a support base for all the topics developed in this report – a set of techniques and mechanisms that lead to the automation of routine and monotonous tasks that do not bring added value to the worker and the organization;

2) **Smart Workflow:** The concept of smart workflow is directly related to previously discussed definitions - Workflow Management Automation - functioning as a combination of both. The intention is to maintain tasks in a more advanced and developed way, for example, by monitoring their status in real-time and providing statistical data, also in real-time, of exceptions or restrictions that may arise during the course of the process;

3) **Machine Learning and Advanced Analytics**: The basic concept of IPA is essential to distinguish it from the more basic concept of RPA. IPA mechanisms use machine learning algorithms to assist in automating processes, using both supervised and unsupervised learning techniques. Supervised learning algorithms work with structured datasets and learn from given inputs and outputs, making predictions based on new inputs and outputs. Unsupervised learning algorithms produce new insights and predictions based on unlabeled data, without prior data training;

4) **Natural-language processing (NLP)**: It involves the interaction between humans and machines, and it mainly refers to the use of artificial intelligence (AI) to generate narratives from datasets – that is, to translate data observations into written form;

5) **Cognitive Agents**: These technologies combine machine learning algorithms and NLG mechanisms, building virtual workforces that can perform tasks, communicate, learn, and extract knowledge from existing datasets. They can even extend their capabilities to work with employees' emotions, through techniques such as emotion detection. The most obvious examples of these cognitive agents can be found in online service centers, where they assist both employees and customers.

According to the same study, IPA has a significant impact on the areas of manual and simple work (mainly aggregation and data collection tasks), front and back-end processes, where it mainly refers to the automation of subparts of processes, such as email correspondence or system information updates. Figure 6 illustrates the benefits of automating processes through RPA mechanisms as well as the losses and areas that need improvement resulting from the practice of time-consuming manual processes within an organization (Berruti et al., n.d.):

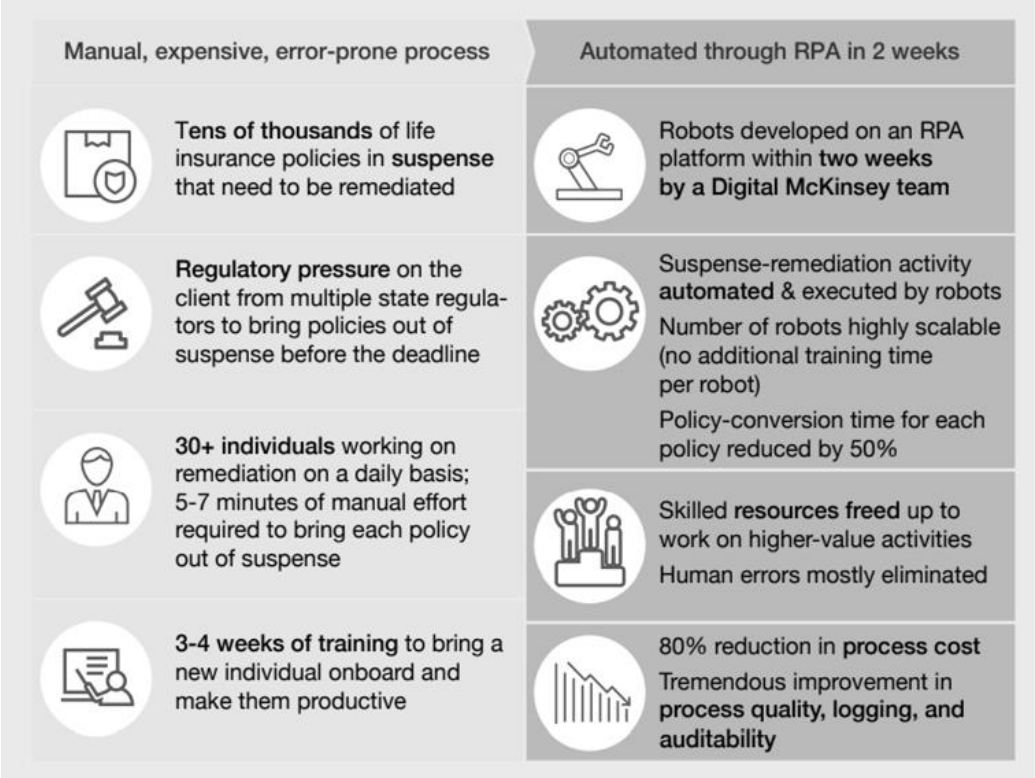


Figure 6: Productivity Gains From RPA

Source: (Berruti et al., n.d.)

In the figure above, only a small part of the advantages brought by the implementation of IPA in processes is reflected. Among all the aspects highlighted, it is important to note the impact in terms of costs, where a large-scale reduction (approximately 80%) is expected, accompanied by an increase in the overall quality level of the process. This is because not only are a large part of the human errors that may occur during the process eliminated, but it also becomes possible to take advantage of the skills of qualified workers in activities of greater value to the company. This is in contrast to a scenario where an organization has about 5 workers doing the same routine task, where the value that enters the company is small and never the maximum that could be achieved. Additionally, any of these workers always needed weeks of integration and training to be able to perform the task in the most efficient way possible.

4. TOOLS & PLATFORMS

Due to the growing interest in the application of RPA software in organizations, many applications and tools that allow the application of this process automation mechanism have emerged. Thus, some RPA vendors, such as AutomationEdge, Automation Anywhere, Blue Prism, Kryon Systems, Softomotive, and UiPath, have become the most sought-after tools in recent years. In addition to these, numerous other tools have inherent RPA functionality in their implemented software - this is the case with Low-code tools such as Power Platform, but also others such as Pegasystems and Cognizant (Jovanović et al., 2019). Figure 7 shows the most used RPA implementation tools, where, according to a study carried out by FORRESTER, UiPath, Automation Anywhere, and Microsoft are the current leaders in this segment - both in terms of current offerings and more developed strategies (The Forrester WaveTM: Robotic Process Automation, Q1 2021 , 2021).

Figure 7: Leaders in RPA Developing Environments – Magic Quadrant

Source: (The Forrester WaveTM: Robotic Process Automation, Q1 2021 , 2021)

4.1 POWER PLATFORM

Power Platform is a Microsoft set of applications that allows its users to build innovative solutions by automating processes, analyze data and many other things. This tool is composed by four principal components:

1) Power BI – As a business analytics tool;
2) Power Apps – Application to develop low code apps;
3) Power Automate – Process Automation;
4) Power Virtual Agents – Intelligent Virtual Robots

4.1.1. Power Automate

Power Automate is the main Power Platform RPA tool, belonging to Microsoft and developed in Azure. Within this tool, we find the Power Automate ecosystem, which is composed of two essential automation development tools: Power Automate Cloud (works as a repository of flows and where it is also possible to develop several) and Power Automate desktop (where it is possible to develop flows on a large scale). In addition to this power automate also provides API integration and orchestration, task mining, AI, and many other features. (Ray Saikat et al., 2022)

According to Gartner, these are some of the strengths presented by Power Automate (Ray Saikat et al., 2022):

1) As it is a tool from Microsoft, it is often included in the licenses that its users obtain in their organizations. This is beneficial for users for two different reasons: firstly, it becomes an application that is easy to access alongside the other components of the Power Platform and Microsoft's system, and in addition to this, many times these users can look for power automate along its licenses with discounts, leading to companies not covering such high initial costs for the application of RPA in their processes;
2) Currently, the Power Platform user community is growing. With more than 500 partners and a community of approximately 2 million users, the Platform has an increasingly useful and developed network for sharing data and clarifying doubts;
3) Microsoft offers a free and limited version of Power Automate to all Windows users, where it is already possible to build any type of flow. In addition, it also offers premium versions where, in addition to process automation, it is possible to use tools such as API connectors, task mining, and IDP.

According to a study carried out by FORRESTER, reflected in Figure 8, these are some of the most notable benefits and impacts brought by the Power Platform (Capaldo Adrienne & Lipsitz Jonathan, 2020):

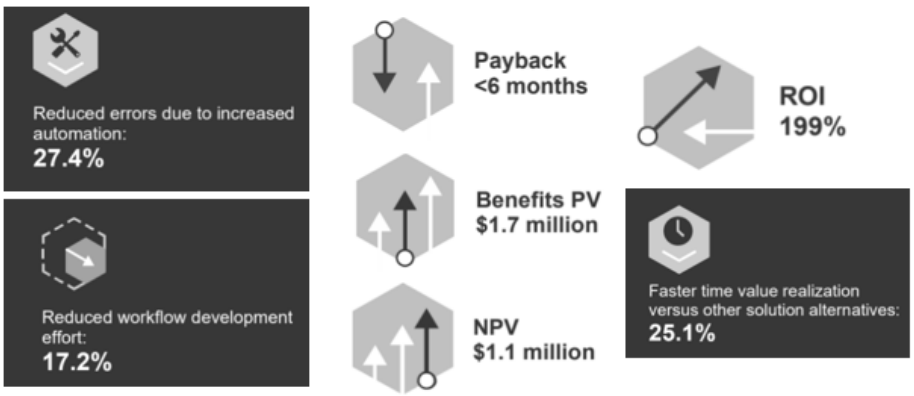


Figure 8: Benefits from RPA Automation Using Power Automate

Source: (Capaldo Adrienne & Lipsitz Jonathan, 2020)

The Figure below shows the functional bases of both mechanisms belonging to the Power Platform:

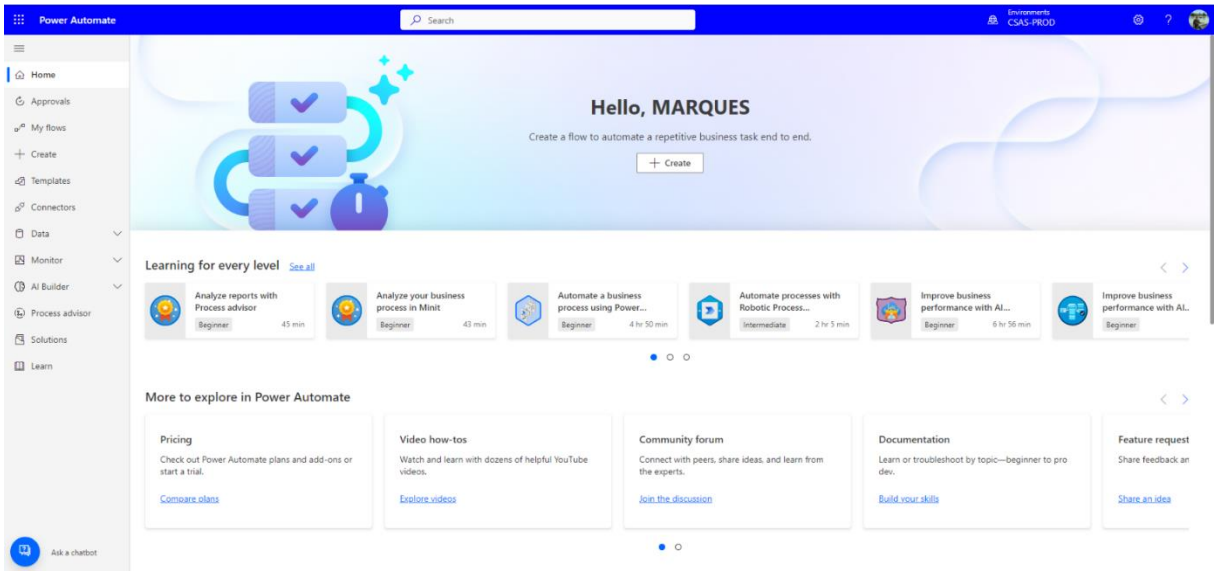


Figure 9: Power Automate Main Environment

Source: Prepared by the Author using Power Automate

In the first image it is possible to observe the general and most used environment of Power Automate Cloud. Here it is possible to perform several actions, among which we can highlight:

1) Creation of several workflows between different services both inside and outside the Microsoft Cloud;
2) Creation of workflows through templates previously provided by the Power Platform;
3) Connection with Power Automate Desktop, connecting flows created to the cloud repository;
4) Schedule created workflows, namely unattended flows;
5) Extract Execution Reports from all created workflows

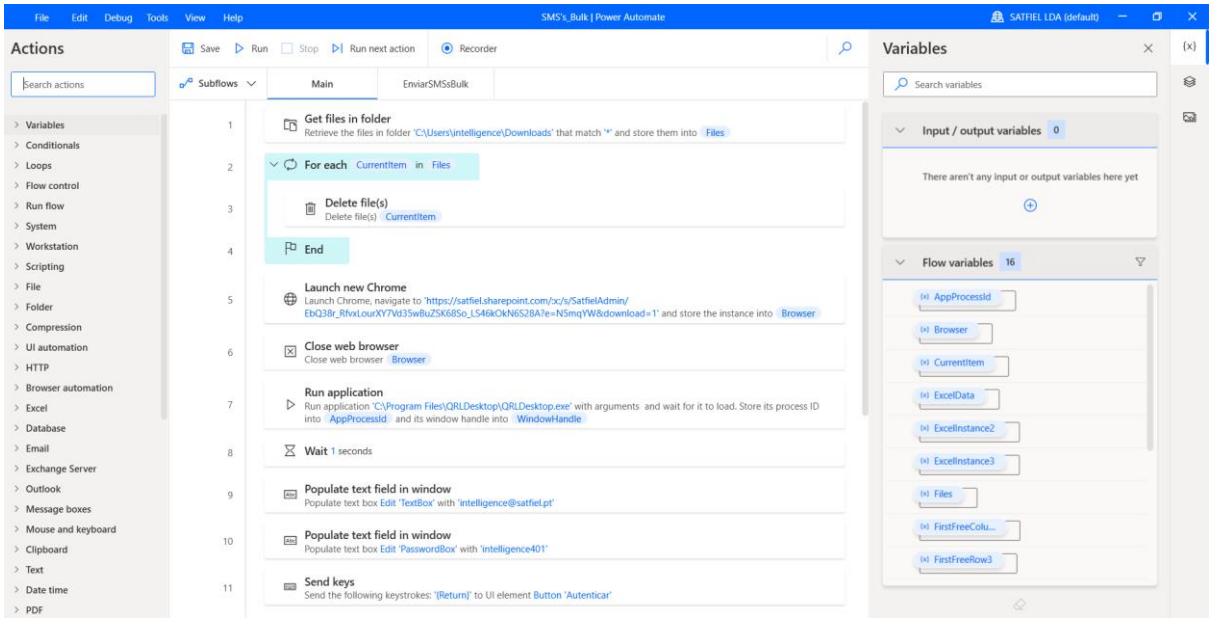


Figure 10: Power Automate Production Environment

Source: Prepared by the Author using Power Automate Desktop

In the image in figure 10, it is possible to observe the development of a certain flow, through Power Automate desktop – here the main functionality is the construction of more complex workflows than those available in cloud templates. Some of the functionalities available for process development are the connection to Python scripts or SQL databases, as well as reading and extracting data from websites or other types of files.

4.1.1.1. Power Automate Desktop Core Concepts

The main difference between the desktop and the cloud functionality is that Power Automate Desktop does not have actions from cloud-based apps like OneDrive, and the fact that flows cannot be triggered automatically.

When building each project, the users have a wide range of activities at their disposal, which are combined to create a specific flow. Some of these activities are displayed in the activity panel, as shown in Figure 11:

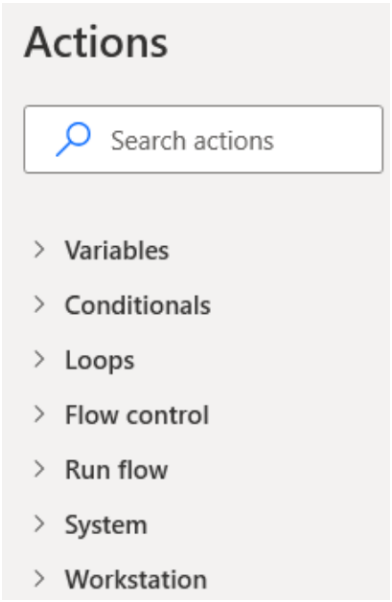


Figure 11: Activities Panel from Power Automate Desktop

Source: Prepared by the Author using Power Automate Desktop

In addition to the Activity Panel, the user will also have access to the Variable Panel, where all the variables created throughout the flow will be displayed, along with their respective values, as shown in Figure 12. These variables can be of two types:

1) **Input/Output Variables:** Variables that do not depend on the execution of any specific step in the flow - the Input variable is required for initiating the flow, and the Output variable is a variable returned at the end of each flow. The presence of these variables is not mandatory.
2) **Flow Variables:** Variables that are created during the course of the flow, with at least one variable per action performed by the flow.

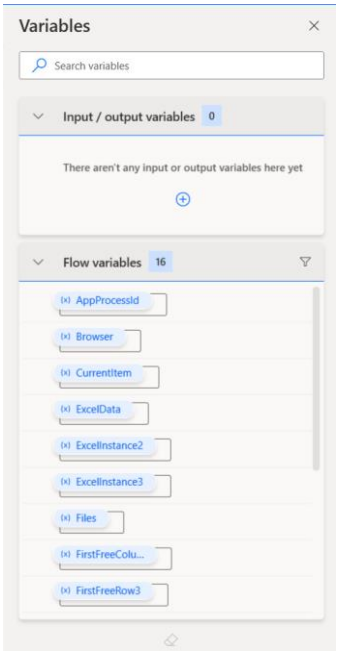


Figure 12: Variables Pannel from Power Automate Desktop

Source: Prepared by the Author using Power Automate Desktop

Lastly, we have the flow construction space itself, as shown in Figure 13. Here, all the activities that make up the flow are detailed, including any necessary sub flows. These are merely auxiliary flows designed to address any issues that may arise in the main flow. Therefore, they are often called upon to control errors in specific activities.

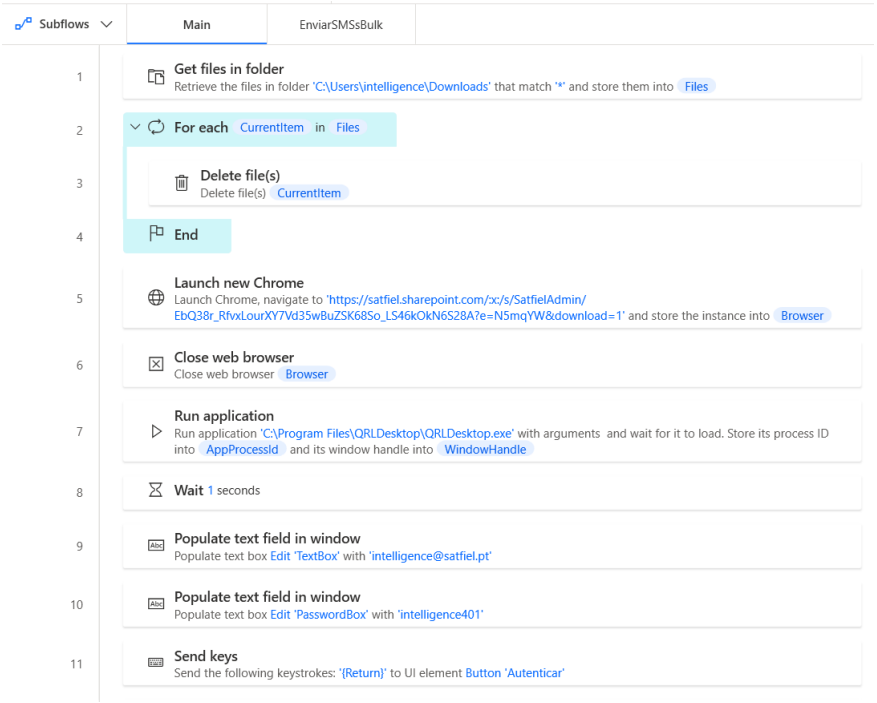


Figure 13: Power Automation Framework

Source: Prepared by the Author using Power Automate Desktop

4.1.1.2. Power Automate Cloud Core Concepts

The cloud aspect of Power Automate provides users with a greater variety of connections and new triggers that are not available in the previously mentioned desktop version. Here, the flow consists of different blocks of actions that correspond to different activities, as shown in Figure 14:

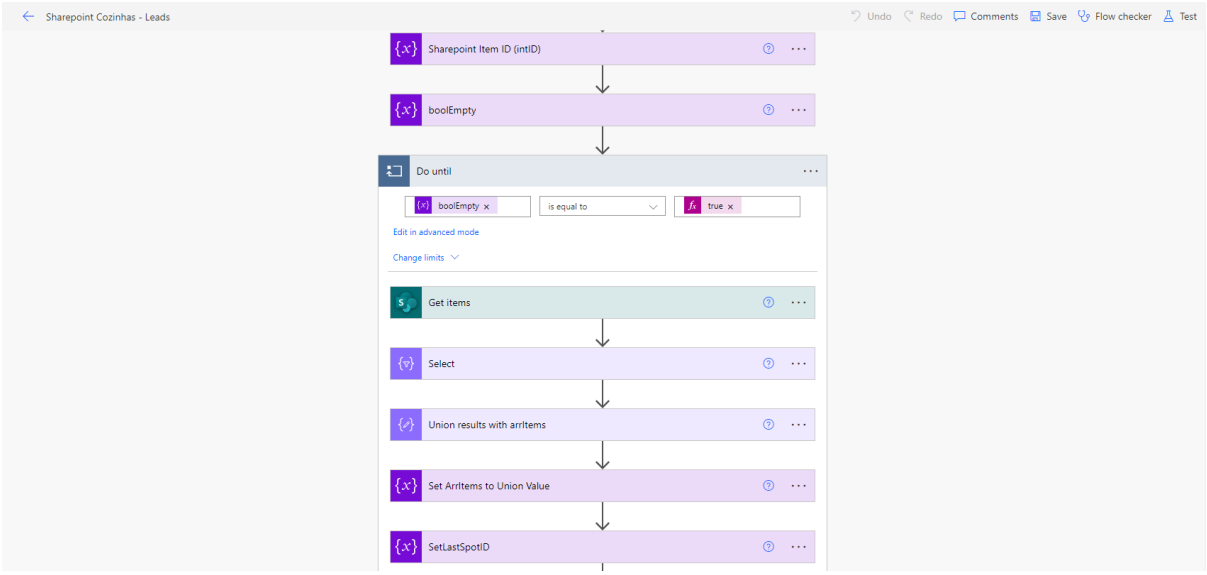


Figure 14: Power Automate Cloud Framework

Source: Prepared by the Author using Power Automate Cloud

As the flow progresses, variables are created. It is based on these variables that subsequent actions receive inputs to generate results. For example, in the figure above, a variable is created by the Set Variable action, which serves as an input variable for the Do Until Condition Block.

It is also important to mention the monitoring panel for each flow, where it is possible to see the execution time for each flow run, the average success and failure rates, and the type of error resulting from unsuccessful attempts. In the case of desktop flows, the information extends to the machine and the group to which the flows belong. Figure 15 illustrates this mapping.

Last runs — See all runs

Requested	Desktop flow	Status	Run mode	Parent flow
Jun 25, 10:01 AM (21 h ago)	SMS's_Bulk	Succeeded	Unattended	NEW_Envio SMS's Bulk
Jun 24, 01:58 PM (1 d ago)	SMS's_Bulk	Succeeded	Unattended	NEW_Envio SMS's Bulk
Jun 24, 11:58 AM (1 d ago)	SMS's_Bulk	Succeeded	Unattended	NEW_Envio SMS's Bulk
Jun 23, 09:58 PM (2 d ago)	SMS's_Bulk	Succeeded	Unattended	NEW_Envio SMS's Bulk
Jun 23, 07:58 PM (2 d ago)	SMS's_Bulk	Failed	Unattended	NEW_Envio SMS's Bulk
Jun 23, 07:39 PM (2 d ago)	Extração Servicemax & Faturação	Failed	Unattended	Tirar FO's - Versão Final
Jun 23, 05:59 PM (2 d ago)	SMS's_Bulk	Succeeded	Unattended	NEW_Envio SMS's Bulk
Jun 23, 05:17 PM (2 d ago)	Extração Servicemax & Faturação	Succeeded	Unattended	Tirar FO's - Versão Final
Jun 23, 03:59 PM (2 d ago)	SMS's_Bulk	Succeeded	Unattended	NEW_Envio SMS's Bulk
Jun 23, 02:53 PM (2 d ago)	Extração Servicemax & Faturação	Succeeded	Unattended	Tirar FO's - Versão Final

Figure 15: Power Automate Flow Control

Source: Prepared by the Author using Power Automate Cloud

4.1.2. Power Apps

Like the previous platform, it is part of the Power Platform and is a strong bet for helping with the automation of processes – in a very simple line, it allows the construction and customization of apps for any type of business needs, having at your disposal a diverse set of services and connections so that any front-end can be built.

As a low code tool, power apps also intend to offer services for transforming manual processes into automation – this through the creation of business applications built without using any type of code complexity, allowing to enrich the business and improve the capabilities of the users workflows.

According to the company Gartner (Cunningham, 2021), there are several reasons why organizations are increasingly relying on platforms such as Power Apps for the development of automations:

1) The fact that it is intuitive for any type of developer due to its simple code aspect;

2) Platform developed on a secure and crafted cloud network – Azure cloud;

3) Innovation – since the platform, along with all other Microsoft Low Code tools, is always bringing new features, providing increasingly enriching experiences for developers;

4) The existing community and support on the platform, involved in the so-called Fusion Teams that allow anyone to have the support of more advanced developers in the development of more advanced app

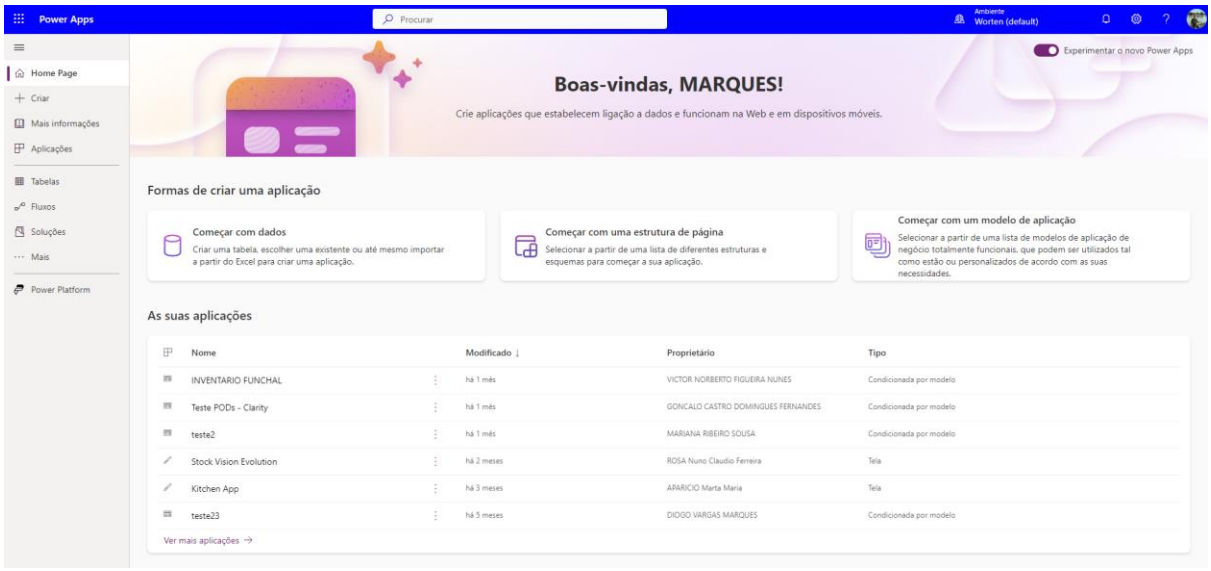


Figure 16: Power Apps Main Environment

Source: Prepared by the Author using Power Apps

In figure 16, we can see the main power apps development environment, here it is not possible to build specific applications however, it is possible to manage them. Here you can do several other types of actions:

1) Manage existing connections – these connections can be made through base connectors (Power BI, Power Automate, SharePoint, etc.) or customized connectors (ODBC drivers, APIs, etc.). These connectors are what are later used to manipulate data within each application;

2) Monitor all applications created through the “Apps” window, where if there is a problem with any application, this situation will be noticed;

3) Create apps from scratch - the platform offers the creation of three different types of apps – Canvas App (from a white screen), Model – Driven Apps (from collected data, mostly through Dataverse connections), and Portal (more complex applications leading to the origin of more developed web portals)

In the figure below, we see the environment available on the PowerApps platform for the development of applications – it has a tree view of the developed application, organized by each screen that constitutes the app and also discriminating all its components. In addition to this, it is still possible to have access to all the data sources that feed a certain application, adding or removing some if necessary.

This whole part of the platform is called Power Apps Studio, and the whole way it is organized is similar to the structure of any other Microsoft resource – the construction of the application itself is done through simple functions where it is necessary to specify necessary parameters, depending on the things we need to create (Create a search button, a page navigation button, etc).

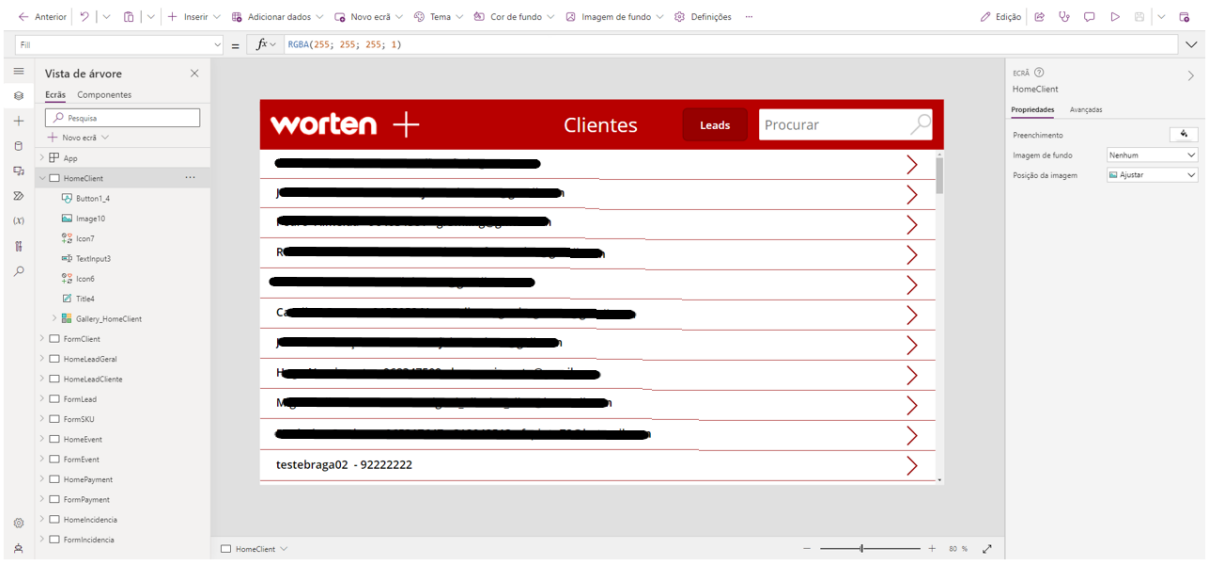


Figure 17: Power Apps Production Environment

Source: Prepared by the Author using Power Apps

4.2 UIPATH

As shown in the quadrant in Figure 7, UiPath is a leader in the RPA market – its Platform allows step-by-step replication of several existing processes in companies, making available to its users' services such as cloud RPA and even specificities such as computer vision and governance features. (Ray Saikat et al., 2022). Recently, with the growth of the platform, new tools such as the automation and point-and-click configuration API for Machine Learning (ML) models were introduced – in addition to these, the biggest novelty came with the creation of a new work environment called Web Studio where it will be possible to develop new Cloud automations. As with the Power Platform, Gartner also highlights the strongest points of this platform (Ray Saikat et al., 2022):

1) As it is the most complete platform, it is the one that has on the one hand, a greater number of tools available to its users, namely IDP capabilities, process mining, cloud delivery and API integration. On the other hand, it is also the platform that adapts to a greater number of users, from software engineers to business technologists, which also means that it has an ever-growing community of support and clarification of any problems;
2) As it is the most developed platform, its viability is one of its strengths – its strong presence in the RPA market means that it is also the one with the highest revenue values – thus managing to fulfill all automation needs that its users aim to be satisfied;

As it is also the platform with the greatest reach and development currently, it also presents some problems that are important to be noted, since they can be extended in the long term to other applications, mentioned above (Ray Saikat et al., 2022):

1) Like any high-usage platform, there is always a period where it becomes difficult to manage profitability, service to users, and maintain sustainable growth. In this way, UiPath has been trying to consolidate its quality-price-growth services, however, there have been some complaints from customers, namely about slow response services;
2) The second point to consider is related to the license fee necessary to be paid by UiPath users, which increasingly confuses them. More and more new RPA platforms are being introduced on the market, whose capabilities are close to those offered by UiPath – many of these tools offer licenses at lower prices, which often leads users to abandon the platform.

The Figure below shows the UiPath base where the automations must be developed:

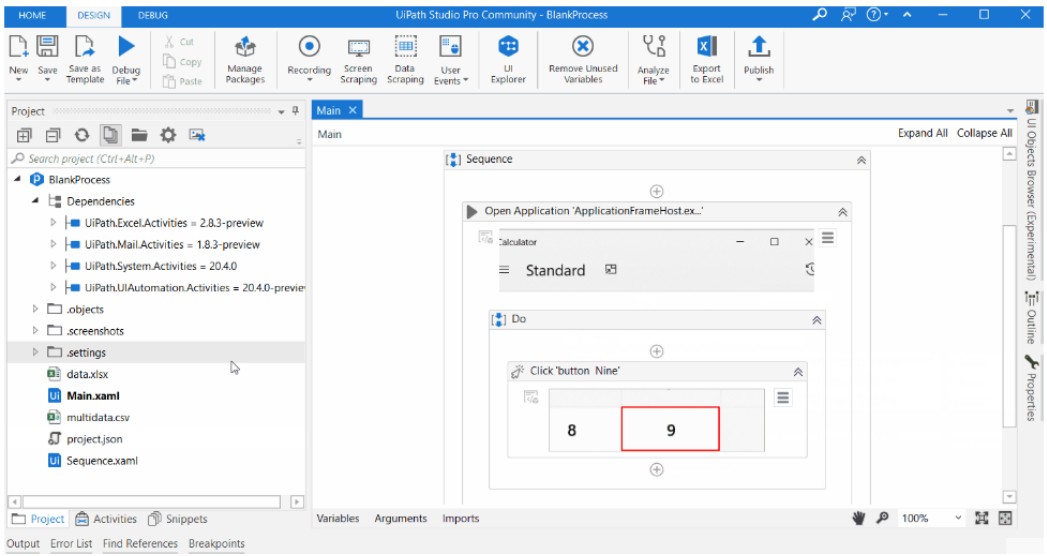


Figure 18: UiPath Production Environment

Source: (UiPath, 2023)

Figure 18 concerns the automation development environment – UiPath Studio. Here not only are all the automations developed, but the user has at his disposal a large number of templates already developed by the software, as well as the UiPath Studio Community where any doubt or difficulty can be clarified.

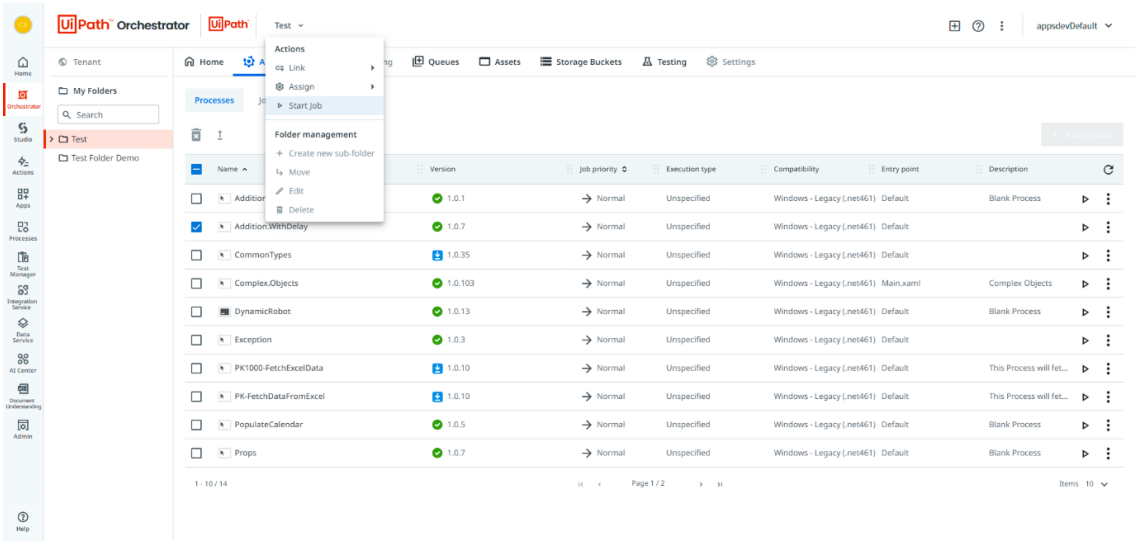


Figure 19: UiPath Orchestrator

Source: (UiPath, 2023)

Figure 19 concerns the Orchestrator functionality where it is possible to provision, deploy, trigger, monitor, measure, and track the work of attended and unattended robots.

5. PROJECTS

5.1 PROJECT 1 – GUIDELINES

As previously stated, the set of guidelines will be designed based on the more relevant conclusions retrieved from the previous research – the figure below shows the steps proposed and that compose the final guidelines that will be implemented in the practical cases of the Worten Company.

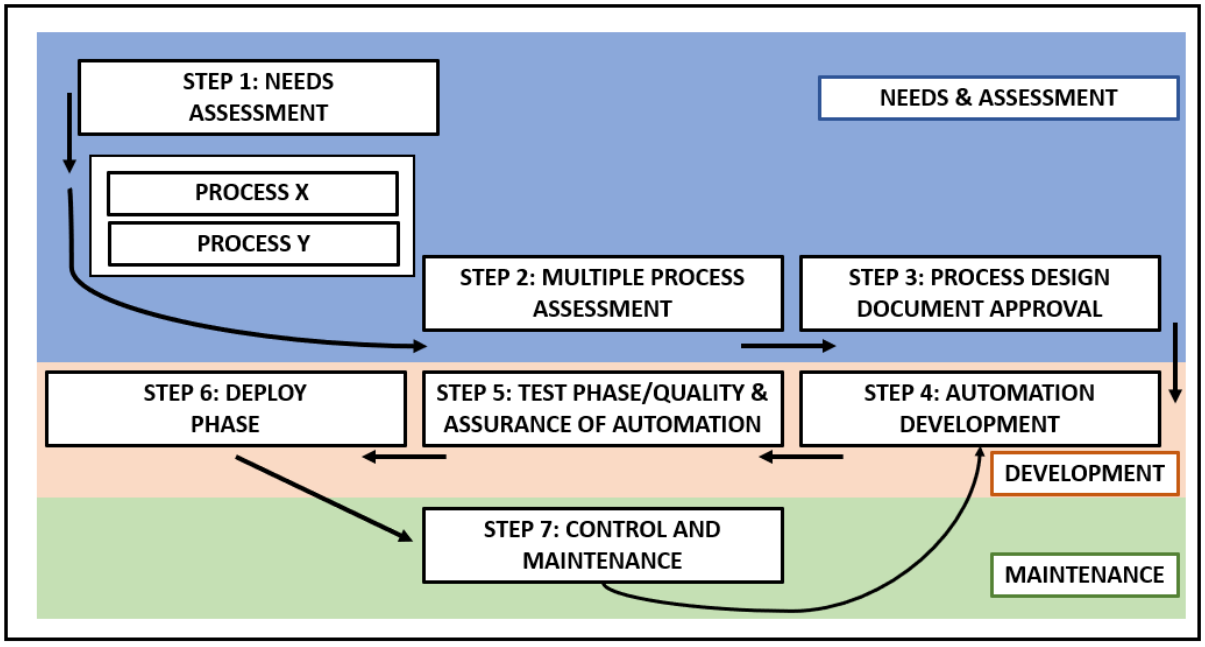


Figure 20: Guidelines for Automation Processes

Source: Prepared by the Author

First and before making a more detailed analysis of each of the steps that make up the proposed guidelines, it is important to make a summary of the three main parts: Needs, Development and Maintenance. The first phase encompasses the first three steps – Needs Assessment, Multiple Process Assessment, and Process Design Document Approval, then the Development phase encompasses three intermediate steps – Automation Development, Test Phase, and Deploy – and the set of guidelines culminates with the maintenance phase of automation.

5.1.1. PHASE 1 – NEEDS & ASSESMENTS

This first phase is the stage where the needs that the company presents in terms of automation will be analyzed, and where all the processes whose need for possible automation is raised will be observed in detail.

STEP 1: NEEDS ASSESSMENT

As in any analysis, the first step that must be taken is to understand the business and the main gaps it presents. In this case, it is important to start by understanding the areas that make up Worten's business, what are the most time-consuming and manual processes that exist to understand if there

are needs that need to be suppressed. This first step meets the questions highlighted in the opening chapter of the theoretical framework (Fettke et al., n.d.):

- "Which processes should be automated?"
- "Which processes should continue to be carried out manually?"
- "How should the automation potential of a process be evaluated?"

In this first stage, the focus is essentially on generating inputs to answer the first two questions – that is, the intention to collect processes currently in force within the company, whose practices are too manual and whose automation may or may not be feasible.

STEP 2: MULTIPLE PROCESS ASSESSMENT

The second step receives as inputs the processes taken from the needs assessment, and its main objective is to answer the questions referred to in the previous point – these will be answered through a methodology developed inside the Guidelines project, called Multiple Process Assessment.

In this way, the Multiple Process Assessment will consist of 3 essential parts:

1) **Scorecard**: Document where the metrics by which the automation potential of a process will be evaluated are defined.

The evaluation parameters are divided according to some categories:

- **Eliminatory Questions**: These questions are intended to assess factors whose non-agreement immediately implies that the processes are not the target of automation – firstly, if we are referring to a process that obeys already established rules, or if, on the contrary, the process being evaluated is more connected to subjective opinions or inputs – with regard to this factor, processes subject to clear sets of rules will always be preferable, as these will be what the RPA automation will obey. Secondly, it is also necessary to assess the type of inputs needed for the process – if the process needs inputs to run correctly, it is desirable that these are fully digitized on the one hand and that they are introduced in a structured way on the other – in case any of the processes under analysis need some resource that is not computerized, this process will also be excluded from any possibility of automation.
- **Postponement Questions**: These questions intend to differentiate processes whose automation is likely to be started at that moment, and others whose automation, for some reason, may be the target of RPA intervention, however, not at that precise moment (requiring postponement). On the one hand, it is necessary to assess the stability of the process itself, that is, whether there are changes expected in the process in the coming days, months, or years – if significant changes are expected, the process should be postponed. If, on the contrary, there are few or no changes expected in the process, it is likely to be automated. On the other hand, it is not just the process in its entirety that must be evaluated, but also all the applications necessary for its operation. If there are applications that, for some reason, undergo a large-scale restructuration, or even become discontinued, the process is no longer viable and should be postponed. If, on the contrary, there are no changes to verify, the process remains an option for RPA mechanisms.
- **Suitability/Benefit Questions:** These two sets of questions serve to assess how relevant the automation of certain processes will be, and which processes have a greater impact on the day-to-day of the company's workers. For this point, it is relevant to determine the frequency of the process, that is, if something is daily, weekly, or monthly, … - considering that the more

frequent the process, the greater the urgency of automation – in this way, the intention is to meet another key conclusion drawn from the prepared theoretical framework:

"Process automation will always be more directed towards more frequent cases since tasks that occur less frequently have higher costs (the more systems involved in each process, the higher the costs)"

In addition, whether the process itself registers peak moments throughout the year, that is, whether it is regular throughout the year, whether they are predictable peaks or whether there are no peaks to be recorded.

- **Ease of Implementation:** In this last set of questions, what is intended is the depth of execution of the process, which will then be translated into a greater or lesser level of implementation effort in the execution of its automation. The initial and most obvious question to be answered is related to the number of steps that make up the process (that is if, on the one hand, we are analyzing a process that boils down to about ten actions, or on the other hand a process with over fifty steps to complete). Another important point to consider is the type of decisions to be taken during the process since processes where overly complex decisions are made are also unfavorable for RPA automation.
- In addition to this, the number of applications and whether or not the use of virtual machines is necessary to run the process are also factors to be considered. Finally, there are still two points that are important to be evaluated, namely whether the data necessary for the process is properly structured, and one of the most important is the impact that this process has on the business globally – this last point varies from business to business, as each one has specific needs – in the case of Worten, the impact will be assessed at the end-Customer level and at the Operational/Efficiency level.

In Appendix I, all the questions mentioned above are arranged, with the appropriate parameters and values to be placed in the following phases of the defined guidelines. In addition, it is important to bear in mind that only in the Eliminatory Questions can the direct elimination of a process from the pipeline of developments occur, in the remaining cases, if the characteristics of the process classify it as not very viable, it will be taken into consideration with the others.

One of the main purposes of the next document is to meet a fundamental aspect advocated by different authors in point two of this report – it is necessary to define which processes are right to automate, since choosing the wrong ones can lead to higher costs and time wasted for the company.

2) **Multiple Process Assessment**: Second of three important documents on the Assessment step, and here the main objective is to put all the questions mentioned above in the same perspective, with the respective scores assigned, in order to reach a final decision about the automation of a given process.
   The categories described above are organized according to two large groups – Automation Potential and Process Complexity – and the scores placed are always analyzed together with the teams that own each process. In this way, what is intended is that after being analyzed together, these rise more generalized factors that will be important for the third and last document. Therefore, it is important to mention which factors are intended to be reached with this assessment:

Man Hours Freed – Estimated Bandwidth Freed expressed as Man Hours/Year: It intends to estimate the number of hours that the automation of a certain process will save annually when compared with solving that same task manually.
This variable takes into account the number of FTEs (Full-Time Equivalent) involved in the process, in addition to some factors evaluated in the field of Process Complexity, namely – Decision Type, Number of exceptions, % of Digital Input, and % of Scanned Input;
Estimated Error Reduction – Expressed as %: Here what is intended is to determine which benefits the automation of the process will bring to the organization – it will be equivalent to the calculated automation potential, based on the fields referred to in the previous point, replacing the % of Scanned Input by the % of Structured Data;
Estimated AHT Reduction: It is equivalent to the reduction of the average execution time, that is, the processing time that will be saved through the execution through RPA when compared to the manual execution of a collaborator. It is calculated based on the automation potential and all its components, thus constituting 2/3 of the previously calculated value;
Man Hours Spent / Implementation: For this measure, the result is presented both in hours and in % - and it is intended to estimate the number of hours that the developer will take to develop all the automation, as well as the implementation effort achieved - it encompasses the feasibility of the process and all the parameters considered in its complexity factor;
Impact: In this last point, what is intended to be evaluated is the level of impact that the process currently has – which may be at the Customer level or at the Operational and Efficiency level.

In Appendix II, all the previously described factors are arranged, with some scores assigned – this scores are then used to put all these factors in perspective in the last element of the Multiple Process Matrix – the Priority Matrix.

3) **Priority Matrix**: This is the last of the three documents that make up the second step of the first phase of the developed set of guidelines. After selecting processes that can be automated, it is important to include them in a prioritization line, forming a pipeline of developments. This pipeline will be developed based on a matrix, built through the combination of four fundamental pillars (based on the Multiple Process Assessment), each with an associated weight – depending on the importance they have for the organization. The pillars and their weightings are as follows:
PILAR 1 – IMPLEMENTATION EFFORT (DEVELOPER'S PERSPECTIVE): 35%
PILAR 2 – BENEFITS FOR THE ORGANIZATION (EMPLOYEE'S PERSPECTIVE): 20%
PILAR 3 – IMPACT IN FTE'S: 35%
PILAR 4 – IMPACT (CLIENT/OPERACIONAL): 10%

In conclusion, in step 2 what is intended is to evaluate which processes are subject to automation, because as stated by some authors in the theoretical framework, it is not enough to have a manual process for automation to be possible and feasible – it makes it, therefore, necessary to define mechanisms that evaluate each process as a whole, making it possible to understand whether they are viable at each point of their development. For this, three essential documents were created for this

evaluation: Scorecard (defines evaluation parameters), Multiple Process Assessment (evaluates factors according to defined parameters), and Priority Matrix (defines a prioritization order among all viable processes).

STEP 3: PROCESS DESIGN DOCUMENT APPROVAL

In step 3, what is intended is not to forget a very important premise taken from the theoretical research carried out: “An RPA tool operates by mapping a process in the RPA tool language for the software robot to follow, with runtime allocated to execute the script by a control dashboard.'' - all this combined with the fact that the learning of an RPA robot is carried out by observing the process, with all the exceptions and particular cases that characterize it, as well as the Worker - RPA relationship highlighted in the challenges described above, are the key points on which this third step is based, which will now be described.

This third step is equivalent to the preparation of a document called Process Design Document, where the entire process, before and after being automated, will be described, and examined in detail - in this way it will be clearer what the process was like before automation, which exceptions and possible errors may exist and how to overcome them, and finally how the process will be automated.

Before filling out the entire described document, it is necessary to previously hold a meeting to observe the process, with the teams that are currently carrying it out, to simulate the process with all its applications and steps and go through all exceptions that may occur. Then it is necessary to fill in the descriptive document, with the information gathered from this meeting – this document is organized into 5 fundamental parts: Introduction, AS-IS Process, TO-BE Process, Operating Model and Monitoring Plan, and Contingency Plan.

Introduction: In this first chapter, what is intended is to have the most basic information of the entire process summarized - it's objective or return, what are the objectives of the automatism, the contacts of the workers who own the process, and also what are the prerequisites to register to make automation possible.

AS-IS Process: Mapping of the process, using the Bizagi platform, in the way it is currently carried out (i.e. manually). Firstly, an overview of the entire process is made, where details gathered in previous steps and others such as the level of risks that the process carries and the expected timetable for it are tabulated. Before mapping the entire process, it is still important to make a list of all the applications that will be necessary for the process to be carried out with the development of its automation.

Then, it is necessary to carry out the mapping of the entire process, from the initial moment, through all the intermediate steps and exceptions, until its final phase. This mapping will be carried out using the Bizagi tool, as we can see from the example in Figure 21:

Figure 21: Process Part Mapping Example

Source: Prepared by the Author

In figure 21, it is possible to observe a small example of what is intended with the process mapping – to identify the pain points of the process, also making it easier to visualize the sequence of all the steps, to make the whole process clearer and more rigorous.

Along with this mapping, it is also important to clarify what happens in each of the steps, and in this way, each process mapping will be accompanied by an explanatory table of the steps that make it up – in Appendix III, we can see the structure of this table, where it is possible to find a column identifying the step in question, accompanied by a description and additional comments.

Finally, still within this chapter, it is important to place a reference to any resources and documentation related to the observation of the process, namely videos of the process visualization meetings carried out before this document.

TO-BE Process: In the TO-BE process, what is also intended is the mapping of the entire process, as in the previous point, however here already considering the points to automate, replacing the tasks identified as previous pain points, by the steps that the robot will perform when performing the task automatically.

Full validation of the TO-BE process by the business team is essential for successful development. Any situation that is not identified in the TO-BE process will not be considered in the development of the automatism and its inclusion will depend on the availability of the development team.

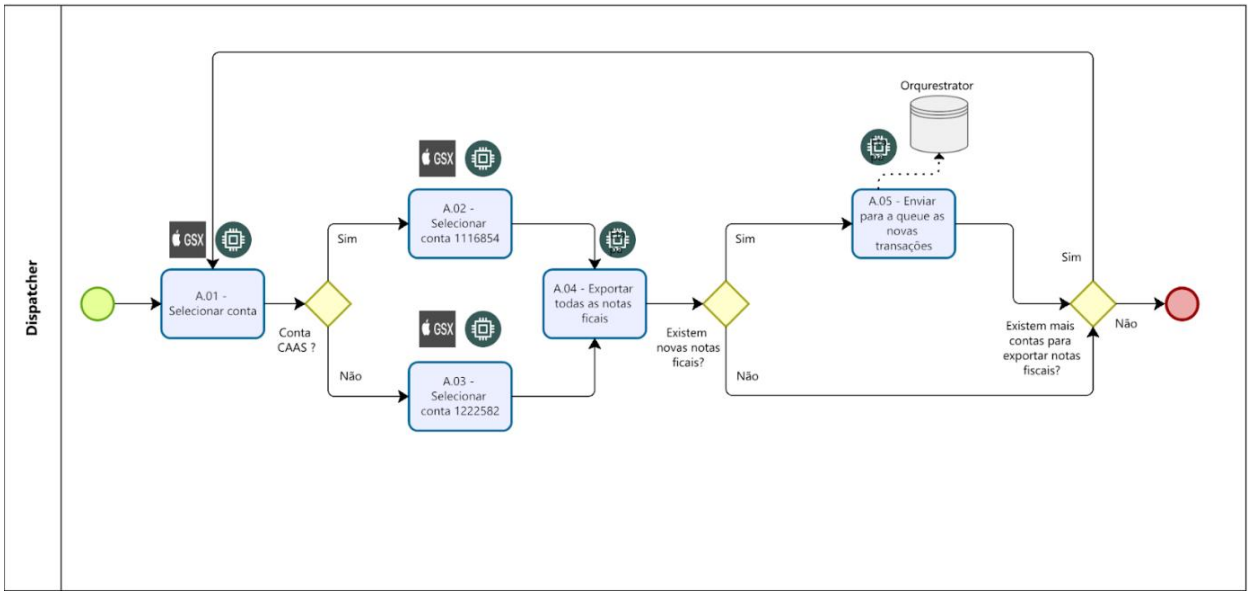


Figure 22: TO-BE Process Part Mapping Example

Source: Prepared by the Author

In Appendix III, there is also a caption that should accompany the mapping of the TO-BE processes, as shown in figure 22, in order to make more perceptible all the steps that will be changed from the original and which ones will be maintained. Also as in the previous table, the mapping must be accompanied by an explanatory table for each step, with the possibility for additional comments, if necessary.

As mentioned in the previous points of the report, the correct identification of exceptions is a key point for the proper development of an automation – and therefore, at this point in the TO-BE process, all exceptions that may be found are also essential. Therefore, there must be a section of this report exclusively dedicated to listing exceptions, which can be of two types: known and unknown.

Known exceptions are parameterized in the automated process – there is a set of actions to be taken concretely defined and individualized for each case – unknown exceptions are new situations never encountered or communicated before that could impact the normal operation of automatism – they can be caused by external factors and are not foreseen in the process.

After each type of exception is well defined, it only remains to describe the actions to be taken by the robot in case it encounters each one of them - in the case of unknown exceptions, the recommendations and steps to follow are generalized.

Operating Model and Monitoring Plan: This section describes how the virtual workforce and people will interact and collaborate after automation goes live.

The first point to summarize in this part is how the division of work and responsibilities of the automatism in question will be carried out – since there may be tasks that, on the one hand, depend on the normal work of the robot, namely all the normal realization of outputs that the task should provide, but others that may depend on the intervention of the business, such as acting in the event of a manual handling exception or even when the delivery of some input is necessary, without which the normal functioning of the process is impossible.

Another point worth mentioning, concerning the operational plan, is the automatism execution window and its criticality – here it should be summarized the frequency of execution of the process (ex. Daily 10 am), the agreed SLAs, the window of defined execution and the criticality of automatism itself.

Finally, and entering into the scope of the monitoring plan, it is important to mention the Reporting point, which will serve as a control plan for the entire development of automation – this reporting can be carried out in different ways – sending an email to the business with the summary of the execution, will be the privileged way of reporting for the majority of the processes under development (this email is expected to include data such as the duration of the execution, number of processed transactions, the volume of successes and failures, etc.

Contingency Plan: This section describes the action plan to be taken to ensure the continuation of the business in cases of virtual or applicational power unavailability. This point is one of the most important of all phase 3 of the produced guidelines, since when entering production, the robot is officially producing the task in place of the collaborator, and therefore there must be some prevention plan in case any type of faults.

In this way, in the event of unavailability at the virtual power level, measures to be taken by the business supervisor must be detailed (ex. evaluating together with the automation developer the possibility of scheduling a new execution), and also by the Bot Controller (ex. identify the estimated duration for resolving the outage).

Eventually, situations of application unavailability may arise, meaning that in cases where one or more applications necessary for the execution of the process are unavailable, measures must be defined to circumvent these situations. Examples of actions to be taken include handling the processes manually if possible, analyzing the processing capacity of the affected transactions in the next robot execution, or the need for a new schedule.

One last thing to consider when defining a contingency plan is the possibility of an excessive workload being verified – verification of a volume of transactions well above normal. In these cases, some measures should also be highlighted, such as the possibility of simultaneous scheduling of new flows of the same process, in other production machines that are not being occupied. The production machine concept will be explored in the next steps of the guidelines set.

Summarizing and highlighting the key aspects of this third step in the proposed guidelines – it consists on the fundamental idea of clarifying all parties involved in the process in what way automation will be developed and in what modes it will adapt to the work of a collaborator. It is therefore important that all parties involved are on the same page when it comes to outlining a virtual line of work that will bring value to the business.

In this way, the created document will always cover all the necessary aspects, for a better implementation of automation to existing processes:

- A perspective of what the process was like before (AS-IS mapping) vs. a perspective of its future operation (TO-BE mapping);

- Detailed mapping of exceptions that can be registered and respective solutions;

- Creation of Maintenance and Contingency Plans, in order to always maintain detailed control of all processes

5.1.2. PHASE 2 – DEVELOPMENT

This second phase is also composed of three essential steps: Automation Development, Test, and Deploy phase – and here the main objective is, as the name implies, the development of the automation. Automation development includes not only the entire practical component of assembling the automatism but also the entire testing phase that seeks to ensure that automation is tested for any scenario that may arise.

STEP 4: AUTOMATION DEVELOPMENT

After the three previous steps, the stage of development of the automation itself arrives – and before any development, it is important to note that the automation is only started when the document described in the previous step is approved by all stakeholders.

Thus, the first step to automate a certain process or task is the choice of platform to use in this development – for this, all the applications referred to in chapter 4 of this report are relevant. So, in this way, the applications to consider will be among others: UiPath, Power Platform, Python, and Databricks.

The first two platforms have a very similar development structure – since they both have a workspace where it is possible to develop all the flows that constitute a given task, and also an additional tool whose objective is to carry out all the management of this automatism after its development – functionality referred to in chapter 4 as Orchestrator.

In addition, it is important to mention that both Python and Databricks can be used as auxiliary automation tools. Although they are not the main development front-end, they can often facilitate automations that depend on platforms like Power Automate and help them reach their full potential.

In this way, in the projects that will be described in the next point of this report, most of the automatisms will be developed using Power Platform mechanisms, combined with Python functionalities and the Databricks platform.

STEP 5: TESTE PHASE/QUALITY AND ASSURANCE OF AUTOMATION

This step is one of the most important of all the guidelines created, as it serves as a connection point between the development of automation and its production phase – where it definitively replaces the manual process.

In the research carried out in the first step, it was highlighted that aspects such as capturing errors, testing times, and scheduling an automation in a viable period are fundamental aspects for its success. So, in this way what is intended is that through auxiliary cases, the development of automation is tested and verified if it presents any type of error in its construction, any exception not considered or not included, and mainly, to test if the time that the robot it takes to carry out the whole process is feasible according to the standards necessary for the normal functioning of the business.

It is also in this step, as in the next one, that the concept of production machine appears, as mentioned earlier – it concerns the fact that a large part of RPA processes, namely the most complex ones and those that take longer to be executed, are programmed to operate through a virtual machine. So in this way, when we execute a certain process that takes some time to complete, we are not compromising any other type of work that is being done simultaneously.

In summary, in step 5 what is intended is for there to be a global test of the automatism developed, going through the analysis of three essential aspects:

1) If there is any error in the developed automation, such as, for example, a poorly constructed step or an application or step not considered;
2) If all exception situations were taken care of and considered during the automation development;
3) If the execution times of the developed automation are effective according to the business needs for that specific task.

STEP 6: DEPLOY PHASE

In phase 6, as indicated in the name, automation leaves the testing phase and officially enters production in place of the task that was done manually. It is also the phase where automations start to produce results, whose value for the company must be monitored, realizing what are the main benefits for it.

5.1.3. PHASE 3 – MAINTENANCE

This last phase is directly linked to development, as it is here that the viability of RPA is ensured throughout the period in which it is in effect. As you can see in the image in figure 20, there may be a possibility that during this last phase, there may be a need to return to the automation development stage, in case any failure is detected, or any change to the original process needs to be introduced from scratch in the automation itself.

This phase will be based on a contingency plan for each of the processes developed.

STEP 7: CONTROL AND MAINTENANCE

The last step of the entire set of guidelines is one of the most important of the entire proposed set, since, as it is directly linked to the previous step, it is also the one that will allow for the correct maintenance of all processes.

In addition, it is also important to remember two fundamental aspects referred to in the theoretical research:

"Starting with the challenges, the first and main one that stands out is the fact that no process is static over time, and there are always new details and decisions that must be altered or adapted over the years. Just like a worker, the automation developed for the process must follow this evolution and encompass all the exceptions found, since if this does not happen, it could lead to incorrect decisions that could affect the entire structure affecting the process"

"When thinking about RPA, we often think that it only encompasses process development, however this does not correspond to reality. It is increasingly important to ensure that the automation developed will contribute to the development of the process, not only at the present time but also in a future logic – it is necessary to guarantee credible and functional process monitoring mechanisms so that, in the presence of an error, the problem is resolved immediately"

The above excerpts, taken from the theoretical framework carried out, recall the importance of automation, its correct maintenance, and control. The simple development of an automation does not guarantee its success during its entire operational period, because as stated in the previous quote, no organization, much less its processes, is static, which implies that the maintenance of automations follows this elasticity to the change that all companies present.

Thus, each project must have a well-structured contingency plan to be able to cope with any type of eventuality or change that may arise in the normal functioning of the processes – this contingency plan corresponds to what was created in the final phase in the functional document created in the third step of guidelines.

With the entire line of guidelines produced, the next step is to apply it to practical projects developed at Worten. Both projects will have a different base purpose:

1) **Process Automation Parts Sourcing:** Process currently carried out manually by employees within Worten, and whose automation becomes necessary, since the costs that the task brings to the company are more than expected. This project will be developed based on the entire set of guidelines developed in the previous point, in order to be able to demonstrate that this is a viable set of steps to implement for a good development of RPA/Low-Code projects.
2) **Kitchen App and Reporting**: Process build from scratch, where it will be possible to see that an RPA automation can not only substitute an existing process but also build new ones. This type of process will follow the logic behind the set of guidelines only after phase 2, since there is no previous process to compare to.

5.2 Project 2 – Process Automation Parts Sourcing

The first project consists on the creation of an automation solution for the Parts Sourcing process, existing at Worten – a process currently carried out by the Worten Technical Service Center, which is highly time-consuming and routine.

Contextualizing a little about what the process consists of and what is its main objective – Worten has an infrastructure called Technical Service Center, whose main objective is to receive all the parts whose arrangement or repair, for some reason, becomes necessary. In this way, it is necessary to have control over which repair parts are in stock since if they do not exist, there is a need to place orders with the suppliers of these same materials. Orders for parts are made through the technicians who handle the repairs, and the sourcing of the same is done by employees who work in the operational branch of the Central - this sourcing process is carried out in two different ways, via email (for suppliers whose contact must be made through this route) or by consultation through the online site. The focus of this automation will be the suppliers whose consultation has to be done through the website since they are the ones whose consultation takes the most time and is completely manual.

The main challenge of this project is to build an efficient solution for this process, using RPA and Low-Code techniques, as well as the set of guidelines produced above. In this way, the solution designed will replace the entire process that employees have to do, of manually checking all TSC sites, bypassing all aspects that made it time-consuming and inefficient - namely the fact that the sites were consulted individually, this is one site at a time, which for cases where 2 or more different parts are needed for a repair, leads to the process becoming very time-consuming and inefficient.

Another aspect to be considered when thinking about and developing a solution for this process concerns the comparison of different products from different suppliers, that is, the developed automation must consider that the process, as a whole, also includes the comparison of the different products selected with regard to aspects such as price, availability and delivery time.

In this way, the final RPA to be developed will include a database where all information on all products from all suppliers that currently supply the TSC will be available – the information will be collected weekly and updated daily. This database will also provide a feature to compare different products, as in the normal course of the process. In the previous paragraphs, a general description was made of what the process is currently for Worten – thus, the next step will be to analyze the viability of the process, for which it is necessary to use and follow all the steps defined in the guidelines produced.

Therefore, following those steps, the development of this automation will be done respecting the three main implementation phases: NEEDS & ASSESSMENT, DEVELOPMENT, and MAINTENANCE.

PHASE 1: NEEDS & ASSESSMENT

NEEDS ASSESSMENT

As explained in the previous chapter, in this point it is important to answer three essential questions, in order to understand the main objectives of the process nowadays, as well as the main points of need for automation.

As this is an essential process for the normal operation of Worten's TSC, since without it there may be no stocks for parts under repair, it's necessary that the fulfillment of the process to be ensured quickly as possible - in this way, a need for automation was identified, replacing the individual and phased consultation of suppliers with a tool that allows a more general view of all the necessary data.

In addition to the previous point, beyond being a process that entails a lot of costs, since the time spent on it is high, the process has an indirect impact on the customer – since the faster the order is placed of parts, the faster the repair reaches the customer. In addition, due to the varied range of products that Worten sells to its customers, it is necessary to mobilize a large number of employees to order parts, in the different repair areas - this will also lead to a higher number of FTE's allocated to the process.

MULTIPLE PROCESS ASSESSMENT

As mentioned in the explanation point in the previous chapter, the entire assessment will be carried out based on the classifications considered in the construction of the scorecard. In this way, this stage will be started by collecting the necessary information, to parameterize the process - the questions asked and the answers to them are found in the following tables:

AUTOMATION POTENTIAL			
FEASIBILITY			
DECISION TYPE	**INPUT TYPE**	**PROCESS STABILITY**	**APPLICATIONS STABILITY**
Are the decisions rule-based or subjective/strategic?	How do the majority of your data inputs look like?	How will your process change in the next 6 months?	How will your process change in the next 6 months?
Mostly Rule Based - **FEASIBLE**	Digital and Structured - **FEASIBLE**	No change expected - **0**	No change expected - **0**

Table 2 - Feasibility Process Scores

Source: Prepared by the Author

In this first block of tables (Table 2 and 3), it is intended to assess the potential for automation that the process currently presents – thus, from a first perspective it is important to analyze the feasibility of the process, that is, its current behavior in terms of data and decisions, as well as the future behavior regarding the stability of applications and the process itself.

Concerning the Sourcing process at the Parts Center, this is characterized, according to the teams responsible for it, as being subject to rules, with all digital and structured inputs as well as with a low volatile nature (there is not a high probability of changes in applications involving the flow itself). In this sense, the process will be classified with a score of 0 in terms of feasibility – an excellent score, since for this factor all questions to be checked are at the lowest level (meaning more feasibility).

AUTOMATION POTENTIAL				
SUITABILITY				
PROCESS VOLUMETRY			**ERRORS**	**PROCESS PEAKS**
What is the frequency of the process?	What is the volume of transactions/frequency?	What is the average time it takes for the process to be ran once?	What is the average number of human errors?	How would you characterize the peaks of the process?
Daily	65 – On average 65 orders are placed daily	In average 5 minutes	20%	Regular - **1**

Table 3 - Suitability Process Scores

Source: Prepared by the Author

In the table above we find the second factor inherent to the process automation potential – Suitability, where we intend to find out how the current framework of the process is today. Technicians solve an average of 65 repair requests daily, through the sourcing process, taking a maximum of 5 minutes for each request, depending on the total number of parts per request.

In addition, an error rate of 20% was set, since as it is a process that deals with large amounts of information, there are occasional errors that can arise from the employees and the technicians responsible for the task. Lastly, the peaks in the process are regular since, normally during a few days of the week, the number of orders arriving for repair is higher than the rest.

Also, according to the data collected regarding the Process Volumetry, we were able to remove the number of FTEs currently allocated to the process - these are calculated on the basis that 1 FTE corresponds to 260H. Since the data previously collected are related to only one segment of activity of the TSC, around 0.7 FTEs (approximately, 0.68) with the total areas considered, we must have approximately 5 FTEs allocated to the process currently.

This FTE value will be more important when we place the process in the prioritization matrix since this is one of the four factors to consider for its positioning. In this way, only the value related to one of the specific segments will be considered, since the automation of the process will be dealt with by the business segment.

PROCESS COMPLEXITY				
PROCESS DETAILS				
NUMBER OF STEPS	**DECISION TYPE**	**EXCEPTIONS**	**NUMBER OF APPLICATIONS**	**THIN CLIENT**
How many steps does the process have?	How difficult are the decisions that you must take to complete the process?	What is the average number of cases where you are unable to complete the entire process?	What is the number of applications that you use for the process?	Are any of the applications accessed via Citrix/VDI?
10-15 steps – **0,2**	The process is linear – there are no decisions to be taken – **0,1**	10%	> 5 applications - **1**	No - **1**

Table 4 - Process Details Process Scores

Source: Prepared by the Author

Moving now to the second block of tables, this one intends to analyze and evaluate the way the process is currently treated – “how complex it is”. The block that evaluates the “Process Complexity” of the process, intends to define which layers of development the automation of the task have to consider. In this way, the following aspects were evaluated:

1. How many steps the process has: The more steps the process has, the more complex it becomes. Regarding this specific task, the number of steps indicated is in line with what is expected, for a process that requires immediate automation;
2. Decisions taken during the process: This is if the process does not require decision-making or if, on the contrary, there are weightings to be taken into account – in the case of this specific process, decision-making is linear, translating into a weighting of 0.1 for final prioritization matrix calculations;
3. Exceptions: Cases where the process ends without having its objective completed – in this case, exceptions may present a very low level since they only occur in cases of virtual unavailability of supplier sites;
4. Number of Applications: The number of interfaces and applications through which the entire process has to go through, in this case, we can consider more than 5 applications, considering not only the parts ordering site but also all supplier sites for querying parts;
5. Remote Access to Data: A score of 1 means that there is no need for a remote connection to access data necessary for the process.

PROCESS COMPLEXITY		
INPUT DATA		
DIGITAL INPUT	**SCANNED INPUT**	**STRUCTURED DATA (%)**
What % of your input data is digital?	Is any of your digital input scanned?	What % of your input data is structured?
100%	No - **1**	>= 80% - **0**

Table 5 - Input Data Process Scores

Source: Prepared by the Author

The second block of tables relative to the complexity of the process intends to evaluate the data that it must receive, for its normal functioning. In this way and in relation to this specific process, all the desired inputs are digital, structured, and there is no need to digitalize them, as it's possible to conclude by the scores in table 5. In this way and considering all the analyzed factors related to both the Potential for Automation and the Complexity of the Process, we can conclude that as this process is reliable in terms of future changes, of low complexity, and with a high number of FTEs in the long term – this process becomes viable and can be automated.

The next step is to place them in the prioritization matrix, by weighing the different factors described in the guidelines chapter:

PILLAR 1 – IMPLEMENTATION EFFORT (DEVELOPER'S PERSPECTIVE): Taking into account relative parameters, essentially to the complexity of the process, it was estimated that this value would be around 35 percentage points;
PILLAR 2 – BENEFITS FOR THE ORGANIZATION (EMPLOYEE'S PERSPECTIVE): It is situated at 20 percentage points, being necessary for this calculation the scores attributed to the previously attributed factors;

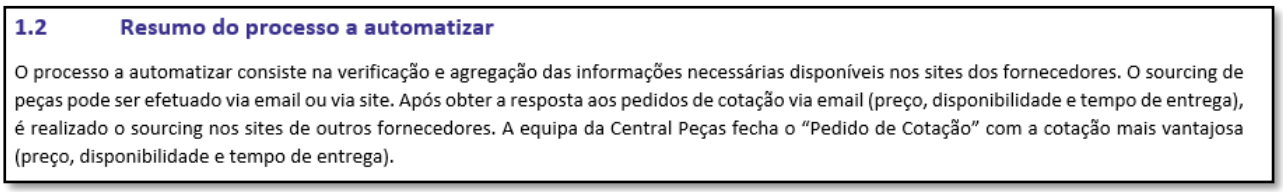
PILLAR 3 - IMPACT IN FTEs: The value to be considered will be the one referred to in the previous FTEs point, 0.68 impacted FTEs;
PILLAR 4 – IMPACT (CLIENT/OPERATIONAL): The impact considered will be the maximum level since the automation of this process will impact the operational level and efficiency of TSC's performance, as well as the faster response to the client.
After placing all the parameters in the prioritization matrix, we were able to conclude that the process is at the forefront, occupying number 2 in the list of development priorities. Thus, the next step is to prepare the Process Document Design, so that all parties involved in the process are aware of what will be done during the automation development.

PROCESS DOCUMENT DESIGN APPROVAL

As mentioned in the previous point, this step consists of creating an explanatory document, which will expose and clarify the whole operation of the process, all the parties involved in it, and the entire future control and maintenance plan. In this way, and although this step consists of creating an explanatory document, it is necessary to clarify some of its points:

INTRODUCTION

At this initial point, it is important to make known what the process itself is, what its objectives are, and who owns it – in this way, we can highlight as a general description of the project, what is reported in the figure below:



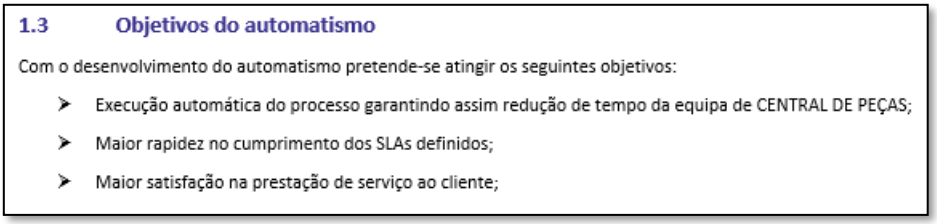
1.2 Resumo do processo a automatizar

O processo a automatizar consiste na verificação e agregação das informações necessárias disponíveis nos sites dos fornecedores. O sourcing de peças pode ser efetuado via email ou via site. Após obter a resposta aos pedidos de cotação via email (preço, disponibilidade e tempo de entrega), é realizado o sourcing nos sites de outros fornecedores. A equipa da Central Peças fecha o "Pedido de Cotação" com a cotação mais vantajosa (preço, disponibilidade e tempo de entrega).

Figure 23 - Description of the Automated Process

Source: Prepared by the Author

Furthermore, it is also necessary to establish what are the main objectives to reach with the development of the required automation:



1.3 Objetivos do automatismo

Com o desenvolvimento do automatismo pretende-se atingir os seguintes objetivos:

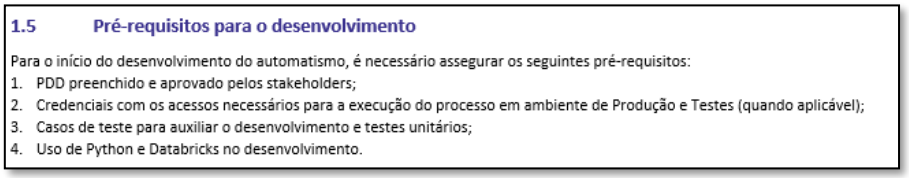
- Execução automática do processo garantindo assim redução de tempo da equipa de CENTRAL DE PEÇAS;
- Maior rapidez no cumprimento dos SLAs definidos;
- Maior satisfação na prestação de serviço ao cliente;

Figure 24 - Main Objectives of the Automatism

Source: Prepared by the Author

As depicted in figure 24, the guarantee of a greater level of efficiency, reduction of time and customer satisfaction, guaranteeing faster repair of its equipment, and compliance with the defined SLAs

(Service Level Agreements) – as per example, the speed of resolution of responses from suppliers – are the main objectives to be achieved with the developed automation. Finally, another important point is to establish the main prerequisites necessary for development – in figure 25, these are listed:



1.5 Pré-requisitos para o desenvolvimento

Para o início do desenvolvimento do automatismo, é necessário assegurar os seguintes pré-requisitos:

1. PDD preenchido e aprovado pelos stakeholders;
2. Credenciais com os acessos necessários para a execução do processo em ambiente de Produção e Testes (quando aplicável);
3. Casos de teste para auxiliar o desenvolvimento e testes unitários;
4. Uso de Python e Databricks no desenvolvimento.

Figure 25 - Requisites for the Automation

Source: Prepared by the Author

As shown in the figure above, certain factors are necessary for the full development of automation. Without these factors, the process cannot proceed. These include: a document resulting from this stage that has been agreed upon by all parties involved in the process; all necessary credentials for the development and subsequent testing of automation; real examples that can be used for the testing phase; and finally, all necessary architectures for the development of automation.

AS-IS PROCESS

The second part of this document deals with the layout of the process as it happens manually – through the AS-IS model – where all the pain points of the current process will be visible, which will then serve as a purchasing bridge for the TO-BE model. The first point to be mentioned is to outline the main characteristics of the process. In Figure 26, we can observe these schematic details, some of which come precisely from the process observation meeting:

#	Item	Descrição
1	**Nome do processo**	Pricing Search – Central de Peças Site Rounded
2	**Direção | Área**	CORE SERVICES & AFTER SALES | Technical Services
3	**Departamento/Equipa**	Central de Peças
4	**Descrição sumária (1-2 frases)**	Este processo consiste na extração de informação do Site Rounded (Lead Time, Disponibilidade, Preço, Descrição), relativa a todos os produtos suscetíveis a pedido de compra por parte da equipa da Central de peças.
5	**Agendamento e frequência**	Semanalmente 18H – Sexta - Domingo Diariamente (2ª Feira a 6ª Feira), três vezes ao dia
6	**# *items* processados/mês**	~500 cotações mensais MOBILE
7	**Tempo médio de tratamento por caso**	~3/5min
8	**Período(s) de pico**	Períodos de pico regulares – 3ª/5ª Feiras, devido a números mais elevados de entregas para reparação. Outras situações de pico, poderão ocorrer devido a campanhas promocionais.
9	**# FTEs que suportam o processo** (1 FTE = 1570 h/ano)	0,21
10	**Savings/Custos Evitados** (estimativa)	7500€ ano
11	**Nível de exceções/ variações ao processo**	Baixo
12	**Inputs**	Não existem inputs a verificar
13	**Outputs**	Relatório de execução diário com o resumo da execução enviado por email, onde será ainda visível o status de execução de cada transação. As transações com erro serão reprocessadas.
14	**Dependências** (*upstream, downstream*)	Não existem dependências a verificar
15	**Riscos**	Médio

Figure 26- Process Details

Source: Prepared by the Author

In the figure above, it is possible to observe the description made for a specific supplier, where we can observe some new details that had not been raised previously:

1) Scheduling and Frequency: Estimated time and number of times the process will run;
2) Item Processed per Month/Average time per case/FTEs: These items were already mentioned when completing the Multiple Process Assessment, however in this specific figure they are mirrored for the specific supplier;
3) Savings/Avoided Costs: The savings entered are just estimated values and are calculated based on the number of items processed and the average time for each item. It is only an estimated value since the real value can only be advanced when the process actually goes into production;
4) Inputs/Outputs: The first point refers to the need to have some input for the process to be started (which does not happen in this specific case), and the second refers to the existence of some specific output of the process carried out (in this case, the most vital output will be the reports of the execution);
5) Dependencies: Dependencies refer to the need for upstream or downstream tasks that are dependent on the execution of this process – for this task it doesn't happen;
6) Risks: The risks are directly linked to the consequences that the business may suffer, due to the non-execution of the process – given the wide range of suppliers currently existing for the TSC, this risk can be considered medium level.

The second point to highlight are the applications used for the development of the automation – in figure 27, all the mechanisms used are arranged:

#	Nome	Língua	Ambiente	Login Module	Interface	User	URLs/File Paths
1	Site Rounded	EN	Produção	Sim	Local Desktop	--	https://rounded.com/
2	Databricks	EN	Produção	Sim	Local Desktop	-	
3	Rounded API	EN	Produção	Não	Local Desktop	-	https://documenter.getpostman.com/view/8759329/UVsHS7ay

Figure 27- Process Automation Applications

Source: Prepared by the Author

The applications to be considered include not only the supplier's website and the API that composes it but also the Databricks architecture, where databases will be created to store all product information.

The last point is that of modeling the AS-IS process and explaining it – in figure 28 the general process is exposed, as well as a sub-process that makes up the way the task is currently carried out.

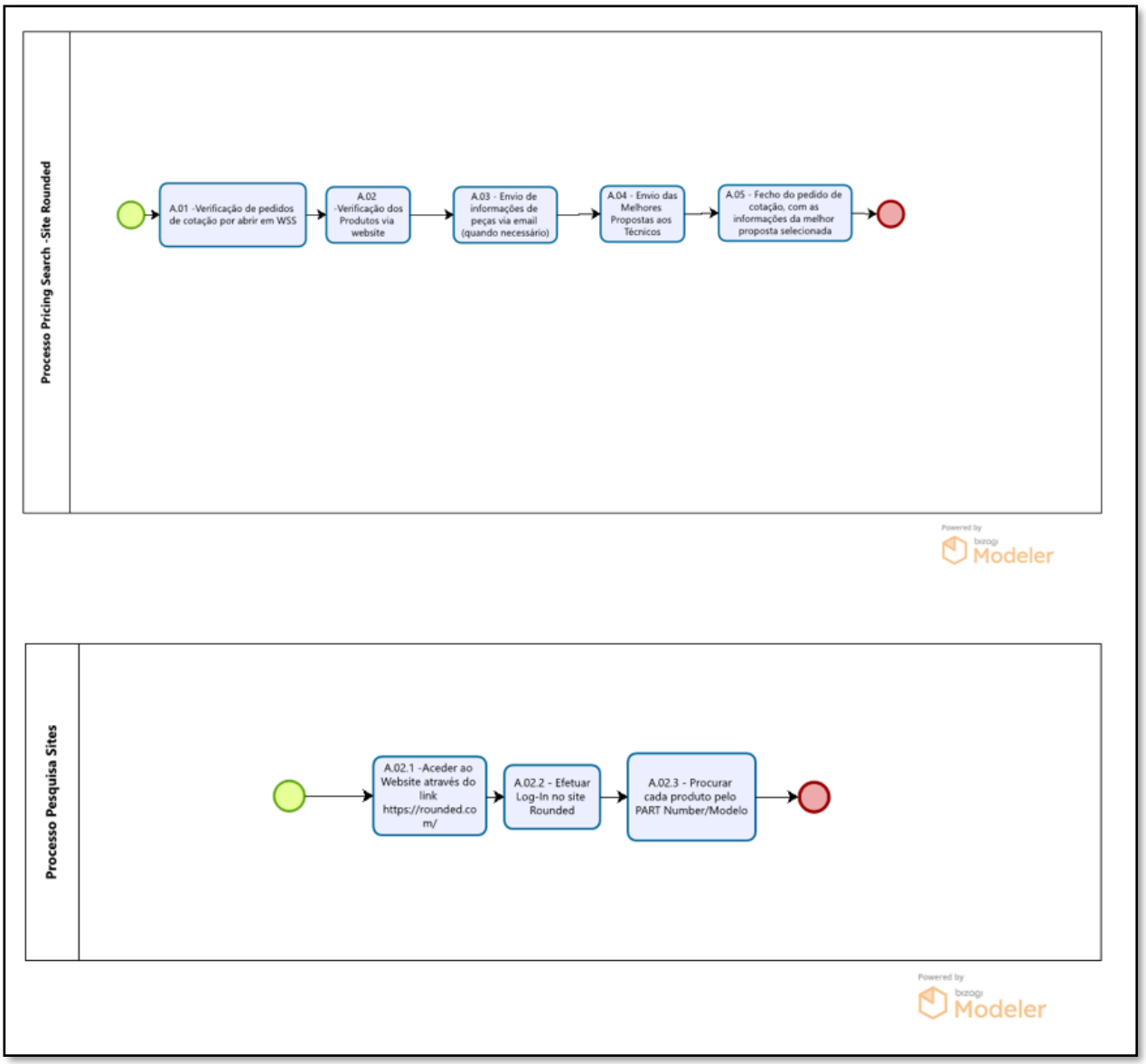


Figure 28 - AS-IS Model Sourcing Process

Source: Prepared by the Author using Bizagi Modeler

By analyzing the AS-IS process, it is possible to understand how the process is currently carried out: a quote request is made by the technician, and a member of the TSC team is responsible for that same request - what the employee does is go through all TSC's suppliers both via the website and through email contact in order to find all the proposals for parts for that request for quotation. The process ends with the sending of the best proposals to the technician, who then closes the request with the choice of the most advantageous proposal. The main pain points of this process are related to the sub-process shown in the second figure, which represents the search process for each part by each existing supplier site – thus this will be the focus of the automation developed.

TO-BE Process

As mentioned in the previous point, the objective of mapping the TO-BE process is to mirror how automation will positively affect the pain points identified in the AS-IS model. Figure 29 shows this process:

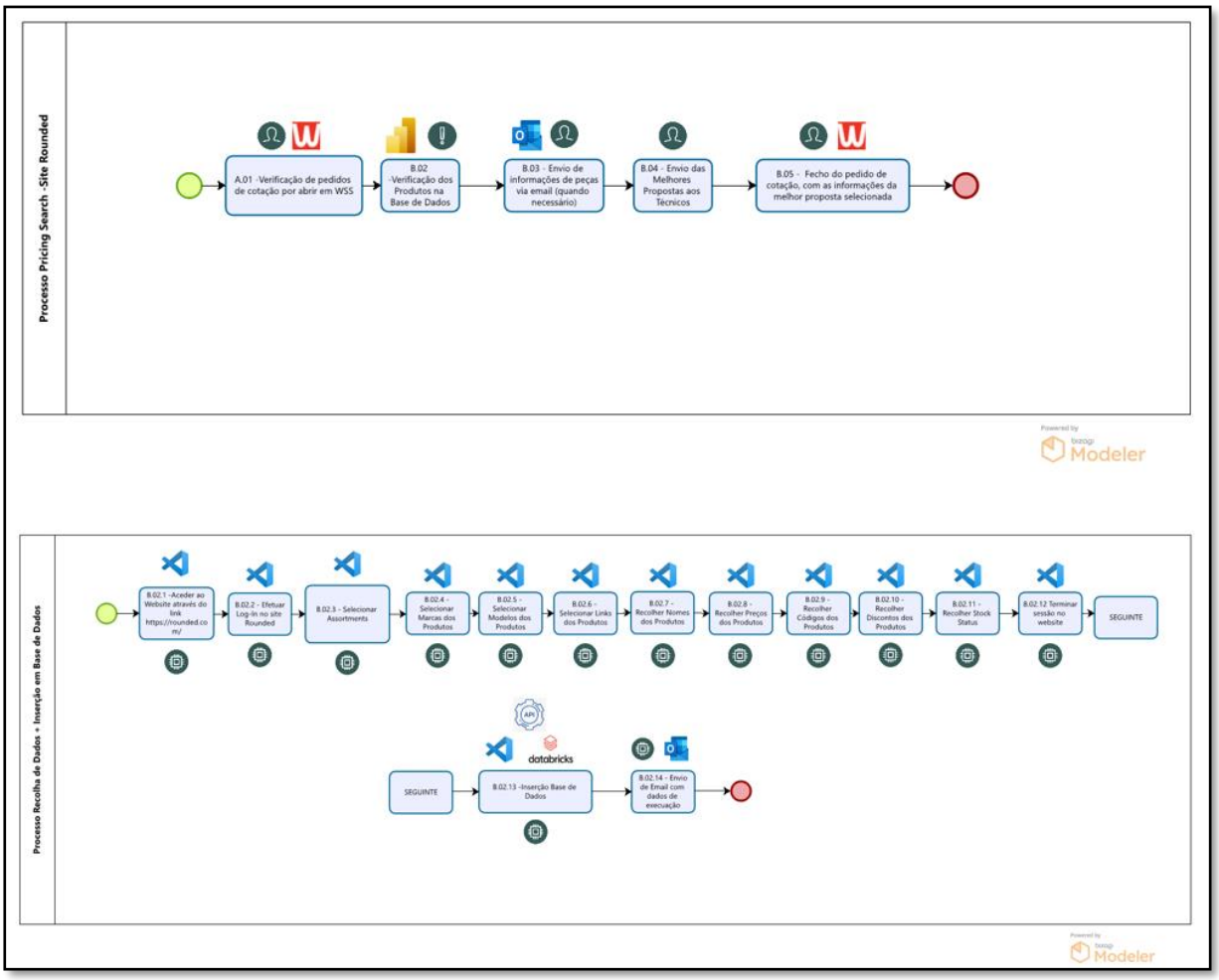


Figure 29 - TO-BE Process Model

Source: Prepared by the Author

In the TO-BE model there are two aspects to be highlighted:

- Firstly, the fact that each step has an indication of how it will be carried out (the mapping of each icon is explained in Appendix IV), and also which application is used for this purpose. Those where the collaborator icon is registered will still be carried out manually, and the steps with exclamation icons will be where the pain point of the AS-IS process was verified and, therefore, will be the steps to automate;

- The process to be automated is displayed in the second figure, where it is possible to observe not only all the steps that the automation will carry out but also all the applications to be used. As it is possible to observe, the steps that the automation will follow when starting the process correspond

to the collection of all the information necessary for the subsequent introduction of a product in a Databricks database.

The underlying and main idea will be to replace the individual and time-consuming consultation of each site, by a general database, where it is possible to have the products all together in one place, and in addition to establish comparisons between them.

Another important step to consider during the mapping of the TO-BE process is to understand how the existing exceptions can impact the operation of the automatism - in this way and as provided, in figure 30 there are some measures to be taken in case certain problems are checked.

BE#	Mensagem da Exceção	Etapa	Ação a tomar
BE001	Conta de Log-In inválida	B.03.2	Terminar execução com erro e enviar email ao negócio
BE002	Site Rounded indisponível	B.03.1	Terminar execução com erro e enviar email ao negócio.
BE003	Elementos Recolhidos de Forma Incorreta	B.03.7-B.03.11	Prosseguir execução para próximo produto ou elemento.
BE004	Elementos não existentes no Website	B.03.7-B.03.11	Levantar Exceção e prosseguir execução para próximo produto ou elemento. Na recolha do código do produto, caso este não exista em site, na recolha de informação e inserção na base de dados – este será marcado como 0, sendo necessária a sua consulta de forma manual.
BE005	Indisponibilidade API	B.03.13	Analisar causa que originou indisponibilidade e tomar as devidas medidas para a sua resolução (i.e., contactar IT, Infraestruturas, developer, etc.). Caso seja um problema da parte do developer, estimar duração para a resolução do problema – levar produtos com baixas unidades de stocks a verificação manual. Caso seja um problema da parte do fornecedor da API – entrar em contacto com o mesmo e pedir a resolução do problema – levar produtos com baixas unidades de stocks a verificação manual.

Figure 30 - Exception Handling

Source: Prepared by the Author

As mentioned in the guidelines chapter, situations of known or unknown exceptions can be registered – in the figure above, only the actions are exposed in case of exceptions already registered – in other cases, the action plan contains more general measures such as reprocessing of products or moving to the next product in the job queue.

OPERATING MODEL AND MONITORING PLAN

As previously mentioned, this chapter is based on defining how the interaction between the various parties involved in the process will be articulated, after its entry into production. In Figure 31, we find how the division of responsibilities will be made:

#	Ação a desenvolver	Responsável
1	Tratar pedidos identificados (execução do automatismo), de acordo com a calendarização definida no Power Automate, Databricks e janelas de execução estabelecidas	Low Code
2	Enviar e-mail ao negócio com resumo da execução (i.e., duração da execução, volume de transações, sucessos, insucessos, reprocessamentos)	Low Code
3	Em caso de erro avaliar execução do automatismo, através da análise de erros levantados pela execução do código em Python	Low Code
4	Avaliar execução do automatismo, através da análise de informação de negócio partilhada por email	Operação/Negócio
5	Tratar os assuntos com exceção de negócio ou sistema manualmente	Operação/Negócio

Figure 31 - Work & Responsibility Division

Source: Prepared by the Author

In the figure above it is possible to observe which responsibilities are attributed to the business and those which are the responsibility of the automation developer – on the one hand, the business will be responsible for evaluating the automatism as well as intervening in case of need for manual action, the developer is responsible for guaranteeing the normal and correct functioning of the automation. Still, within this point, it is important to mirror what the automation execution time will be, and its level of criticality – these data are shown in the figure below:

Periodicidade da execução	SLA	Criticidade do automatismo	Janelas de execução	Tempo médio de execução do processo	Tempo médio por transação	Calendarização definida
Semanalmente Sexta-Domingo	24h	Alto	8h	~48h	~1m	Semanal
Diário 2ªFeira-6ªFeira 3 vezes por dia	24h	Alto	7h30-9h30 10h30-12h30 14h30-16h30	~2h	~1m	Diária

Figure 32 - Operational Automation Plan

Source: Prepared by the Author

The process will take place during two different phases – the insertion of all the suppliers' products in the database will be done on a weekly basis, taking about 48 hours, until it is complete. The price update phase for each product will take place daily, three times a day – with an average execution time of approximately 2 hours.

CONTIGENCY PLAN

The contingency plan is one of the most important phases to be defined, as it works as a means of controlling and monitoring what could go wrong during the process. Figures 33 and 34 show all the actions to be taken in case of virtual or applicational power unavailability, respectively:

#	Responsável	Contingência
1	*Supervisor (negócio)*	*- Contactar equipa de Automação e comunicar indisponibilidade* *- Avaliar em conjunto com a equipa de Automação a possibilidade de voltar a agendar nova execução.* *- Caso não seja possível, encaminhar transações não processadas para tratamento manual no próprio dia*
2	*Bot Controller*	- Analisar causa que originou indisponibilidade e tomar as devidas medidas para a sua resolução (i.e., contactar IT, Infraestruturas, developer, etc.) *- Identificar a duração estimada para a resolução da indisponibilidade* *- Avaliar impactos da indisponibilidade nos SLA's do robot e, em casos urgentes, proceder à comunicação ao negócio para realização da atividade de forma manual* *- Analisar capacidade de tratamento das transações afetadas na execução seguinte do robot ou a necessidade de nova calendarização (de acordo com as janelas de execução)*

Figure 33 - Automation Failure

Source: Prepared by the Author

In the event of failure or unavailability of the virtual machine, the business must analyze the possibility of resuming automation on the machine itself, or for more extreme cases of errors, ensure the manual execution of the process for that specific occurrence. The automation developer's responsibility is to understand what caused the error and thus ensure the fastest resolution of the problem- if this resolution is easy to perform, evaluate the availability of the automation to run on the next schedule.

#	Contingência	Responsável
1	Indisponibilidade de Site Rounded: Analisar a necessidade de nova calendarização ou encaminhar as solicitações afetadas para tratamento manual.	*Bot Controller/Negócio*

Figure 34 - Application Failure

Source: Prepared by the Author

Figure 34 shows the measure to be taken in case of application failure, in this case, in terms of a failure of the supplier's site it will be necessary to verify the possibility of executing the process on the next schedule, and if this is not possible, carry out manual execution.

PHASE 2: DEVELOPMENT

AUTOMATION DEVELOPMENT

After the automation profile is duly planned and approved by all parties involved, the next step following the entire set of guidelines created is the development of the automation itself.

In this way, and before moving on to the development of automation itself, it is important to clarify the two branches through which it will be developed – in addition to this, it is also important to mention that all the mechanisms used by automation are those that lead to it being completed with more efficient times – in this way, automation will not be developed exclusively using the Power Automate platform, but its combination with other environments. In this way, the platform will be developed following two distinct phases:

Insertion of Products – This first phase is the most complete since it intends to go through the entire supplier's website and update all the products in the database, so that they always correspond to those on the website, with the objective of ascertaining the existence of new products on offer. It takes

longer, as it involves collecting all the details of each product on the website – it is scheduled to be carried out throughout the weekend.

Product Update – The second phase will be the update of the inserted products, throughout the week. Through the website's API, it is possible to update all products more efficiently, and for this phase, we only need to update stocks and prices. This second flow part will take place three times a day, as established in the Design Document Process.

For the development of the automation, three essential tools will be needed:

Power Automate – Automation tool that maps the entire process flow – through a certain schedule, the tool will execute the desired processes, whether these are insertions or updates;

Python – The need to introduce python into the project arose as a result of extracting products only using power automate not being efficient enough in terms of time. By introducing python scripts, and using easy-to-read code construction, this product extraction could be done faster. This way, this mechanism will be used not only to extract the details of each product but also for the robot's interaction with the API of the supplier in question.

Databricks – It will be the platform that will serve as a database, where all product information will be stored, and will also be where all the tables to be generated and replaced during the process will be managed.

In addition to these, an information front-end will also be built, through Power BI, where employees will be able to have access to all available information collected by automation.

In Figure 35, it is possible to find the flow of applications that the automation will follow - the explanation and development of automation will also follow the same logic:

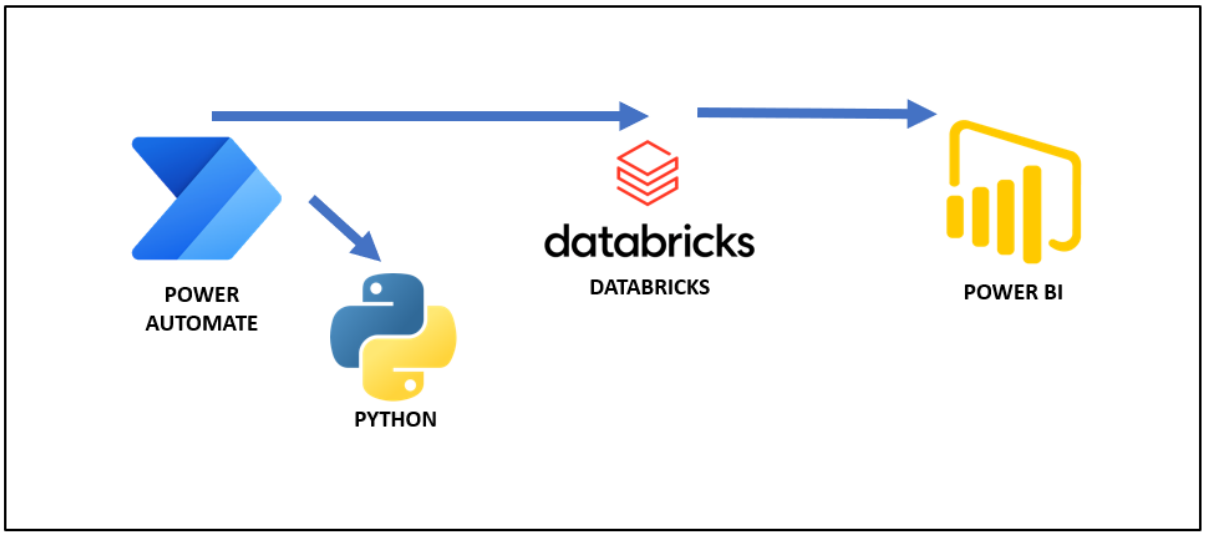


Figure 35 - Applications Workflow

Source: Prepared by the Author

Power Automate & Phyton: As mentioned in previous points, for the main part of the automation (that deals with scraping the site), different tests were carried out in several ways: the two main ones

were just the use of Power Automate for the purpose and the other was through the introduction of python to help effect. In this way, the most effective way to scrape a website is through its internal structuring, going through the code that is behind its construction, using the mixture between Power automate and Python which proved to be more efficient in terms of time.

In this way, the power automate desktop flow will be used for the following measures:

- A trigger that will start the automation;
- Control of errors and exceptions that may exist during the flow;
- Read code built through Python

In figures 36 and 37, it is possible to find the flow in Power Automate Desktop properly structured:

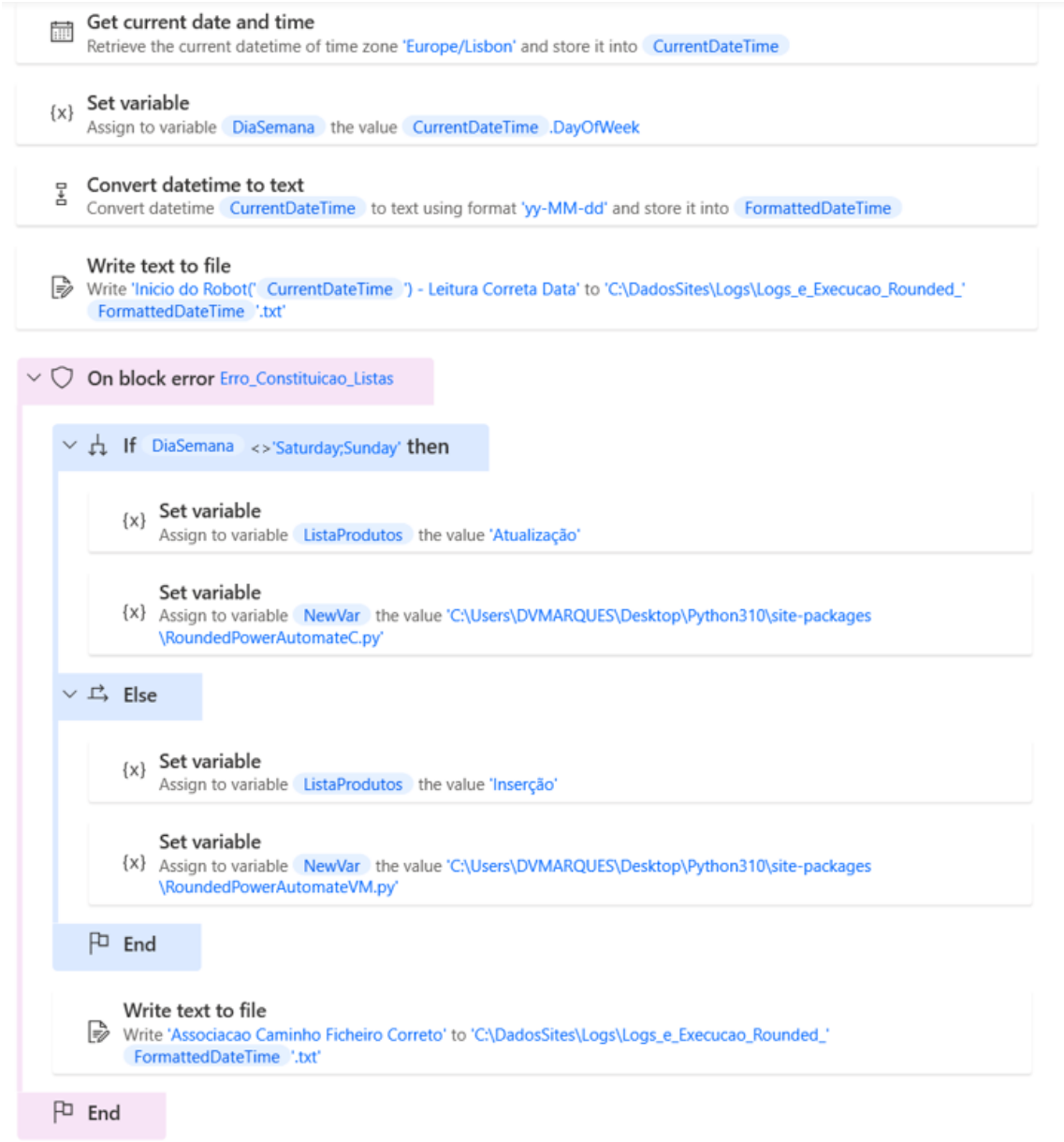


Figure 36: Power Automate Flow Part 1

Source: Prepared by the Author using Power Automate Desktop

The first phase of the flow is the one that will determine which Python file will be read in the following steps, and also has the function of generating some control files so that it is possible to determine, when it happens, which step the process ended up failing. In this way, the process is started by removing the date on which the process was started, recording a first control file with the detail: “Robot start – with the variable corresponding to today's date”. The loop part of the flow is the one that determines which file needs to be run – this distinction is made through the day of the week the flow is being initialized. Thus, through the day of the week variable, it is determined whether the flow is running during the week or at the end of the week. In the first case, the file that will run is the one for updating products through the supplier's API, in the second case, the file to run is the one that deals with scraping the supplier's website, extracting more detailed information from all available products.

The last point concerns once again the need to control the flow, a new file is recorded with the description: “Association Path File Correct”. Furthermore, and with the probability that the day of the week is recorded incorrectly in the variable, all these points are included within an error block, where the variable is initialized again and the association to the file is established again.

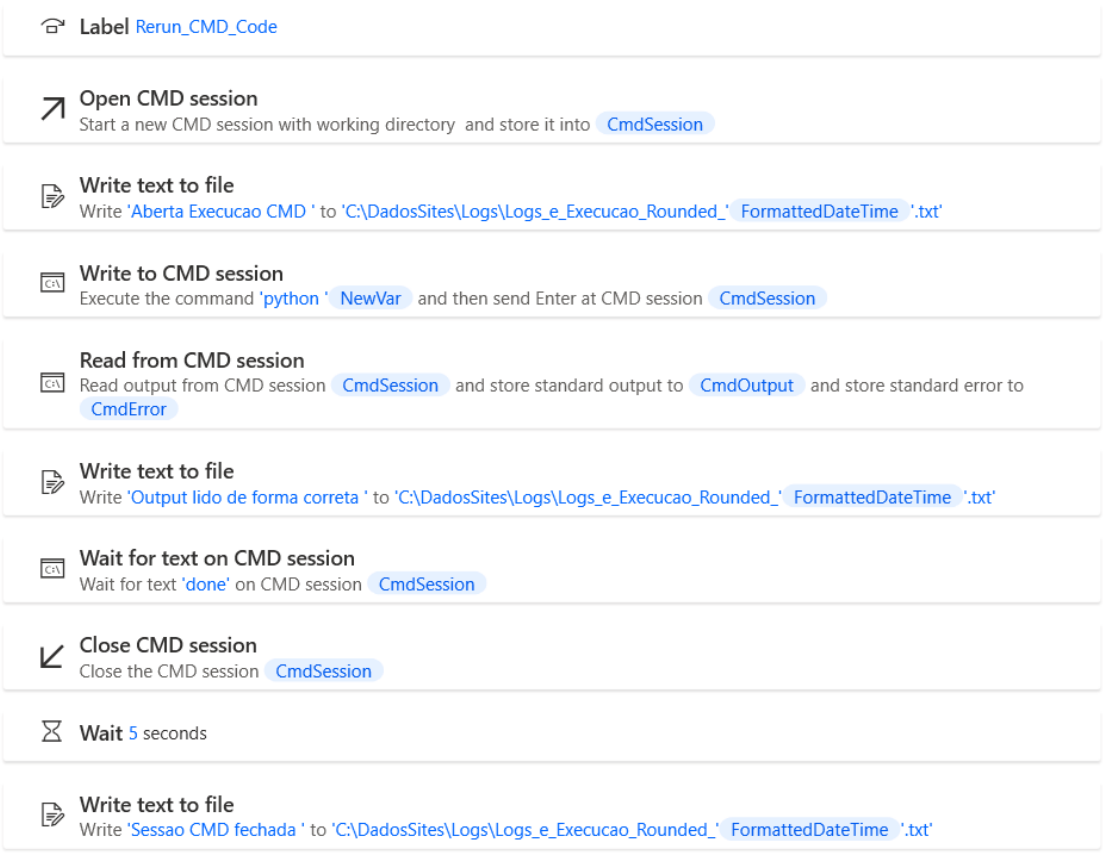


Figure 37: Power Automate Flow Part 2

Source: Prepared by the Author

The second part of the flow is the most important, as it will handle the execution of the Python file and ensure that its execution was successful. The execution of this file is ensured, by the action of all the boxes that include tasks that are linked with CMD actions, including:

- Open CMD Session: Opens the CMD action available on the machine where it is being executed;
- Write to CMD Session: Write the code that will trigger the flow to start;
- Read from CMD Session: Reads the output that comes out of executing the code of the previous action, ensuring that the code started without problems, or if a problem exist, it is stored in the CMD Error variable to be treated;
- Wait for text on CMD Session: This action is the way that the Power Automate platform knows that the execution of the entire Python file has been successful. In the code file, a last line was included that makes a print of a certain word, in this case, “Done”. As soon as this action registers that this word is output in the CMD, the file is considered totally executed;
- Close CMD Session: Action that closes the previously started CMD session

Throughout all these steps, control actions are included, where different files with the automation passages through the actions are recorded. In addition, a greater control block was also created, so that if the word “Done” is not registered as an output of the CMD session, the code is re-executed. The Python language will be used to build a code that allows it to go through the entire site, and in this way get all the necessary information to build a considerable database. In figures 38 and 39, it is possible to find the structure of the main class of the constructed code:

```
produtsLinks = Extraction.getProdutsLinks()
print("A inciar extração")
for brand in produtsLinks:
    productsFirstPage = []
    counterNode0 = 0
    counterLinkNode0 = 0
    brandNode0 = Extraction.getMarcasAndSubMarcas(curl, [brand])
    if brandNode0 == False:
        while counterNode0 < 2 and Extraction.getMarcasAndSubMarcas(curl, [brand]) == False:
            brandNode0 = Extraction.getMarcasAndSubMarcas(curl, [brand])
            counterNode0+=1
    pageList = Extraction.getProdutFromPagitation(brand, curl)
    linkProductsNode0 = Extraction.getLinkFromProdut(curl, brand, pageList)
    if linkProductsNode0 == False:
        while counterLinkNode0 < 2 and Extraction.getLinkFromProdut(curl, brand, pageList) == False:
            linkProductsNode0 = Extraction.getLinkFromProdut(curl, brand, pageList)
            counterLinkNode0+=1
    if len(linkProductsNode0) > 0:
        print("A extrair detalhes dos produtos Node0")
        productsFirstPage.append(Extraction.extractProdutDataAndInsertIntoBd(curl, linkProductsNode0))
        print("Extração concluida com sucesso")
    for node1 in brandNode0:
        products = []
        counterNode1 = 0
        counterLinkNode1 = 0
        brandNode1 = Extraction.getMarcasAndSubMarcas(curl, [node1])
        if brandNode1 == False:
            while counterNode1 < 2 and Extraction.getMarcasAndSubMarcas(curl,[node1]) == False:
                brandNode1 = Extraction.getMarcasAndSubMarcas(curl, [node1])
                counterNode1+=1
        pageListNode1 = Extraction.getProdutFromPagitation(node1, curl)
        linkProductsNode1 = Extraction.getLinkFromProdut(curl, node1, pageListNode1)
        if linkProductsNode1 == False:
            while counterLinkNode1 < 2 and Extraction.getLinkFromProdut(curl, node1, pageListNode1) == False:
                linkProductsNode1 = Extraction.getLinkFromProdut(curl, node1, pageListNode1)
                counterLinkNode1+=1
        if len(linkProductsNode1) > 0:
            print("A extrair detalhes dos produtos Node1")
            products.append(Extraction.extractProdutDataAndInsertIntoBd(curl, linkProductsNode1))
            print("Extração concluisda com sucesso")
```

Figure 38: Python Code Part 1

Source: Prepared by the Author using Visual Studio Code

In this code, the most essential part to retain is the way the site scraping is carried out – the logic is to follow the branches as the supplier itself is organized. The site is organized as follows:

1) Typologies
2) Brands
3) Sub-Brands
4) Products

In this way, the code was structured to follow this same logic, so as it runs through each of the branches, it saves all the links it finds – and if it finds a product link within the given branch, it enters that link and takes all the necessary information.

```
def getQuerySQLProducts(products, nomeTabela):
    values = ""
    try:
            for product in products:
                produto = ""
                strData = datetime.datetime.today().strftime("%Y-%m-%dT%H:%M:%S.%f")[:-3]
                columns = "(Tipologia, Marca, Modelo, SubModelo, link, Data_Criacao, Data_Atualizacao, Eliminado)"
                Tipologia = str(product[0]).replace(",","").replace("'","")
                Marca = str(product[1]).replace(",","").replace("'","")
                Modelo = str(product[2]).replace(",","").replace("'","")
                SubModelo = str(product[3]).replace(",","").replace("'","")
                values += "(" + "'"+Tipologia+"'," + "'"+Marca+"'," + "'"+Modelo+"'," + "'"+SubModelo+"'," +  "'"+str(product[4])+"','"+

            sqlStr = values[:-1]
            sqlQuery = "Insert into wkb_csas."+str(nomeTabela)+" "+ str(columns) + " values "+sqlStr

            print(str(sqlQuery))
    except Exception as error:
        print(error)
    return str(sqlQuery)
```

Figure 39: Python Code Part 2

Source: Prepared by the Author using Visual Studio Code

The last part of the code intends to insert all the information in a function with all the products details saved in a variable, which builds an Insertion query in the corresponding table in Databricks.

Databricks: The Databricks environment will be the tool used to do all the data provided through the Power Automate flows. In this way, the data will be saved, with a table for each of the suppliers in question, as shown in Figure 40. In addition to these, there will be a final table with all the suppliers together, which will be the one that will be linked to the front-end of data query in Power BI.

Table +

	id_produto	Tipologia	Marca	Modelo
1	2005974	Repuestos Móviles	Sony Xperia	Sony Xperia E3 D2203 repuestos
2	2005975	Repuestos Móviles	Samsung	Samsung Galaxy W I8150 repuestos
3	2005976	Repuestos Móviles	Lg	LG Optimus G Pro Lite D680 repuestos
4	2005977	Repuestos Móviles	Lg	LG Flex D958 D950 repuestos
5	2005978	Repuestos Móviles	Samsung	Samsung Galaxy Express I8730 repuestos
6	2005979	Repuestos Tablets	Repuestos Alcatel	Alcatel OneTouch Hero 8 pantalla lcd + tactil blanco origina
7	2005980	Repuestos Móviles	iPhone	iPhone 5C

6,383 rows | Truncated data | 3.65 seconds runtime Refreshed now

Figure 40: Supplier Databricks Table Example

Source: Prepared by the Author using Databricks

Thus, all connections between the individual tables and this final table will also be made using the Python functionality available on the platform. This management will be done through some queries

in Databricks, which will simply delete the previous information from this table about the corresponding supplier and later merge the two tables, inserting the most recent details.

POWER BI: The latter will be the only one with direct access by employees who carry out the process daily – it will be through this data query dashboard that they will be able to access all existing parts by supplier, brand, or typology and their prices and availabilities - Figure 41 shows the specified dashboard page:

Figure 41: Dashboard Sourcing Worten Part 1

Source: Prepared by the Author using Power BI

In addition, they will also have at their disposal a window where it will be possible to select the products they want to see in more detail, and in this way establish comparisons of parts from different suppliers, in an easier and faster way. In Figure 42, the product comparison page is shown in detail:

Figure 42: Dashboard Sourcing Worten Part 2

Source: Prepared by the Author using Power BI

In this way, the main objective of automation was achieved, that of providing TSC workers with an alternative to the process that currently exists, where the consultation was done individually and by supplier, and in this way, it is possible that there is a query more effective where the employee can immediately select which supplier he wants to see and which parts he may be interested in buying.

TESTE PHASE/QUALITY AND ASSURANCE OF AUTOMATION

The testing phase refers only to the existing need of before putting the automation effectively into production, it is necessary to test it with some experimental data. Thus, for this testing phase, 3 fundamental points were necessary:

1) A virtual machine with a Power Automate environment so that the tests can take place without influencing other processes;
2) A user for the automation, so you can enter the respective websites of the suppliers;
3) Data as close as possible to real data, which can reflect possible exceptions that may occur

After all these elements were gathered, it was possible to draw the following conclusions from the tests carried out:

1) For the case of this specific supplier, it is necessary to divide the type of product so that the automation can run in a viable way (that is, instead of all products running at once, it is necessary to have an initial division of products, so that they are all collected within the correct time – this way the type of product with the most allocated parts will have a specific code and the remaining types will have another);
2) There were some errors in the code, which were changed as the testing phase progressed;
3) The entire insertion block can take a maximum of 48 hours – with the code improvements, currently for the typology with more products this phase takes about 24 hours;
4) The update phase, to be carried out three times a day, may take a maximum of 2 hours, which is the time that is currently stipulated.

PHASE 3: MAINTENANCE

CONTROL AND MAINTENANCE

Concerning the last topic of the set of guidelines built, the control and maintenance of the automation, must be done through the analysis of its behavior throughout the month – this through the statistics shown by power automate. In addition, all control work is carried out by being in constant contact with the employees who use the front-end daily, to understand if there are points to be improved, or others that need to be corrected because problems have occurred.

5.3 Project 3 – Kitchen App And Reporting

Recently, Worten started a new kitchen sales business area – however, as it is a recent business segment, there is still no sales management and reporting mechanism necessary to properly manage sales made and control data from purchases in this sector. In this way, this second project intends to respond to this need. In this way, as it is a recent and urgent need, there is no concrete data to formulate a PDD or a prioritization matrix assessment, just as there is no previous process to be analyzed and revised to be replaced. The need for automation is used here in another aspect – building a reporting system that is easy and accessible for any employee to use.

Thus, the first basis for building the reporting mechanism was to be able to develop an efficient way to bridge the gap between the information that comes from the stores and the information that reaches the employees who are working on the reporting itself. The best way to do this is through a mechanism common to all stores that records all kitchen sales information, and as soon as an kitchen related event is made, it is immediately reported. In order for the effect of the previous paragraph to be achieved, another Power Platform tool – Power Apps – will be used. An application will be developed with different forms associated with different scenarios that can be registered during the process of selling a kitchen. As long as any progress is made, be it contact with a customer, an appointment, or a final sale, this step will have to be registered in the application whose information will also be available for reporting purposes.

The entire reporting mechanism developed will be based on two essential fronts – the management of all the information that comes from the stores through the application developed in Power Apps, and all the reporting dashboards where the information is worked on in Power BI – the connection established between the two endpoints will be done through SharePoint lists and Power Automate flows that will always match the information from one side to the other. As the objective is to build a root reporting system through automation, the guidelines system will be followed from phase two, because there is no way to include it in a prioritization matrix or establish any comparisons with old processes, since these do not exist. In this way and as a basis for the development phase, the main objective of automation is to overcome the main pain point currently felt - Lack of data organization related to the sale of kitchens.

PHASE 2: DEVELOPMENT

AUTOMATION DEVELOPMENT

If in the case of the previous automation, it was necessary to take the entire functional document built for approval, for the case of this automation it was necessary to take a structure of what the reporting system would be expected to function like, what would be the applications that would compose it, and which would be the synergies between them. Figure 43 shows the application system delivered:

Power Apps & SharePoint: The Power Apps provided by the Power Platform were the mechanism chosen to register in real-time all records related to the kitchen segment. Data storage and management will be done through SharePoint lists – in this way, whenever a collaborator launches a certain result in the Power App, it is added as a new line of data in the corresponding SharePoint list, and vice versa;

Power Automate: Power Automate will be used as the first tool to get the data to Power BI, to use them as a form of reporting and analysis. In this way, Power Automate flows will be built in order to pass the SharePoint lists to Databricks tables.

Databricks: As in the previous automation, Databricks will be our central database where each SharePoint list will have its own table;

Power BI: It is not part of the development of the automation itself, however, it will be the endpoint where all the data previously collected will be used to prepare detailed reporting analyses.

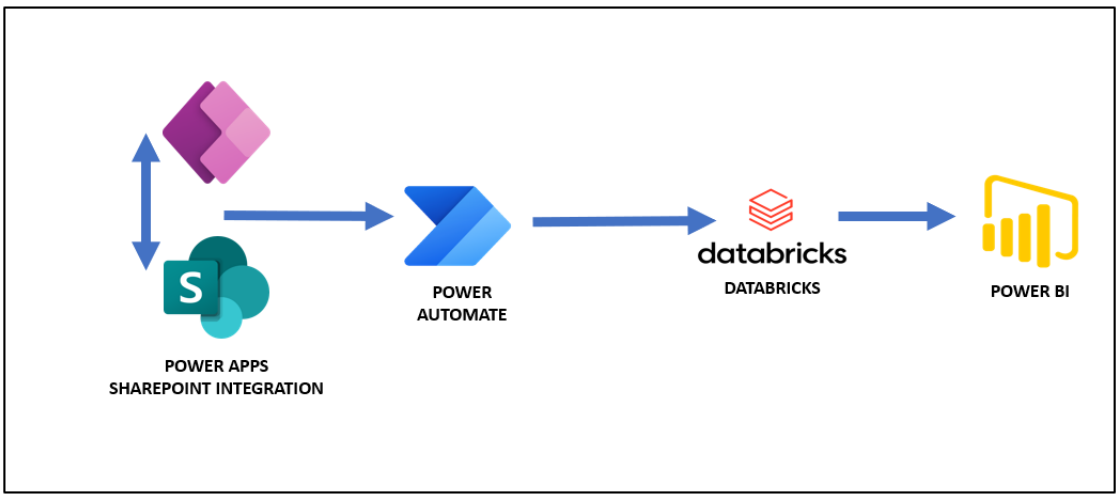


Figure 43: Applications Workflow

Source: Prepared by the Author

Power Apps: The App's construction logic will be like that of a customer registration form, incidence, or certain event. In this way, each screen that makes up the application will consist of a different form which will in turn correspond to a different SharePoint list. As you can see in the image in Figure 44, this page concerns the registration of a new event for a given customer – the data registered here will be placed in the SharePoint Events list since the fields to be filled in are the same as those that make up the list. All the forms used here were completely built from scratch in order to encompass all the necessary information for the stores and reporting.

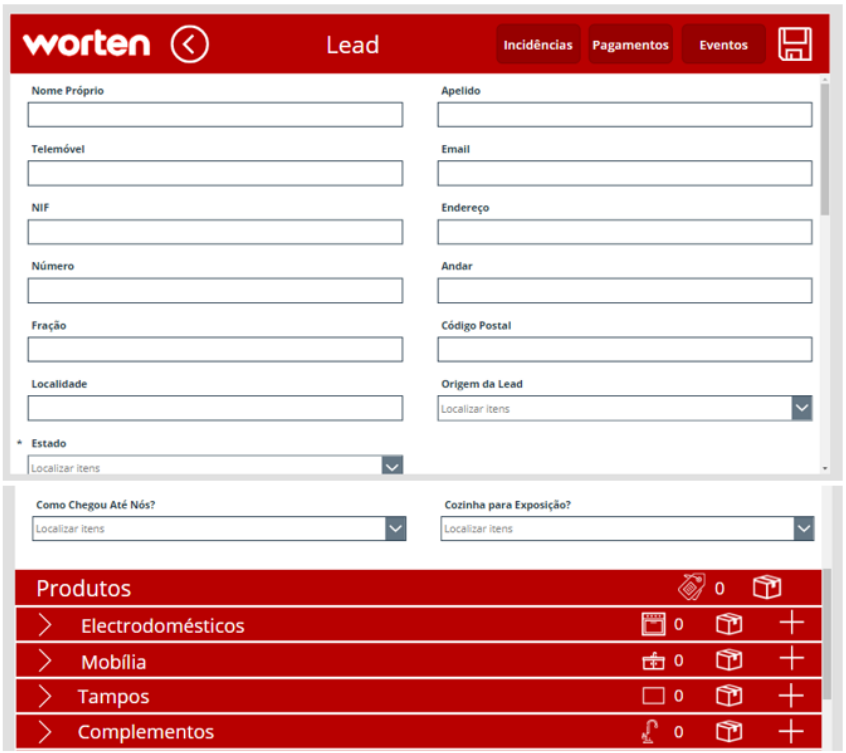


Figure 44: Lead Event Application Form

Source: Prepared by the Author using Power Apps

In addition, there will be other elements of the application, as the galleries and the buttons that are important to mention – the first ones refer to the disposition of data, both in the initial screen and in other selection screens, the buttons will be primarily responsible for the navigation between the different pages.

Power Automate: Every day in the morning, the flow goes through all the SharePoint lists, takes the updated data from the previous day and formulates csv tables with this data. An image of this flow is available in Appendix V.

Databricks: As in the previous flow, each table will correspond to a SharePoint list – as the lists are updated daily, the tables will also be. In Appendix VI, a preview of one of the tables is available.

Power BI: Reporting tool to use to work on the collected data. One of the pages of the Reporting Dashboard can be seen in figure 45.

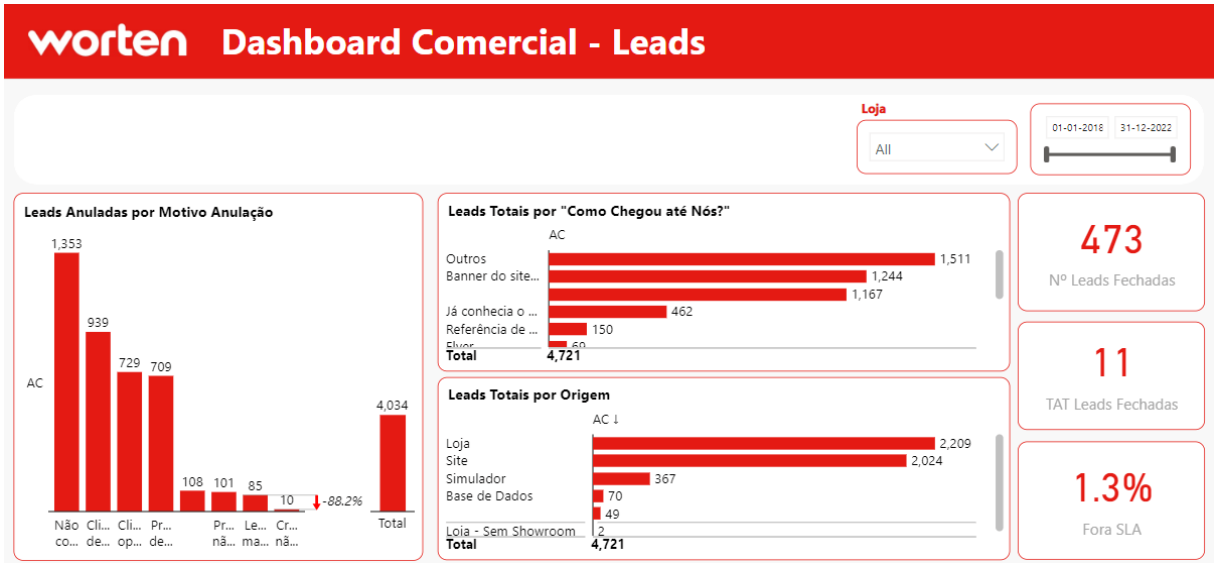


Figure 45: RPA Information Reporting Dashboard

Source: Prepared by the Author using Power BI

TESTE PHASE/QUALITY AND ASSURANCE OF AUTOMATION

In the previous automation, the starting point of the testing phase was realizing the need to obtain virtual servers to carry out these same quality tests – in this case, as we are not talking about a process that runs 1 or 2 times a day, but a reporting system whose application must always be operational, the testing phase will extend to just one Worten store.

In this way, the main problems registered and subsequently resolved were:

- There was a need to create a way to manage employee access to the application, different employees may have different accesses, as well as employees from different stores will only be able to access the records of the store where they work;

-The need also arose to create new variables in the forms. In order to, these needs to be communicated in due time, using communication channels that were created between the stores and the developers to eliminate this type of problem;

-The code that is at the base of the construction of the application, both in the aesthetic aspect and in the distribution of the data, also had to be changed, since with the addition of new variables, the need arose to structure the form that makes up the application with new fill fields.

PHASE 3: MAINTENANCE

CONTROL AND MAINTENANCE

The control and maintenance of the developed mechanisms will be done through the built communication channel since it is the only way for the developers to know with the store employees whether the application is being used correctly.

In addition, the passage of data through the Power Automate flows will also serve as a form of control, since through this tool it is possible to identify the level of errors committed in the passage of data to Databricks.

In this way, it was possible to prove that automation does not only serve to replicate processes, it can also serve to build a root solution mechanisms. In this case, the set of guidelines was not followed in the same way as in the last automation, since there was no old process to improve, however, the same reasoning was followed - the creation of a reporting system for the area of kitchens was given as a priority, and thus went to the beginning of the prioritization matrix.

Subsequently, the project was successfully developed, having built an automation that involves all the prisms requested – sending data from stores, further processing of data, and also building a solid reporting base. In this way, it was possible to give new control to the Worten Kitchens business, moving from a system where there was no data control, to a solid application that allows recording events at the second and whose reporting will allow for much more detailed analyses.

6. RESULTS AND DISCUSSION

After the completion of both projects, it is important to reflect on the impact they truly had on the company and its teams. In this way, the first results to be examined are those of the actual execution flow. Therefore, it is essential to analyze the monitoring reports provided by Power Automate itself. In Figure 46, it is possible to observe some of the results obtained for the TSC Web Scraping flow. In this specific case, it pertains to only one of the websites and solely for the update of prices and product stocks. As can be seen, for normal cases, the process runs a maximum of once per day, and sometimes, if there is no need to update the website, the process is not initiated.

Some special cases were registered in these statistics:

1. Cases where the flow ran 2 to 3 times per day, always with successful records - these are related to days with a higher influx of orders, requiring prices and stocks to be updated more than once a day;
2. Cases of flow cancellation, where there was a need to cancel it due to identified corrections and changes in time for the flow to register the problem itself;
3. Cases where the flow automatically stopped due to encountering an error or inconsistency in one of its steps - in this case, all cases were registered on the same day and were caused by an error in the Python code, which must be corrected immediately, following the contingency plan built in the previous steps.

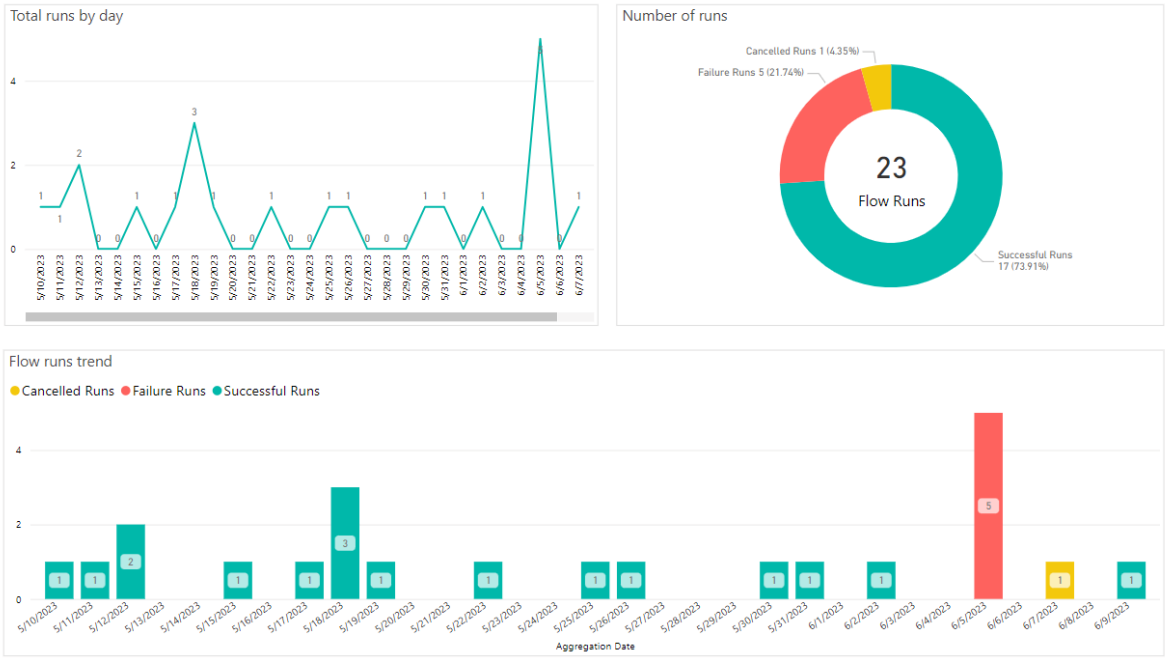


Figure 46: Web Scraping Flow Runs Analytics

Source: Prepared by the Author using Power Automate

Regarding the Kitchen Business Reporting project, the control of flows that allow data transfer from the developed application to the desired dashboards is important. As it's possible to observe in figure 47, the flow has not presented many issues - the number of times it is activated daily can vary, depending on the amount of information entered into the built application. The main problems that

arise are related to connections to SharePoint lists or connections to the Databricks platform, which need to be restored in case of a bug.

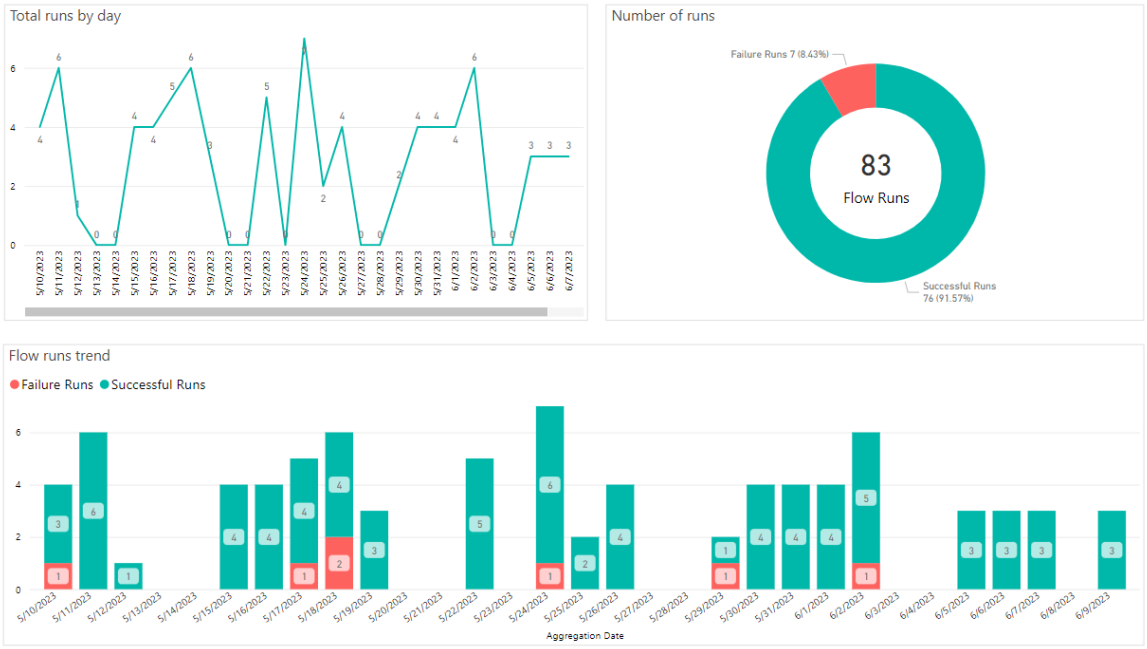


Figure 47: Kitchen App Flow Runs Analytics

Source: Prepared by the Author using Power Automate

It is also important to mention that these data refer to the last 30 days, and at the beginning of the production entry for each of the processes, the level of errors and maintenance was much higher. However, as can be observed from the figures in Appendix VII, the level of errors shown has been reasonable, and so far, none of them have required the automations to stop for an extended period.

In addition, gathering feedback from teams directly involved in each of the built automations, the data shown in figure 48 was obtained:

1) Regarding the Web Scraping RPA, the data extracted does not yet cover the full capacity that could be achieved through automation, as it only includes two vendor websites. However, since these two sites are of major importance to TSC, it was already possible to reduce 1 FTE for the task at hand.
2) Furthermore, the quotation request processing time has also been reduced, and the total response to monthly quotation requests has increased by approximately 200 additional requests.
3) Regarding the RPA that manages the entire reporting system for the kitchen area, the main impact according to the teams is the arrival of new data, which allows for increasingly consistent business analysis.

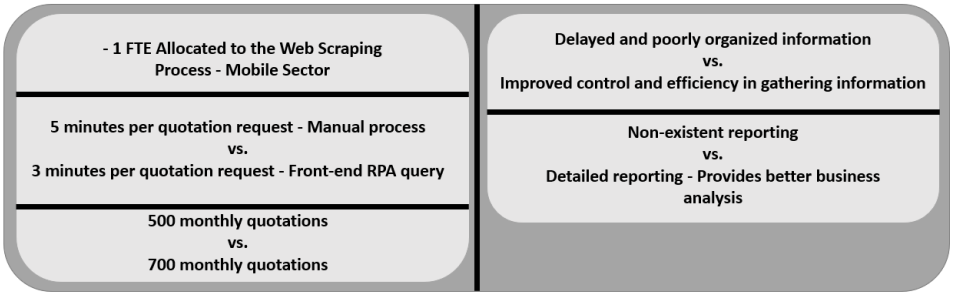


Figure 48: RPA Automation Impacts

Source: Prepared by the Author

7. CONCLUSION

After reaching the final stage of the project's development, the objectives achieved were varied – the main one was to prove the thesis defended in the theoretical framework – the development of RPA's and commitment to automation, can make the difference in a large company like Worten. The possibility for a company to be able to function without processes that involve too many manual steps or bureaucracy, and to be able to evolve and create value having as its main source the added value brought by the innovations developed by its workers, is essential, especially for an organization that wants to position itself as a technological and modern company.

In addition, other objectives were achieved, namely the possibility of learning, growing and consolidating my position as an RPA Developer - this was essentially achieved through the tasks and internal projects that were passed over.

Of the various projects that were asked of me, the two explored in this report were the most important, as they allowed me to explore two different aspects of automation. On the one hand, an aspect in which RPA replaces an old process whose costs for the company are high and whose tasks do not allow the proper use of the company's employees - for this, in addition to the project itself, I was asked to develop a form of documentation and a good practice guide for the implementation of RPA's in the company.

On the other hand, an aspect in which automations can themselves be basic innovation tools, building projects from scratch, not making any kind of substitution to others – this was the case of the second project, which brought a new horizon to the Kitchen sector Worten.

The two projects brought many more benefits to the processes in question – on the one hand, the parts search process flows much more easily – increasing the number of parts searched per day and per employee – also improving the level of decision-making. On the other hand, the kitchen sector now has a sales control system that brings benefits not only to teams of internal employees but also to those who deal with reporting and data analysis.

Finally, it is important to mention that the knowledge bases retained during the Data Science course were fundamental for my adaptation to the projects developed, especially with regard to the bases of reading and understanding the code behind websites, codes, or applications. The company was pleased with my performance, having fulfilled the requirements for which my function had been highlighted – all the work developed is now thought to be used in future developments.

6.1 LIMITATIONS

The main limitations are essentially linked to the fact that as it has not passed enough time, since the start of the projects development to explore all the aspects and potential that the development of RPA through Low Code could bring to the global spectrum of the company - this is because the program was very focused on the projects mentioned above, with others having to remain in a development pipeline.

In addition, and speaking of the first project specifically, the fact that the process deals with around 20 different suppliers has meant that the potential of automation has not yet been evaluated in its full spectrum, since for now it only encompasses the 3 suppliers of greater expression.

6.2 RECOMMMENDATION FOR FUTURE WORK

In addition to limitations, it is important to clarify what aspects the company should continue to invest in, growing sustainably with the development of automation.

The main recommendation is for the automation component for process improvements – continue to follow the steps defined in the set of guidelines, proceeding with all the processes already identified following the order of the prioritization matrix.

Another point to always keep in mind are the changes that the RPA branch can undergo over time – Worten, as a company that intends to invest in this level of technology, must always be alert to new automation tools and see if they can bring added value. In addition, the guidelines produced must always be monitored in terms of maintenance, always considering that there may be improvements to be made.

To all this, we can also refer to the fight against one of the obstacles mentioned in the theoretical research – the lack of knowledge of workers regarding the benefits of RPA. Undoubtedly, this is one of the biggest obstacles to the introduction of RPA in a company, so it must be overcomed, by showing results and tools, providing training, and expanding the spectrum of action to new areas of the company.

Lastly, it would also be interesting, in the long term, to extend the automation initiatives, not only internally within Worten, as mentioned in the previous point, but also to see if it would be feasible to extend them to other companies in the SONAE group.

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APPENDIX

APPENDIX I – SCORECARD QUESTIONS

ELIMINATORY QUESTIONS

Rule Based vs Ad-hoc/Judgemental	
Possible Answers	Scoring
Exclusively Rule Based	Feasible
Mostly Rule Based	Feasible
Somelevel of subjectivity involved	Feasible
Mostly subjective	Low Feasibility
Exclusively Subjective	Low Feasibility

Type of Input	
Possible Answers	Scoring
Not digital and Unstructured	Low Feasibility
Non Digital and Structured	Digitize first
Digital and Unstructured	Feasible
Digital and Structured	Feasible

POSTPONEMENT QUESTIONS

Process Stability	
Possible Answers	Scoring
No change expected	0
Very Small Change	0,2
Some change	0,4
Medium Change	0,8
Significant Change	Postpone

Applications Stability	
Possible Answers	Scoring
No change expected	0
Very Small Change	0,2
Some change	0,4
Medium Change	0,8
Significant Change	Postpone

SUITABILITY/BENEFIT QUESTIONS

Frequency of the Process		
Possible Answers	Scoring	
Daily	These are control questions that are not	260
Weekly	scored. The frequency x AHT x	52
Bi-weekly	Volume/frequency will be used to estimat	26
Monthly	the number of FTEs	12
Quarterly		4
Annualy		1

Process Peaks	
Possible Answers	Scoring
Regular (e.g. month closing), lasting for several days or weeks in a row and increasing the utilization of the team capacity by > 20%	1
Rare but predictable event (e.g. winter holidays/ yearly closing), lasting for the several days or weeks in a row and increasing the utilization of the team capacity by > 20%	2
Rare event, hard to predict, of short duration	3
The process does not have peaks	N/A

EASE OF IMPLEMENTATION

Number of Steps - complexity proxy 1	
Possible Answers	Scoring
<=10 steps	0,1
10-15 steps	0,2
15-25 steps	0,4
25-40 steps	0,6
>40 steps	1

Difficulty of decisions	
Possible Answers	Scoring
The process is linear - there are no decisions to be taken	0,1
The process involves simple decisions (yes/no type)	0,2
The process involves complex decisions	0,7

Number of Applications	
Possible Answers	Scoring
1 application	0,1
2-3 applications	0,3
4-5 aplications	0,6
> 5 applications	1

Thin Client?	
Possible Answers	Scoring
Yes	1,6
No	1

OCR?	
Possible Answers	Scoring
Yes	1,2
No	1

Structured Data vs Un-Structured	
Possible Answers	Scoring
>= 80%	0
60%-80%	0,4
40%-60%	0,7
<40%	1

Impact	
Possible Answers	Scoring
Client	0
Control	0,4
Operational / Efficiency	0,7
Operational / Efficiency & Client	1

Source: Prepared by the Author

APPENDIX II – PRIORITY MATRIX

Rank Sugestão	JIRA	Description	Área	Owner	% effort	% Automation	Equivalent FTEs	Impact
1	CSASBT-248	Preenchimento de detahes de Orçamentos em ServiceMax	Contact Center	Carina Azinheira	12,00%	94,00%	1,09	Operation
2	CSASBT-153	Price Searching - Central de Peças	PARTS	Sara Guilherme	15,00%	89,00%	0,68	Operation
3	CSASBT-252	Price Searching - Site SpainSellers	PARTS & Satfiel Commercial	Sara Guilherme / Aurélio Pereira	7,00%	94,00%	0,47	Operation
4	CSASBT-159	Picagem de Código de Barras no Check In em sistema (WSS)	Technical Service Center	Logística	9,00%	97,00%	0,42	Operation
4	CSASBT-161	Impressão de etiqueta no Check In em sistema e no CQ (WSS)	Technical Service Center	Logística	9,00%	97,00%	0,42	Operation
4	CSASBT-162	Preenchimento de alguns "campos" em sistema no Check In (WSS)	Technical Service Center	Logística	9,00%	97,00%	0,42	Operation
4	CSASBT-164	Picagem de Código de Barras no Check In em sistema (WSS)	Technical Service Center	Logística	9,00%	97,00%	0,42	Operation

Cálculo Matriz = Esforço (35%) + Automação (20%) + FTE's Impactados (35%) + Impacto (10%)

wortenresolve

Source: Prepared by the Author using Power BI

APPENDIX III – PROCESS STEPS DETAILS

#	Descrição	Comentários
A.01	*Verificação de pedidos de cotação em WSS*	
A.02	*Efetuar sourcing das peças necessárias pelos sites de fornecedores, cuja via de contacto não é por email*	*Entrar nos sites de fornecedores, não contactados via email, e extrair informações sobre cada peça requisitada*
A.02.1	*Para analisar o website em questão, o primeiro passo será o de abrir a página do mesmo*	
A.02.2	*De forma a navegar no site com todas as vantagens possíveis, é necessário iniciar sessão, preenchendo os campos de log-in*	*Apenas com a sessão iniciada no website, será possível obter preços mais baixos*

Source: Prepared by the Author

APPENDIX IV – TO-BE PROCESS LEGEND

Ícone	Legenda
	Etapa a automatizar
	Etapa a ser realizada manualmente
	Alteração ao processo *as-is* / oportunidade de melhoria
	Automatismo já existente

Source: Prepared by the Author

APPENDIX V – POWER AUTOMATE APPLICATION DATA FLOW

Source: Prepared by the Author using Power Automate Cloud

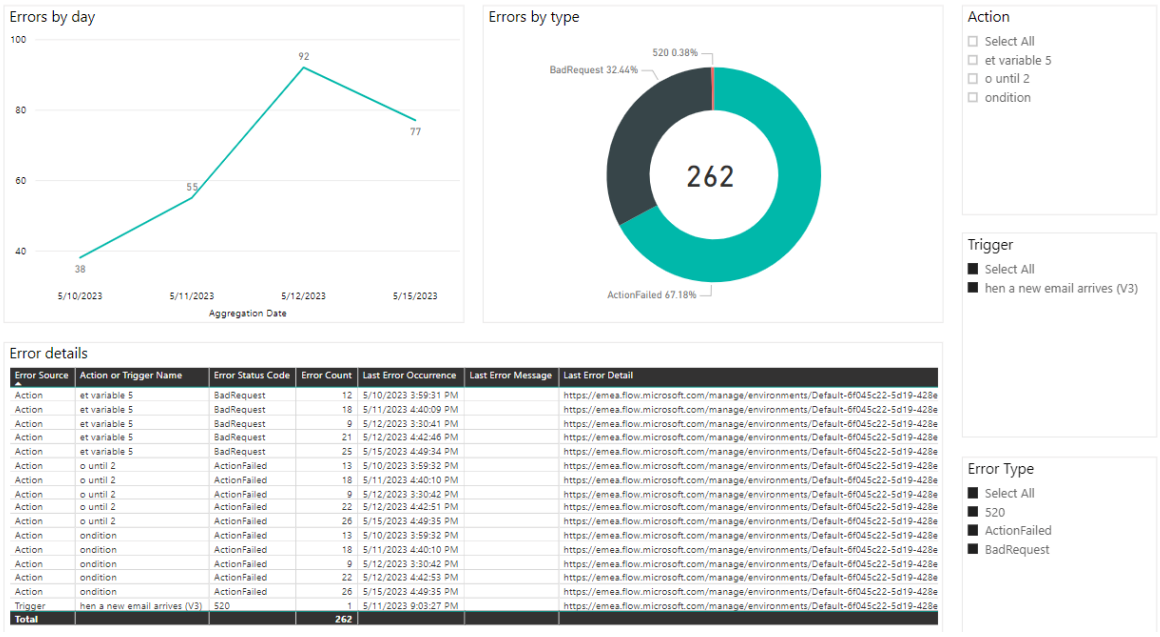
APPENDIX VI – DATABRICKS APPLICATION TABLE DATA

Table +

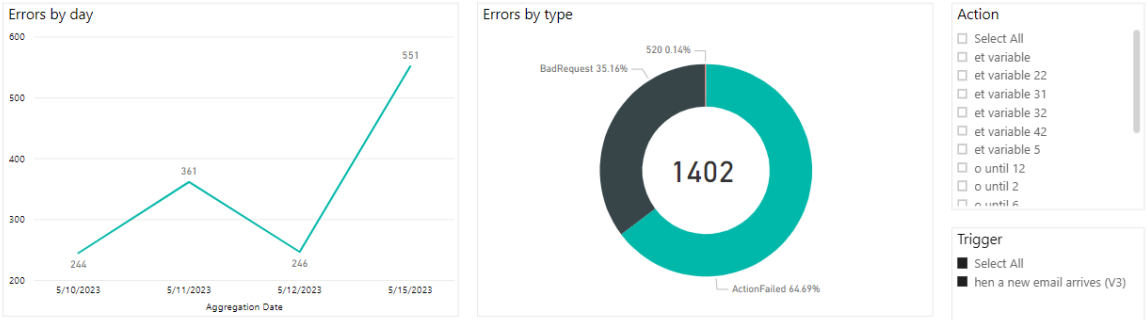
	TITLE	MODO_PAGAMENTO	ESTADO_PAGAMENTO	DATA_ANULACAO	MOTIVO_ANULACAO	TIPO_PAGAMENTO	VALOR_PAGAMENTO
1	57	Numerário	Anulado	null	null	Inicial	0
2	164	Vários	Activo	null	null	Final	8478.3
3	135	Cartão Multibanco/Crédito	Activo	null	null	Inicial	1085.15
4	83	Cartão Multibanco/Crédito	Activo	null	null	Inicial	1913.31
5	300	Numerário	Activo	null	null	Inicial	1025
6	104	Transferência bancária	Activo	null	null	Inicial	8391.27
7	114	Cartão Multibanco/Crédito	Activo	null	null	Inicial	2785.63

Source: Prepared by the Author using Databricks

APPENDIX VII – POWER AUTOMATE PROJECTS FLOW ERRORS



Error Source	Action or Trigger Name	Error Status Code	Error Count	Last Error Occurrence	Last Error Message	Last Error Detail
Action	et variable 5	BadRequest	12	5/10/2023 3:59:31 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	et variable 5	BadRequest	18	5/11/2023 4:40:09 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	et variable 5	BadRequest	9	5/12/2023 3:30:41 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	et variable 5	BadRequest	21	5/12/2023 4:42:46 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	et variable 5	BadRequest	25	5/15/2023 4:49:34 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	o until 2	ActionFailed	13	5/10/2023 3:59:32 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	o until 2	ActionFailed	18	5/11/2023 4:40:10 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	o until 2	ActionFailed	9	5/12/2023 3:30:42 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	o until 2	ActionFailed	22	5/12/2023 4:42:51 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	o until 2	ActionFailed	26	5/15/2023 4:49:35 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	ondition	ActionFailed	13	5/10/2023 3:59:32 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	ondition	ActionFailed	18	5/11/2023 4:40:10 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	ondition	ActionFailed	9	5/12/2023 3:30:42 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	ondition	ActionFailed	22	5/12/2023 4:42:53 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Action	ondition	ActionFailed	26	5/15/2023 4:49:35 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Trigger	hen a new email arrives (V3)	520	1	5/11/2023 9:03:27 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-428e
Total			**262**			



Error Source	Action or Trigger Name	Error Status Code	Error Count	Last Error Occurrence	Last Error Message	Last Error Detail
Action	et variable	BadRequest	1	5/10/2023 5:02:05 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 22	BadRequest	28	5/11/2023 4:47:23 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 22	BadRequest	45	5/15/2023 4:18:37 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 31	BadRequest	47	5/12/2023 11:31:58 AM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 32	BadRequest	32	5/10/2023 11:48:51 AM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 32	BadRequest	28	5/11/2023 11:03:12 AM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 32	BadRequest	25	5/12/2023 11:37:28 AM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 32	BadRequest	56	5/15/2023 12:17:10 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 42	BadRequest	34	5/10/2023 2:06:48 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 42	BadRequest	32	5/11/2023 1:32:38 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 42	BadRequest	27	5/12/2023 1:41:59 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 42	BadRequest	59	5/15/2023 2:43:11 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 5	BadRequest	15	5/10/2023 11:56:57 AM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 5	BadRequest	29	5/11/2023 1:18:30 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 5	BadRequest	11	5/12/2023 11:34:57 AM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	et variable 5	BadRequest	24	5/15/2023 10:47:22 AM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Action	o until 12	ActionFailed	37	5/10/2023 2:06:50 PM		https://emea.flow.microsoft.com/manage/environments/Default-6f045c22-5d19-42
Total			**1402**			

Source: Prepared by the Author using Power Automate