



João Miguel Alves Moitas

**ROBOTIC PROCESS AUTOMATION (RPA) IN FINANCE AND ACCOUNTING:
A SOLUTION IN A HOTEL COMPANY**

Coimbra, October 2024



João Miguel Alves Moitas

Robotic Process Automation (RPA) in Finance and Accounting: A Solution in a Hotel Company

Project submitted to the Higher Institute of Accounting and Administration of Coimbra to fulfil the requirements for obtaining a master's degree in Management Information Systems, conducted under the guidance of Doctor Fernando Paulo dos Santos Rodrigues Belfo and supervision of Lucília Nair dos Santos Lopes.

Coimbra, October 2024

Robotic Process Automation (RPA) in Finance and Accounting: A solution in a Hotel Company

STATEMENT OF RESPONSABILITY

I declare that I am the author of this Dissertation, which is an original and unpublished work, which has never been submitted to another Higher Education Institution to obtain an academic degree or other qualification. I further certify that all citations are properly identified and that I am aware that plagiarism is a serious lack of ethics, which could result in the annulment of this project.

Robotic Process Automation (RPA) in Finance and Accounting: A solution in a Hotel Company

THOUGHT

"The only impossible journey is the one you never begin."

Tony Robbins

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ABSTRACT

As organizations continuously strive to enhance efficiency and streamline their operations, automating repetitive and time-consuming tasks becomes a priority. RPA has emerged as a key technology in achieving this objective, enabling businesses to transform manual processes into automated workflows. This project explores the design and implementation of an RPA solution tailored for the finance and accounting operations of a hotel, focusing on automating the handling and processing of routine accounting documents.

The solution leverages Microsoft Power Automate (RPA) integrated with AI Builder to automate data extraction from various accounting-related documents, significantly reducing manual effort and minimizing the potential for errors. By implementing AI-driven models, the system can intelligently read, process, and categorize document data, which is then organized into an appropriate format ready for integration into the SAP system. Automating these steps, from document reception to data processing, greatly improves operational efficiency and data accuracy.

The entire design and development process and its corresponding documentation followed the Design Science Research methodology. It included defining the problem, setting objectives for the RPA solution, developing the system, and conducting multiple phases of testing to evaluate the system's performance. The outcome was a reliable and scalable solution capable of handling monthly accounting tasks with minimal human intervention. This project also serves as a foundation for future research and development, offering possibilities for expanding the use of AI technologies to further optimize business processes in other departments and industries.

Keywords: RPA, Robotic Process Automation, Accounting Processes, Microsoft Power Automate, AI Builder, Document Processing. Design Science Research, DSR.

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RESUMO

As organizações esforçam-se continuamente para melhorar a eficiência e otimizar as suas operações, tornando prioritária a automação de tarefas repetitivas e demoradas. *Robotic Process Automation* surgiu como uma tecnologia chave para alcançar esse objetivo, permitindo que as empresas transformem processos manuais em fluxos de trabalho automatizados. Este projeto explora o *design* e a implementação de uma solução RPA direcionada para as operações de finanças e contabilidade de um hotel, com foco na automatização do tratamento e processamento de documentos contabilísticos.

A solução utiliza o *Microsoft Power Automate* integrado com o *AI Builder* para automatizar a extração de dados de vários documentos relacionados à contabilidade, reduzindo significativamente o esforço manual e minimizando o potencial de erros. Ao implementar modelos baseados em AI, o sistema é capaz de ler, processar e categorizar os dados dos documentos, que são então organizados num formato adequado para posterior integração no sistema SAP. A automação desses passos, desde a receção dos documentos até ao processamento dos dados, representa uma melhoria considerável na eficiência operacional e na precisão dos dados.

O processo de *design* e desenvolvimento deste projeto, juntamente com a documentação correspondente, seguiu a metodologia *Design Science Research*. Incluiu a definição do problema, a definição de objetivos para a solução RPA, o desenvolvimento do sistema e a realização de várias fases de testes para avaliar o desempenho do sistema. O resultado foi uma solução fiável e escalável, capaz de lidar com tarefas contabilísticas mensais com o mínimo de intervenção humana. Este projeto também serve como base para futuras pesquisas e desenvolvimento, oferecendo possibilidades para expandir o uso de tecnologias de AI para otimizar ainda mais os processos de negócios em outros departamentos e setores.

Palavras-chave: RPA, Robotic Process Automation, Processos Contabilísticos, Microsoft Power Automate, AI Builder, Processamento de Documentos, Design Science Research, DSR.

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List of abbreviations and acronyms

AI	Artificial Intelligence
AS	Autonomous Systems
BPMN	Business Process Model and Notation
CRM	Customer Relationship Management
DSR	Design Science Research
EY	Ernst & Young
ERP	Enterprise Resource Planning
IQ	Intelligence Quotient
IS	Information Systems
IT	Information Technology
JSON	JavaScript Object Notation
ML	Machine Learning
PDF	Portable Document Format
POS	Point of Sale
ROI	Return on Investment
RPA	Robotic Process Automation
SAP	Systems, Applications and Products

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1 INTRODUCTION

1.1 Motivation

The growing need for accuracy and efficiency in financial and accounting processes within a hotel business served as the impetus for this study. Alongside and combined with a personal interest in the use of robotic tools applied to the Enterprise Resource Planning (ERP) world, it was possible to develop this project. The incorporation of a Robotic Process Automation (RPA) solution with AI tools aims to improve work efficiency and counteract the ramifications of manual tasks and repetitive workflows, including error mitigation, delays, and data loss. By automating conventional procedures, RPA endeavours to mitigate these challenges, thereby supporting the overall financial framework of the business. This will contribute provide useful information and insights into the creation and application of RPA solutions in the hotel industry's finance and accounting departments by showcasing the implementation of RPA's ability to significantly reduce costs, boost productivity and by highlighting how RPA improves data quality and makes real-time financial reporting possible (Kaushik et al., 2022).

1.2 Objectives

This project aims to design and implement an RPA solution tailored to the finance and accounting operations within a hotel organization, leveraging Design Science Research (DSR) to guide each development phase. Through the structured stages of this methodology, from problem identification and solution objective definition to artefact development, demonstration, evaluation, and communication, the project addresses the complexities associated with financial documentation processing, categorization, and validation.

A core objective is to create an RPA workflow that integrates automated document processing using AI (Artificial Intelligence) tools, enhancing the categorization, validation, and data extraction of accounting documents such as bank records and American Express (Amex) transaction summaries for credits, and SAP-generated reports for debits. The workflow consolidates this information to streamline monthly financial

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reporting, reducing dependency on manual data handling. The design also incorporates validation cycles and document count checks to make sure that every document count is attached accordingly.

Overall, the solution not only advances current process efficiency but also fosters scalability for future workflow expansion, enhancing capabilities across departments within the hotel organization. The structured approach ensures that the solution remains adaptable, supporting continuous improvement in accounting automation and opening avenues for broader organizational innovation.

1.3 Report Structure

The document is organized in eleven Chapters. The introduction in Chapter One provides an overview of the topic, its context and framework, explains the rationale and importance of the study, specifies the aims, and highlights the anticipated contributions to this field. Chapter Two introduces the external organization involved in this project that provided crucial information and context related to the current processes used for accounting. Chapter Three presents a comprehensive literature review to provide context and foundational background for the project. This involves an in-depth examination of current research to highlight the relevance of RPA and its potential impact. This Chapter explores the manual processes currently employed in invoice processing, reviews available RPA software options, and provides an overview of RPA technology, focusing on its benefits and potential advantages for automation in accounting tasks. Subsequently, an application to the domains of finance and accounting is carried out, along with an integration between RPA and AI. In Chapter Four, the DSR methodology clarifies the research procedures applied throughout the study. Chapters Five to Ten encompass all the actions employed in the DSR methodology to structure tasks, milestones, and work carried out in this project. This encompasses problem identification and motivation, solution objectives, design and development, demonstration, evaluation, and communication. Finally, a conclusion of this project within the domain of ERP provides a detailed description of the key findings, consequences, contributions, future work, and concluding considerations.

2 EXTERNAL ENTITY PRESENTATION

2.1 Products and Services

The NH Coimbra Dona Inês is a hotel located about a 10-minute walk from the centre of Coimbra and the city's train station. It provides vehicle rental services, a tennis court, an outdoor pool, SPA services and a business centre. Every public space has free Wi-Fi access. The Dona Inês Hotel has 122 contemporary rooms, each of which includes a mini-bar, a desk, a flat-screen cable TV, air conditioning and a bathroom. Visitors may unwind at the cutting-edge Ego Lounge Bar. Regional Portuguese dishes as well as foreign cuisine are served at the A Garça Restaurant. The Machado de Castro National Museum, and the renowned University of Coimbra, which is listed as a UNESCO World Heritage Site are all conveniently close to the Dona Inês Hotel. The nearest bus stop is a two-minute walk away (NH Coimbra Dona Ines, 2023).

It celebrated its 30th anniversary in 2022 and according to Diário de Coimbra (2023) it was hailed as "an icon in the city's hospitality" and "for the art of serving well". On November 11, 1992, a three-star residential hotel with 84 rooms initially welcomed its first visitor. Since then, it has undergone several stages of reconstruction and operating growth, solidifying its position in the industry it serves.

Currently, the hotel presents 122 rooms, including its distinctive superior rooms, which were created because of renovation and extension work undertaken to enhance customer comfort and services. The hotel's upgrade to 4 stars was accompanied by new spaces and services offered, namely the pleasant outdoor swimming pool, the new panoramic elevator, the new light-filled breakfast area, the renovated and expanded conference centre adaptable for various meetings and conferences and the expanded and ample parking. All these amenities were designed with the needs of the customer in mind. Along with the continuous training of its team so that they can identify with the well-being of the clients. The management of this business, represented by the Belfo family who maintained the same family ownership structure from the very beginning, decided to change course (Diário de Coimbra, 2023). Thus, from February 2023, this hotel unit, now known as NH Coimbra Dona Inês, established a partnership agreement with the NH

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Hotels group, with which this family group has already been a partner for several years in other hotel units. The addition of this hotel to the well-known global brand NH Hotels will help it reach new markets, further expand its international market and increase its prestige on a global scale (Notícias de Coimbra & Lusa, 2023). The hotel continues to operate in this new phase with the same staff of over 30 employees, led by the director Helena Sequeira, and a committed group from the new partner, particularly in the sales department (Loureiro, 2021).

For the meetings' success, the conference centre at Hotel D. Inês offers qualified solutions catered to a variety of requirements. In addition to facilitating events for 10 to 500 people, it offers adaptable conference rooms with different layouts, dedicated high-speed internet, and multimedia support services. It also has spacious, useful eating areas to match its offers. The mediterranean diet and local goods are highlighted when it comes to food and drink (Notícias de Coimbra & Lusa, 2023).

According to Diário de Coimbra (2023), the welcoming hotel stated that it has "managed to rejuvenate itself in the last three decades in the city of Coimbra, enhancing the experience of those who visit it, with the usual signature that sets it apart: The Art of Serving Well".

Figure 1 illustrates the front view of Hotel Dona Inês, showcasing its modern architectural design with a sleek glass facade and minimalist structure.

Meanwhile, Figure 2 presents the rear view, where features such as the swimming pool and terrace can be observed. Together, these images provide a comprehensive visual overview of the hotel's exterior from both the street-facing and rear-facing perspectives.

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Figure 1. NH Coimbra Dona Inês Hotel (front view)

Source: Foursquare City Guide (2023)

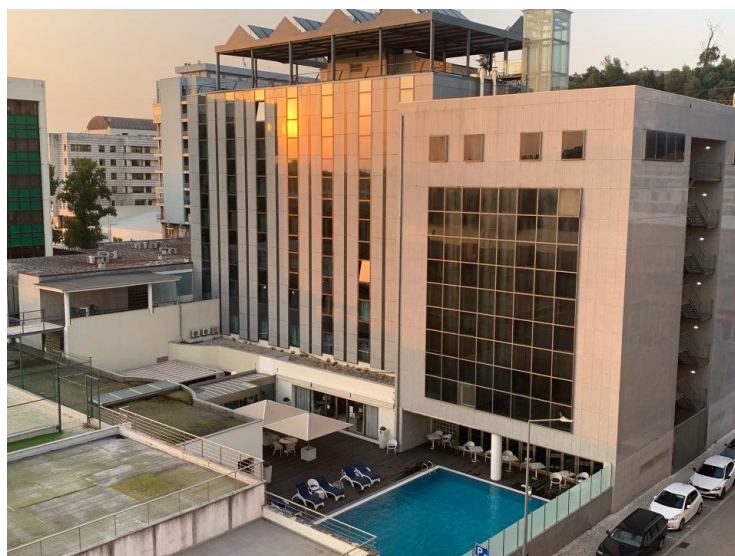


Figure 2. NH Coimbra Dona Inês Hotel (rear view)

Source: HOTEL-RN (2023)

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2.1 Information Systems (IS)

Currently, the Hotel uses a range of digital tools to support its financial and operational processes. These include Home Banking for managing transactions and account monitoring, Point of Sale (POS) systems for handling customer payments, and Systems, Applications and Products (SAP) as an ERP system, which integrates key business functions such as finance and accounting. In addition, the Hotel heavily relies on Microsoft Office tools like Excel for data organization, analysis, and reporting, as well as Portable Document Format (PDF) as the preferential document format for document management and archiving. These tools, while effective, often require manual intervention and integration between platforms, creating opportunities for automation tools and efficiency improvements through technologies such as RPA.

3 LITERATURE REVIEW

This Chapter presents a literature review that results from an extensive investigation of current knowledge in the area of RPA in accounting and finance, as well as the integration of AI technologies within these domains.

3.1 Invoice Processing Method

Large and medium-sized companies deal with a large number of invoices daily and the accountants are responsible for manually entering these details into the systems or databases. A task that is both labour-intensive and time-consuming (Hartikainen et al., 2022).

For processes involving paper invoices, it's necessary to manually cross-reference and verify each invoice against corresponding transaction records. This approach is labour-intensive, prone to errors, and often involves repetitive, tedious tasks. After the electronic invoice is connected to the company's financial management system, the system can automatically match invoices and transfer records according to preset rules, which improves accuracy and efficiency. At the same time, for cases that do not comply with the rules, the system can also issue warnings or prompts in time to help users discover and solve problems in a timely manner (Hartikainen et al., 2022).

Paper invoices need to be sorted and filed manually, while electronic invoices can be automated and analysed directly in the system. For example, the system can automatically classify and calculate invoices according to different categories and time horizons, generating financial statements and analysis results. This not only improves the efficiency of data processing, but also provides more accurate and timely information support for the financial decision-making of enterprises (Yang et al., 2023).

3.2 Robotic Process Automation

Automation is a crucial driver in digital business transformation, impacting both individual tasks and broader processes. While job automation depends on employees' perceptual and analytical skills, process automation is increasingly facilitated by robotic and RPA technologies. Such technologies offer versatile applications across a range of

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organizational settings, from firms to various departments, enhancing productivity and operational efficiency (Lacurezeanu et al., 2020).

RPA encompasses a convergence of interconnected technologies, including Autonomous Systems (AS), Machine Learning (ML), AI, and robotics. These technologies have influenced the structure of RPA solutions, which helped establish a foundation for RPA. The system operates by effectively replicating the activities performed by day-to-day tasks, which involve utilizing established core apps, visiting websites, and manipulating spreadsheets, documents, and email to accomplish various tasks (Kaya et al., 2019). While the name "RPA" may evoke images of physical robots that have been electromechanically engineered to perform a wide range of tasks through computer programming, hence enabling them to autonomously execute intricate sequences of activities carrying out human jobs in office settings, it refers to the automation of service functions that were traditionally executed by people (Madakam et al., 2019). These functions may include the transfer of data from various input sources, such as email and spreadsheets, to ERP and Customer Relationship Management (CRM) systems (Kaya et al., 2019).

3.3 Software selection for RPA

In the realm of automation, this domain encompasses the application of automated systems inside both office and factory settings. The pace of office automation development lags behind factory automation. Since the year 1980, there has been a notable increase of 75% in the level of automation observed in the factory, whilst the degree of automation in the office has only experienced a marginal growth of 3%. At present, there are numerous office automation technologies. One of the most promising technologies in the field is RPA, which has an annual growth rate of approximately 30% (Axmann & Harmoko, 2022).

RPA encompasses three distinct categories, namely the attended robot, the unattended robot, and a hybrid robot that combines elements of both. The robot in question operates in direct conjunction with the user's computer and functions as a personal assistant, necessitating the user to initiate or activate the process. In contrast, unattended robots

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operate inside the confines of the company's server and function with minimal or no human intervention. The hybrid robot is an amalgamation of both attended and unattended robots (Axmann & Harmoko, 2022).

Currently, the industry has three prominent providers of RPA, namely UiPath, Automation Anywhere, and Blue Prism. UiPath, formerly Desk-Over, was founded in Bucharest in 2005. It creates an efficient, resilient, and stable cloud-based robotic workforce. Automation Anywhere, formerly Tethys Solutions, LLC, was formed in 2003. More than 1.5 million bots (RPA robots) have been operating in 20 countries. Automation Anywhere Enterprise A2019, the latest version, leverages intelligence quotient (IQ) bots to recognize documents on a web or cloud platform. Blue Prism was created in 2001 in Warrington, UK. Blue Prism sought to remove low-return, high-risk manual data entering. Blue Prism allows comprehensive automation with clever and responsive bots that handle diverse data kinds. Also, according to Axmann & Harmoko (2022), choosing a successful automation project process is a difficult challenge. Many businesses have realized in recent years how important it is to enable "citizen developers," or non-IT workers who can use low-code/no-code platforms to automate processes and boost productivity. One such tool that makes it simple to create automated workflows without requiring advanced coding knowledge is Microsoft Power Automate. Users may synchronize files, receive notifications, and gather data effectively using Power Automate's seamless platform interaction (Wadiwala, 2021).

3.4 Benefits of RPA

Automation offers many compelling benefits to the workplace and effective and strategic human resource management. Figure 3 shows most important benefits of implementing an RPA system.

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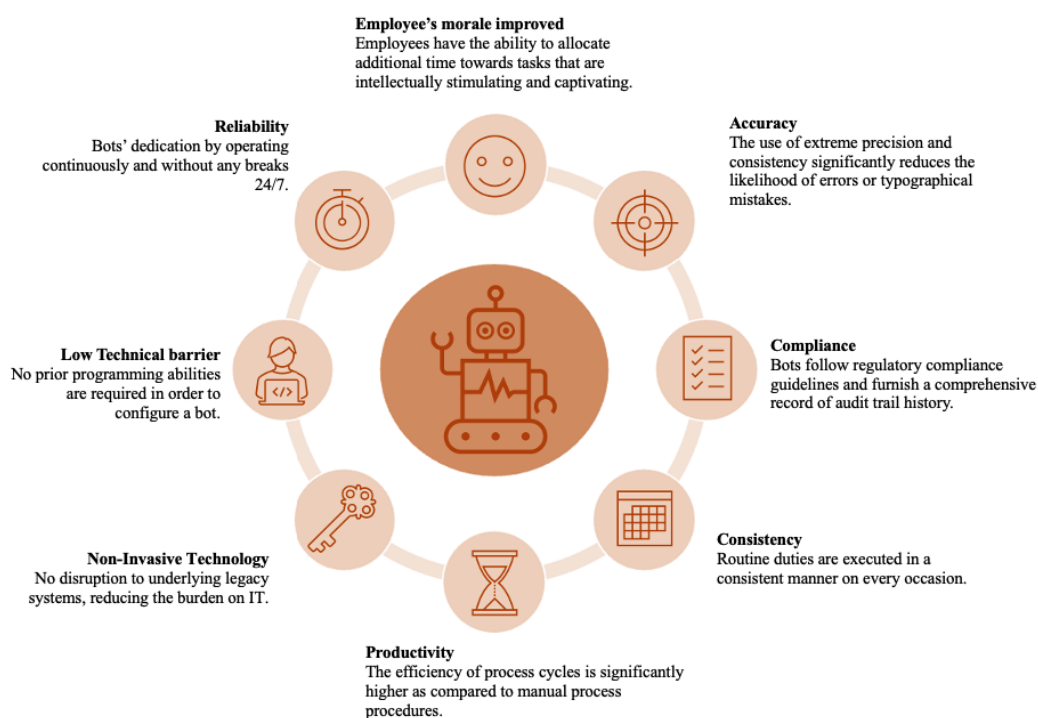


Figure 3. Benefits of Robotic Process Automation

Source: adapted from Madakam et al. (2019)

Implementing RPA can substantially reduce the duration required for the team to accomplish essential tasks, enabling them to allocate additional time towards crucial and strategic initiatives to improve productivity, quality, transparency, accuracy and consistency in data. To ensure adherence to regulatory requirements, the fields of finance and accounting require a high degree of meticulousness. An organization may encounter significant financial consequences because of a single mistake. RPA software effectively enhances the team's precision by mitigating any errors originated from human involvement (Kaushik et al., 2022).

3.5 RPA in Accounting and Finance

The impact of RPA on accounting and finance is well-documented. Prominent research by Moffitt et al. (2018) as cited in Lacurezeanu et al. (2020) has highlighted how robots have been increasingly utilized in these sectors, marking a significant evolution in the way financial services operate. By the nature of its specific activities, the field of accounting services has been directly influenced by the evolution and acceptance of IT.

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The financial and accounting functions of a corporation act as its core systems, continuously driven to evolve alongside technological advancements. RPA technology will undoubtedly have an impact on accounting and finance. The position of accountants is set to undergo a dramatic transition as a result of the automation of accounting operations. Robots and technology will take over manual, time-consuming activities, freeing accountants to concentrate on strategic analysis and thought. As integrated business services solutions utilizing robots take on more transactional tasks, personnel will have more time to focus on decision support, predictive analytics, and performance management. This technological advancement not only increases the productivity of accountants but also enables contemporaneous and continuous reporting and analysis by allowing real-time access to financial data. It is important to realize that this is not replacing accountants; rather, technology is gradually and admirably changing their jobs and allowing them to focus on providing the most value to their enterprises (Kaya et al., 2019).

One advisable approach is to implement automation for operations that exhibit stability (repetitiveness) and reliability (few changes over time). These processes have favourable characteristics for automation due to their high potential for effective and efficient automation, resulting in a timely return on investment (ROI).

According to Harrast (2020), a paper published by Ernst & Young (EY) in 2015, it is evident that the domains of finance and accounting hold considerable appeal for the implementation of RPA. This observation is unsurprising, given the inherent analogy between accounting and finance. Both systems receive data feeds from operational systems and other entities and subsequently carry out data processing. Personnel involved in the accounting and finance domains frequently encounter the need to gather, merge, consolidate, and execute various operations on operational data.

The use of it is frequently employed to enhance efficiency and reduce expenses, particularly in tasks that involve a significant amount of repetition. The EY white paper posits that the accounting and finance sector exhibits unparalleled potential for enhancing efficiency, surpassing other industries in this regard. It further suggests that automation can be applied to any computer-based repetitive process. The transition to analytical work

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is occurring at a rapid pace, and although it may appear exaggerated, the use of this technology is currently prevalent among accounting experts (Harrast, 2020).

Accounting professionals have the opportunity to automate time-consuming activities such as data gathering, entry, and other repetitive processes that formerly constituted a significant portion of their daily workload. An example from Harrast (2020), presents an analysis of the tasks performed by a typical office worker in the accounts payable department, allowing for a detailed understanding of their responsibilities.

The office worker is responsible for receiving bills in the form of email attachments. Upon receipt, the office worker proceeds to open the invoices, print a physical copy, and subsequently enter the relevant data into the accounting information system or the ERP system. This process involves a thorough evaluation of each invoice, including a recalculation of the total amounts. Once the invoices have been inputted into the system, the office worker proceeds to perform a query on the system. This query entails verifying the accuracy of invoice records by comparing the system's total recorded invoices with a separate batch total that has been manually calculated. Once the totals are agreed upon, the process is considered finalized and the bills are filed, awaiting payment by the designated payment officer (Harrast, 2020).

The automated method employs a bot to access the system using its unique credentials and navigates to the directory folder that houses the PDF invoice attachments. The process involves opening each attachment, conducting a scan, and extracting the invoice data from the appropriate fields. Certain vendors have either developed or are now in the process of developing integrated functionalities that enable the extraction of data from business documents through the automated reading of business forms. In the presence of numerical data, the bot possesses the capability to execute a validation procedure on the data to ascertain the accuracy of computations and totals. After the collection of all invoice data, the bot proceeds to access the accounts payable production system. It then navigates to the relevant transaction screen and proceeds to input the invoices individually into the designated fields. Upon the conclusion of the procedure, the automated system commences the generation of an electronic mail that provides a concise overview of the

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completed transactions. The bot primarily performs tasks like an individual but with greater efficiency and the ability to operate continuously day and night (Harrast, 2020).

3.1 Integrating RPA with AI

In (Kitsantas et al., 2024), the authors explore the potential of integrating RPA with AI through different business processes, along with identifying several key application areas, where this integration can significantly enhance operational efficiency. Notably, RPA and AI can be applied in finance and accounting to automate data entry, invoice processing, and financial reporting tasks. In manufacturing, these technologies streamline production processes and improve inventory management. The banking and financial services industries benefit from enhanced customer service through automated responses and transaction processing. Additionally, customer service operations can leverage chatbots and virtual assistants to handle inquiries and support requests effectively. In healthcare, RPA and AI can automate patient data management and various administrative tasks, while in human resources, they can streamline recruitment processes and employee onboarding.

In general, AI algorithms and techniques enhance RPA's performance in critical areas such as information extraction, recognition, classification, and process optimization. This synergy allows RPA tools to handle complex tasks more effectively, leading to improved operational and business processes (Ribeiro et al., 2021).

However, Kitsantas et al. (2024) highlights several limitations and challenges associated with the integration of RPA and AI. One significant concern is the high implementation costs, which can pose a barrier for many organizations. The cognitive constraints of RPA are another limitation, as these systems have limited capabilities when it comes to complex decision-making tasks. Furthermore, integrating RPA and AI with existing legacy systems can be challenging, often hindering the implementation process. Security vulnerabilities are also a critical issue, as intelligent software robots may have access to sensitive data, making them susceptible to cyber threats if not properly secured. Additionally, the lack of technical expertise within organizations can impede the successful implementation and maintenance of RPA and AI systems.

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To overcome these challenges, Kitsantas et al. (2024) suggests several strategies. Firstly, organizations should invest in comprehensive training for employees to ensure they are equipped to work alongside RPA and AI technologies. This approach can help mitigate fears of job loss and improve acceptance of automation within the workforce. Moreover, careful assessment of business processes is essential to identify areas where RPA can add value, ensuring a smooth transition to automation. Establishing governance frameworks to manage risks associated with automation and ensuring compliance with security protocols is also crucial. Finally, the authors emphasize the importance of continuous maintenance and support for RPA and AI systems to ensure they function correctly and securely, adapting to any changes in the business environment.

Although there are challenges in implementing these technologies, the opportunities they present for improving operational performance and responding to market demands are substantial. Ultimately, the collaboration between these tools is positioned as a strategic advancement that can significantly enhance the capabilities of organizations in the digital age (Ribeiro et al., 2021).

4 METHODOLOGY

To fully address the study's aims, the Design Science Research (DSR) methodology was proposed to be used in this project.

DSR is a research approach that aims to create and evaluate innovative artefacts, such as models, methods, and systems, to solve practical problems. The methodology presented incorporates principles, practices, and procedures required to carry out such research and meets three objectives: it is consistent with prior literature, it provides a nominal process model for doing DSR, and it provides a mental model for presenting and evaluating DSR in IS. The methodology is intended to provide a commonly accepted framework, which may contribute to its wider adoption (Peffer et al., 2007).

It aims to present a set of recommendations that delineate the essential qualities of well-executed research in the field of IS discipline, especially focusing on the partial principles for doing DSR whereas these guidelines serve as a framework for ensuring the quality and rigor of it. The following guidelines outline the recommended practices: the research should yield an artifact designed to tackle a specific problem. Moreover, the artifact must contribute to the resolution of a significant and previous unresolved business problem. A thorough evaluation of its "utility, quality, and efficacy" is required (Peffer et al., 2007).

The research should constitute a contribution that can be verified, and both the creation and assessment of the artifact must adhere to rigorous principles. An inquiry-based process should inform the creation of the artifact, which would involve the application of established theories and knowledge to resolve a predetermined issue. Ultimately, the research must be effectively conveyed to the appropriate audiences (Peffer et al., 2007).

To develop this methodology, Peffer et al. (2007) looked to influential prior research and current through to obtain the appropriate elements, by drawing upon the insights provided by prominent researchers in the field, as documented in prior literature, about the practices and recommended approaches of data science researchers. The objective of this study was to develop a methodology that could be widely recognized as a framework for doing research following the principles of data science mentioned earlier. As a result, a process

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model consisting of six activities in a nominal sequence was designed. This process model is designed and described in Figure 4.

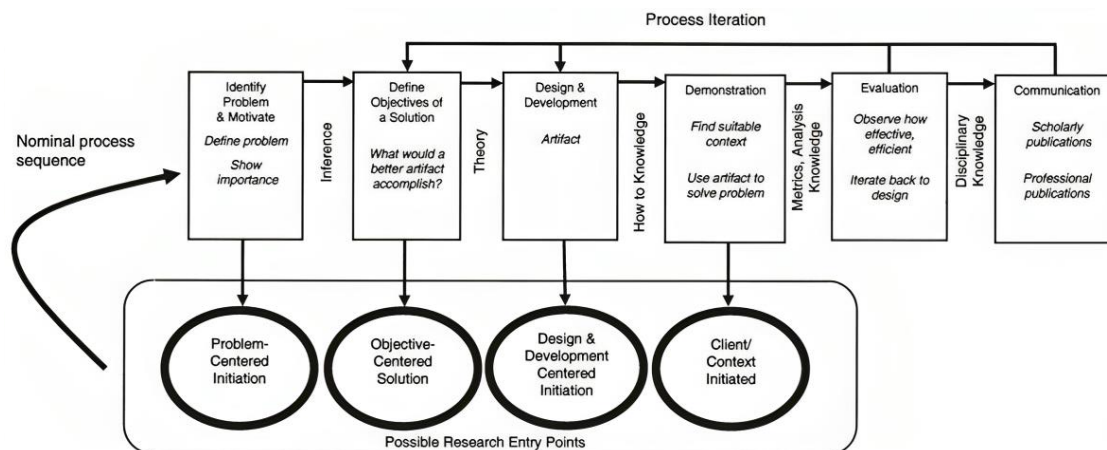


Figure 4. DSR methodology

Source: Peffers et al., (2007).

According to this DSR methodology, a real-world evaluation and implementation is performed to monitor the RPA solution's performance in the hotel company's finance and accounting processes and collect data on its impact.

1. **Problem Identification and Motivation:** This phase establishes the necessity for an RPA solution to address the repetitive and time-consuming manual tasks in finance and accounting at the hotel. The primary motivation is to improve efficiency, reduce human error, and streamline the handling of financial documents that are currently managed manually, like invoices and transaction reports. The problem statement identifies the reliance on conventional, labour-intensive methods that slow down financial processing, potentially leading to delays, inaccuracies, and resource inefficiency.
2. **Define the Objectives for a Solution:** The objective is to develop an RPA system that makes use of AI tools like AI Builder from Microsoft to automate essential finance-related processes, enhancing accuracy, reliability, and efficiency. The solution should streamline document processing, reduce manual data entry, and improve data consistency. Key objectives include automating data extraction from documents, integrating data into spreadsheets, and facilitating seamless document management across Microsoft Office platforms.

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3. **Design and Development:** The design phase involves creating an artefact, and an RPA workflow using Microsoft Power Automate integrated with AI Builder for document processing. This artefact performs functions such as detecting incoming emails with attachments, extracting data from documents, and compiling information in an Excel file. Using tools like OneDrive for document storage and Excel for data entries, this phase focuses on configuring connectors, automation sequences, and validation checks to build a robust, reusable workflow tailored to the hotel's finance processes.
4. **Demonstration:** In this phase, the developed workflow is put into action to showcase its ability to handle real-world financial documents. The workflow is tested with sample documents, demonstrating how it processes incoming financial data, categorizes information, and compiles entry results in Excel. By simulating the actual tasks performed by hotel finance staff, the demonstration validates that the automated process meets initial requirements, performs accurate document handling, and maintains data integrity.
5. **Evaluation:** This phase involves evaluating the RPA workflow's effectiveness by comparing its performance efficiency to manual processes. Metrics such as processing speed and consistency are assessed to determine whether the automation meets the project's objectives. The evaluation establishes the workflow's efficiency and its impact on reducing repetitive tasks in finance operations.
6. **Communication:** The final phase involves documenting the project and its outcomes, with insights into how the RPA solution improved the hotel's finance operations. This phase also includes sharing the DSR approach and findings, which can benefit similar organizations looking to adopt RPA for financial tasks. The communication piece targets stakeholders, the academic community, and RPA practitioners, emphasizing the automation solution's value in reducing manual labour and supporting digital transformation in finance.

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5 IDENTIFY PROBLEM & MOTIVATE

Through the integration of personal interest in the application of robotic technologies in the ERP domain, this project was successfully developed. This study was also motivated by the increasing demand for precision and effectiveness in financial and accounting processes.

A significant amount of manual, repetitive, and time-consuming activities frequently marked the finance and accounting processes in businesses. These activities can result in inefficiencies, elevated error rates, and operational obstacles. Despite the rapid progress in technological innovations, a considerable number of firms continue to heavily depend on conventional, labour-intensive approaches to oversee their financial and accounting operations. The dependence on manual processes possesses the capacity to impede cost-efficiency, precision, and overall efficiency (Kaya et al., 2019).

In this scenario, before the RPA implementation, the company had several difficulties when it comes to accounting invoices management, time management, and document organization. These factors result in inaccuracies, replicated documents, lack of structure, and limited ability to promptly retrieve invoice data. The technologies that were included are Excel, PDF format, Home Banking, POS and SAP ERP. Accounting information such as invoices was dispersed across many platforms and stored as PDF files and checks, resulting in challenges for centralized access and control.

The reliance on files of an employee responsible for data input into the SAP ERP system represents a unique layer of complexity in the company's accounting processes. This worker played a crucial role in transferring data from these papers into the digital system of SAP ERP guaranteeing the incorporation of vital finance data into the ERP. Nevertheless, this manual data entry method presented a series of difficulties. The reliance on a human intermediary for data input culminates in several vulnerabilities, such as errors and overall delays. These transcription procedures were prone to human errors, resulting in inconsistency.

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The need for human data input was limiting resource allocation and consequently efficiency. The activity required a significant amount of time and effort, causing the accountant to shift his attention away from other important activities.

It can also be emphasized issues about redundancy, where similar entries in the system can be performed for equal and different periods.

Below, Figure 5 presents an As-Is diagram describing an overview of the current process handled by the Hotel, designed with a Business Process Model and Notation (BPMN).

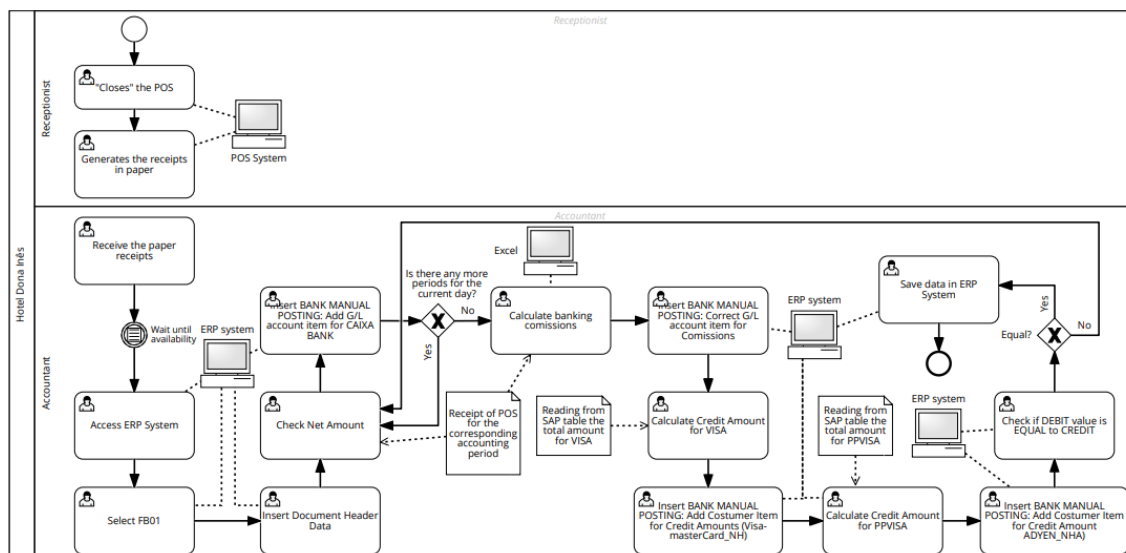


Figure 5. Manual Daily Receipts Process

Below there is a detailed process on how the invoice is processed from the beginning, since the hotel reception to the data input to SAP ERP System.

In the current operational workflow of the hotel, the process of providing data to the accountant for manual entry into the ERP system involves some steps initiated by the hotel receptionist. Before the accountant receives the necessary data for manual input, the receptionist follows a specific routine that includes printing receipts detailing the total value of transactions during the POS closure and the daily SAP tables for credit Amounts for VISA and PPVISA.

Upon the POS closure, the receptionist generates printed receipts to capture the financial transactions recorded during that specific day.

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Each day can have several accounting periods, which means that one day doesn't represent specifically one accounting period.

Notably, for the demonstration below, for the period 19 September 2023, it was used two separate receipts that were created and printed to track the transactions falling within accounting periods 71 and 72. The dual receipts align with the accounting practices of the hotel, reflecting the distinct periods during which financial activities are categorized and managed.

The process begins with the closure of the POS, signifying the conclusion of financial transactions for the day.

The POS system records all financial transactions that occurred during the day, capturing details such as payments and other relevant financial information.

Subsequently, the receptionist initiates the printing of receipts summarizing the total value of transactions. Given the two accounting periods (71 and 72), two separate receipts are generated to align with the hotel's accounting structure. These receipts can be seen in Figure 6.

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HOTELS DONA INES		HOTELS DONA INES LDA	
COIMBRA		COIMBRA	
Ident. TPA:0082724		Ident. TPA:00827243	
2023-09-19 23:53:3		2023-09-19 15:38:05	
Per:072 Tr:011 Mg:7		Per:072 Tr:015 Mg:698	
TOTALS (FECHO/ABERT)		TOTALS (FECHO/ABERT)	
7 454500450006390005		7 454500450006390005	
Conta303040226430647		Conta303040226430647	
COMPRA 009		COMPRA 013	
3071,18 €		1604,38 €	
O-MC CR N 001		MB 001	
Valor 47,60+ €		Valor 76,00+ €	
Desc.: 0,86+ €		Desc.: 0,38+ €	
VI CR EEA 001		VISA DB N 001	
Valor 476,66+ €		Valor 86,00+ €	
Desc.: 2,38+ €		Desc.: 0,43+ €	
VI DB EEA 001		O-MC DB N 002	
Valor 51,60+ €		Valor 20,36+ €	
Desc.: 0,26+ €		Desc.: 0,20+ €	
O-VIC C E 001		VI CR EEA 001	
Valor 35,80+ €		Valor 135,90+ €	
Desc.: 0,64+ €		Desc.: 0,68+ €	
O-V C C N 001		O-VI CR E 001	
Valor 25,00+ €		Valor 6,00+ €	
Desc.: 0,45+ €		Desc.: 0,11+ €	
O-VELC DB 001		MC DB EEA 001	
Valor 8,40+ €		Valor 56,40+ €	
Desc.: 0,08+ €		Desc.: 0,28+ €	
MC CP N 001		O-MC DB E 001	
Valor 1865,32+ €		Valor 23,50+ €	
Desc.: 29,85+ €		Desc.: 0,24+ €	
A.EXPRESS 002		MC C C EE 002	
Valor 560,80+ €		Valor 420,75+ €	
Desc.: 19,63+ €		Desc.: 6,74+ €	
Total a Movimentar		MC C C NE 001	
3017,03+ €		Valor 258,80+ €	
		Desc.: 4,14+ €	
		VI CNEAP 001	
		Valor 441,00+ €	
		Desc.: 7,06+ €	
		MC C TRAV 001	
		Valor 79,66+ €	
		Desc.: 1,27+ €	
		Total a Movimentar	
		1582,85+ €	

Figure 6. Printed receipts by the receptionist to capture the financial transactions recorded during the day

The printed receipts are then handed over to the accountant, who starts his activities according to his availability. The accountant utilizes these documents as a basis for manual data entry into the ERP system. The accountant is responsible for accurately transcribing the financial data, ensuring alignment with the respective accounting periods.

Already in the SAP system, the accountant starts the data input for the cash flow process. This process starts by opening the SAP system. After this, in the “SAP Easy Access Menu for Hotel Director TMS PT13.Porto” page the accountant selects the FB01 directory, as seen in Figure 7. This is the option to start the launch of the cash flow.

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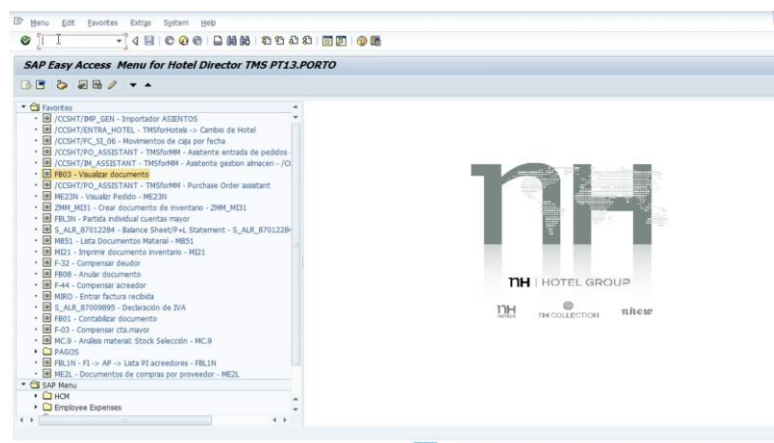


Figure 7. “SAP Easy Access Menu for Hotel Director TMS PT13.Porto” page

In the “Post Document: Header data”, as shown in Figure 8, the employee inserts the variable values for “Document Date”, “Type”, “Company Code” (in this case, always used PT13 since it’s the code of the company we are currently working on), “Posting Date”, the “Period” and finally insert the “Reference” of the document. The employee in every posting entry needs to check if the “Currency” variable entry is accordingly. Also, as previously said, these postings are organized by dates that can have one or more accounting periods. For the current process used by the hotel, it will be demonstrated two SAP postings were assigned for September 19, 2023. One posting for period 71 and another for period 72.

Post Document: Header Data			
Held Document	Account Model	G/L Item fast entry	Post with Reference
Document Date	19.09.2023	Type	lsm
Posting Date	01.10.2023	Period	10
Document Number		Company Code	PT13
Reference	CAIXA 19 sete	Currency/Rate	EUR
Doc. Header Text		Translatn Date	
Trading Part. BA		Cross-CC no.	

Figure 8. “Post Document: Header Data” page

In the “First Line Item” option at the bottom of the page, seen in Figure 9, also in the “Post Document: Header data” page, the employee inserts the “PstKy” (key type) of the

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account, and the “Account” number used by this society to perform the launching of the cash flows of the POS.

The screenshot displays the 'Post Document: Header Data' window. The 'Posting Date' is set to 01.10.2020, 'Document Number' is 1000000000, and 'Reference' is CAIXA 19 aete. The 'Account Model' is set to 'G/L Item fast entry'. The 'First line item' section at the bottom shows 'PstKy' 40, 'Account' 57201901, 'L Ind' checked, and 'TType' empty.

Figure 9. “Post Document: Header Data:” adding “First line item” for net amounts

Firstly, data will be posted for period 71 into the ERP.

In the menu “Insert BANK MANUAL POSTING: Add (or Correct in case correction is needed on already inserted values) G/L account item”, from Figure 10 the accountant inserts the net “Amount”, “Business Area”, “Value Date” and “Text” for context if needed. In order to insert the “Amount”, the accountant checks the total net amount in the paper receipt of POS for the corresponding accounting period. For period 71, the net amount is 1582,85 euros, as seen in Figure 10. This amount can be seen on the right-hand receipt, at the bottom, identified by the green box in Figure 6.

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Enter BANK MANUAL POSTING: Add G/L account item

More data Account Model G/L item fast entry Taxes

G/L Account 57201901 LA CAIXA BANK 1
Company Code PT13 HOTEL DONA INES LDA

Item 2 / Debit entry / 40

Amount 1582,85 EUR
Business Area 1017 Trdg Part.BA
Value Date 19.09.2023
Assignment
Text caixa dia 19 set Long Texts

Next Line Item

PstKy Account SGL Ind New co.code

Figure 10. “Enter Bank Manual Posting: Correct G/L account item” for period 71

The same will be performed for period 72 in Figure 11. To insert other entries, the accountant duplicates the item and follows the same process described above.

The accountant checks the total net amount in the paper receipt from POS for the corresponding accounting period which is 3017,03 euros. This amount can be seen on the left-hand receipt, at the bottom, identified by the green box in Figure 6.

Enter BANK MANUAL POSTING: Correct G/L account item

More data Account Model G/L item fast entry Taxes

G/L Account 57201901 LA CAIXA BANK 1
Company Code PT13 HOTEL DONA INES LDA

Item 1 / Debit entry / 40

Amount 3.017,03 EUR
Business Area 1017 Trdg Part.BA
Value Date 19.09.2023
Assignment
Text caixa dia 19 set Long Texts

Next Line Item

PstKy Account SGL Ind New co.code

Figure 11. “Enter Bank Manual Posting: Correct G/L account item” for period 72

The accountant can check in the “Enter BANK MANUAL POSTING: Display Overview” page, as shown in Figure 12 the current entries made in the system.

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Enter BANK MANUAL POSTING: Display Overview

Display currency: Choose (F2) 19.09.2023 Type: BM Company Code: PT13
 Posting Date: 01.10.2023 Period: 10 Currency: EUR
 Document Number: INTERNAL Fiscal Year: 2023 Translatn Date: 01.10.2023
 Reference: CAIXA 19 SETE Cross-CC no.:
 Doc.Header Text: Trading Part.BA:
 Tax Report Date:

FK	BusA	Acct	EUR	Amount	Tax amnt
001	40	1017 0057201901 LA CAIXA BANK 1		3.017,03	
002	40	1017 0057201901 LA CAIXA BANK 1		1.582,85	

D 4.599,88 C 0,00 4.599,88 * 2 Line items

Other Line Items
 PstKy: count SGL Ind: TType: New co.code:

Figure 12. "Enter Bank Manual Posting: Display Overview" Page

Furthermore, it is necessary to compute the amount of commissions to be included in SAP, as shown in Equation 1. In this case, the accountant uses an Excel spreadsheet to perform this calculation, by deducting the net value from the gross value, both stated on the receipts from Figure 6. This formula is essential for determining and inputting commissions into the ERP system, especially regarding the debit balance.

$$\sum \text{Daily Comissions} = \sum \text{Daily Gross Amounts} - \sum \text{Daily Net Amounts}$$

Equation 1. Calculation of daily commission amounts

Also, in Figure 6, both identified by an orange box, the gross amount for period 71, is 3071,18 euros, and as for period 72, the gross amount is 1604,38 euros.

In Figure 13 it is shown the Excel file used to calculate the commission values. In column C it is inserted the gross amounts and in column D the net amounts. In cell E3 we have the corresponding bank commission for the first amount for period 72 and in E4, the bank commission for the second amount for period 71. This gives a total commission of 75.68 euros to be inserted into the system.

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The Excel spreadsheet displays commission calculations for credit cards. It includes columns for card types (VISA, PPVISA, AMEX), amounts, and commission percentages. The 'Diferença' (Difference) column shows the net amount after commissions.

Card Type	Amount	Commission %	Commission Value	Net Amount
VISA	3071,18	3017,03	54,15	
PPVISA	1604,38	1582,85	21,53	
AMEX				
Total	4675,56	4599,88	75,68	

Figure 13. Excel document used to calculate the commission values

Now in the ERP system, also in the “Enter BANK MANUAL POSTING: Display Overview”, in “Other Line Items” it’s inserted the “PstKy” (key type) and “Account” related numbers of the “CRED CARD COMISS” type of entry. The “PstKy” is 40 and the “Account” is 0066900000, as seen in Figure 14.

The screenshot shows the 'Enter BANK MANUAL POSTING: Display Overview' screen in an ERP system. It includes fields for Document Date, Posting Date, Document Number, Reference, and Doc. Header Text. Below these, there is a table of 'Items in document currency' and a section for 'Other Line Items' where 'PstKy' and 'Account' are specified.

FK	BuaA	Acct	EUR	Amount	Tax amnt
001	40	1017 0057201901 LA CAIXA BANK 1		3.017,03	
002	40	1017 0057201901 LA CAIXA BANK 1		1.582,85	

Other Line Items:

PstKy: 40 Account: 66900000 SGL Ind: TType: New co.code:

Figure 14. “Enter Bank Manual Posting: Display Overview:” adding Other Line of Items for “CRED CARD COMISS” entry

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After this, the manual posting page will open and the accountant will insert the commission “Amount” value and “Business Area” as input. The “Cost Center” and “Profit Center” are filled automatically since they are mapped to the “Business Area” variable. This action is shown in Figure 15.

Figure 15. “Enter Bank manual Posting: Correct G/L account item” for the commission amount

Finally, and transitioning to the credit side, the receptionist also provides a concise table displaying the aggregate amounts of invoices issued according to the payment method, by accessing the SAP instance. This table is shown in Table 1. The hotel makes use of two payment methods: PPVISA and VISA.

Pay. method	Currency	Accr. Tot.	Init. Balan	Tot. Incom	Tot. Outg	Accr. Tot.	Tot. Incom
CASH	EUR	976,20				0,00	0,00
PPVISA	EUR	359,46				0,00	0,00
TRANSFER	EUR					0,00	0,00
VISA	EUR	4.316,10				0,00	0,00

Table 1. Table extracted from SAP, displaying the total amounts according to the payment method

The accountant examines the data and subsequently inputs them into the ERP system individually, with one daily entry for PPVISA and another for VISA. These movements can be identified as being of type “Visa-masterCard_NH” for VISA and “ADYEN_NH” for PPVISA in the ERP System. For both, the corresponding “PstKy” (key type) and “Account” codes are inserted.

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As seen in Figure 16, for “Visa-masterCard_NH” the “PstKy” is 15 and the “Account” code value is 5001001017.

PK	BusA	Acct		EUR	Amount	Tax amnt
001 40	1017	0057201901	LA CAIXA BANK 1		3.017,03	
002 40	1017	0057201901	LA CAIXA BANK 1		1.582,85	
003 40	1017	0066900000	CREDIT CARD COMMISS		75,68	

D 4.675,56 C 0,00 4.675,56 * 3 Line items

Other Line Items

PstKy 15 Account 5001001017 L Ind TType New co.code

Figure 16. “Enter BANK MANUAL POSTING: Display Overview:” adding “Other Line Items” for “Visa-masterCard_NH”
After that, the “Amount”, “Business Area”, and “Bline Date” are inserted as shown in Figure 17. The “Amount” variable can be retrieved from Table 1, which is 4316,10 euros.

Customer 5001001017 Visa-MasterCard_NH DONA INES C G/L Acc 43012000

Company Code PT13 HOTEL DONA INES LDA

Item 4 / Incoming payment / 15

Amount 4316,10 EUR

Bus. Area 1017

Bline Date 19.09.2023

Invoice ref. / /

Pmt Method

Print Block

Payment Ref.

Assignment

Text

Long Texts

Next line item

PstKy Account SGL Ind New co.code

Figure 17. “Enter BANK MANUAL POSTING: Add Customer item” for “Visa-masterCard_NH”

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For ADYEN_NH the “PstKy” is 15 and the “Account” variable value is 5002101017, as seen in Figure 18.

Enter BANK MANUAL POSTING: Display Overview

Document Date: 19.09.2023, Type: BM, Company Code: PT13, Posting Date: 01.10.2023, Period: 10, Currency: EUR, Document Number: INTERNAL, Fiscal Year: 2023, Translatn Date: 01.10.2023, Reference: CAIXA 19 SETE, Cross-CC no.: , Doc.Header Text: , Trading Part.BA: , Tax Report Date: .

PK	BusA	Acct		EUR	Amount	Tax amnt
001	40	1017	0057201901	LA CAIXA BANK 1	3.017,03	
002	40	1017	0057201901	LA CAIXA BANK 1	1.582,85	
003	40	1017	0066900000	CREDIT CARD COMMISS	75,68	
004	15	1017	5001001017	Visa-MasterCard_NH	4.316,10-	

D 4.675,56 C 4.316,10 359,46 * 4 Line items

Other Line Items

PstKy: 15 Account: 5021001017 L Ind: TType: New co.code:

Figure 18. “Enter BANK MANUAL POSTING: Display Overview:” adding “Other Line Items” for ADYEN_NH

And once more, the “Amount”, “Business Area” and “Bline Date” are inserted as shown in Figure 19. The “Amount” can also be retrieved from Table 1, which is 359,46 euros.

Enter BANK MANUAL POSTING: Correct Customer item

Customer: 5021001017 ADYEN_NH DONA INES COIMBRA, G/L Acc: 43012000, Company Code: PT13, HOTEL DONA INES LDA.

Item 5 / Incoming payment / 15

Amount	EUR
359,46	

Bus. Area: 1017, Bline Date: 19.09.2023

Invoice ref.: / / , Prmt Block: , Prmt Method: , Payment Ref.: , Assignment: , Text: , Long Texts: .

Next line item

PstKy: Account: SGL Ind: New co.code:

Figure 19. “Enter BANK MANUAL POSTING: Correct Customer item:” for ADYEN_NH

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Through Figure 20, it can be concluded that the debit amount is equal to the credit amount, which leads to an overall balance of 0 euros. This means that the accountant can save the changes and close the cash flow for the corresponding day in the ERP System.

Enter BANK MANUAL POSTING: Display Overview

Display currency Park document Account Model G/L Item fast entry Taxes

Document Date: 19.09.2023 Type: BM Company Code: PT13
Posting Date: 01.10.2023 Period: 10 Currency: EUR
Document Number: INTERNAL Fiscal Year: 2023 Translatn Date: 01.10.2023
Reference: CAIXA 19 SETE Cross-CC no.:
Doc.Header Text: Trading Part.BA:
Tax Report Date:

PK	BusA	Acct		EUR	Amount	Tax amnt
001	40	1017 0057201901	LA CAIXA BANK 1		3.017,03	
002	40	1017 0057201901	LA CAIXA BANK 1		1.582,85	
003	40	1017 0066900000	CREDIT CARD COMMISS		75,68	
004	15	1017 5001001017	Visa-MasterCard_NH		4.316,10-	
005	15	1017 5021001017	ADYEN_NH DONA INES		359,46-	

D 4.675,56 C 4.675,56 0,00 * 5 Line items

Other Line Items
PstKy count SGL Ind TType New co.code

Figure 20. Enter Bank Manual Posting: Display Overview Page: Check Debit and Credit amounts

During this process, to integrate this meticulously prepared data into the SAP ERP system, the responsible employee faces a labour-intensive and error-prone process as these tasks need to be performed daily. With the help of Excel spreadsheets and formulas, the accountant navigates through the ERP interface, manually entering each calculated amount, selecting appropriate business areas, and assigning the corresponding account codes and dates for each cash flow process entry. This manual handling introduces the risk of typographical errors, inaccuracies, and inconsistencies during the process. The employee can mitigate some of these risks by double-checking (this would lead to overtime consumption), but the potential for human error remains.

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6 DEFINE OBJECTIVES OF A SOLUTION

The project is intended to design and create an RPA solution. These objectives are integral to the overarching goal of enhancing the efficiency of the finance and accounting processes of the hotel organization. These objectives can go from efficiency enhancement to error reduction, to cost reductions, improve accuracy of data and compliance, seamless integrations between existing systems, and a user-friendly interface (Axmann & Harmoko, 2022).

The Ought To-Be Diagram, designed with BPMN, is presented in Figure 21. This figure illustrates the intended implementation of the overall workflow for this project.

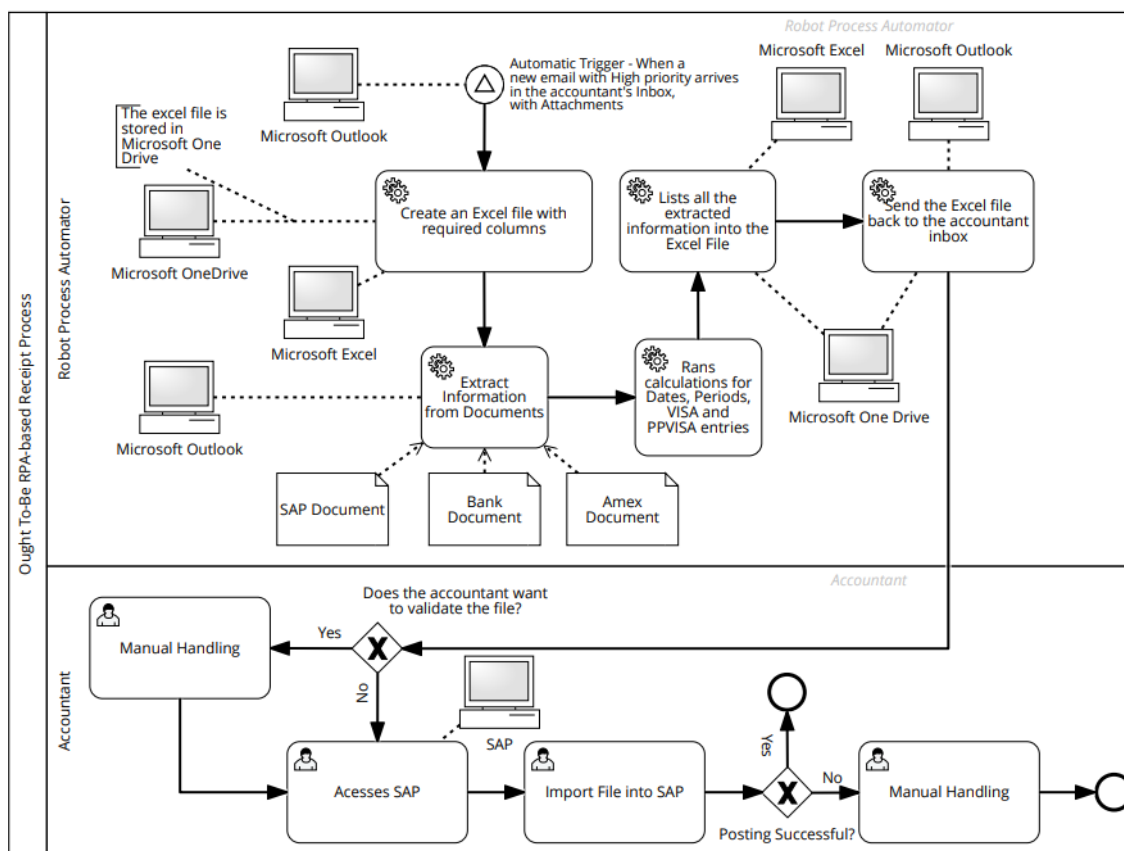


Figure 21. Ought To-Be RPA-based Receipt Process

This process starts with Microsoft Outlook, which automatically is triggered in the workflow when a high-priority email with attachments is received in the accountant's inbox. Once the email is detected, the RPA creates an Excel file containing the necessary processing columns. After the file is created, the attached documents, which can be of

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three types: SAP, Bank or Amex documents, are analysed. The RPA extracts relevant information from these documents and processes the data in Excel, where calculations are performed by dates, periods, and specific VISA or PPVISA transactions.

The completed Excel file is then sent back to the accountant's inbox. At this point, the accountant has the option to validate the file manually. If the validation is not a required step, the file is imported into the SAP system. Once imported, the system checks if the posting was successful. If it is, the workflow ends. If not, manual handling is required to correct the issue.

By achieving these objectives, the solution will ensure smoother integration between existing software systems, reduce the manual workload, and improve overall process transparency and accountability.

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7 DESIGN AND DEVELOPMENT

The project addresses inefficiencies and challenges in the hotel's finance and accounting processes. Traditional manual handling of financial documents led to time-consuming and error-prone processes. To overcome these challenges, an automated solution was implemented to streamline the processing of these documents, ensuring greater accuracy and efficiency.

Although according to Axmann & Harmoko (2022), UiPath, Automation Anywhere, and Blue Prism are leading providers in the RPA industry, Microsoft Power Automate was chosen as the core platform for this project due to several key factors. One of the main reasons is its seamless integration with other Microsoft products, which the hotel already uses, allowing for smoother implementation and minimal disruption for future workflows.

Additionally, according to (Microsoft, 2024), Power Automate offers a free one-month trial, which can be extended, providing 200,000 AI Builder credits for each month. The trial can be renewed at the end of the 30 days, granting another 200,000 credits. Considering that this project involved numerous processing workflows for multiple attempts over three months, approximately 510,000 AI Builder credits were used to support the initial implementation. The credits played a crucial role in allowing for extensive testing and development without incurring immediate costs.

Furthermore, Power Automate's low-code/no-code capabilities are an advantage for the IT employees within the organization, enabling non-technical staff to manage workflows and automate tasks without the need for extensive programming knowledge. This user-friendly interface aligns well with the hotel's operational goals of reducing manual intervention while increasing efficiency and accuracy in handling financial documents such as documents from SAP, Bank, and Amex.

However, it is important to note that while Power Automate provided a non-cost-effective solution during the trial phase, the AI Builder feature used for document processing comes with additional costs. These costs will require further investigation by the hotel, as different packages are offered based on usage. Since this workflow will only need to run

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once a month, the cheapest package “Power Automate Premium” may suffice, ensuring that the solution remains cost-effective in the long term (Microsoft, 2024).

By combining Power Automate with AI Builder tool, the solution allows for seamless document extraction and data processing while reducing manual intervention. Microsoft OneDrive and Excel were also integrated into the workflow for handling and storing processed data, with SAP serving as the target system for final data entry and reporting.

This Chapter presents the To-Be model, separated by individual actions due to the length and complexity of the process. It reflects the current state of the workflow as implemented, outlining the various actions, connectors, validation cycles, and constraints considered during each step. This diagram demonstrates the expected outcomes of using Microsoft Power Automate with AI Builder to automate accounting processes, illustrating how the solution was tailored to the specific requirements of the project.

The automation workflow was designed to streamline the extraction of data from financial documents, including those from Amex, Bank, and SAP. A critical part of this process was the creation of these AI models that were specifically trained to handle the unique data structures within these documents.

Here, two distinct AI models were created using AI Builder: one called “Bank/Amex Document Processing” to handle the Bank and the Amex documents and another called “SAP Document Processing”, to handle exclusively the SAP documents. These models were designed to enable the automatic extraction of structured financial data from these 3 document types.

Below, the process from Figure 22 illustrates the sequential steps involved in choosing, training and deploying a custom AI model using Microsoft AI Builder, designed to automate document processing.

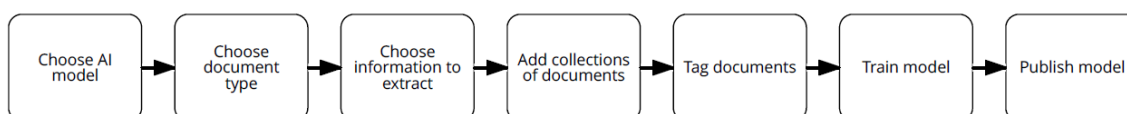


Figure 22. AI Model Creation Process

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The model creation process began by accessing the AI Builder feature within Microsoft Power Automate. The “Document Processing” template was selected, as shown in Figure 23 for both AI Models to allow the identification and extraction of fields that can be tailored to specific needs.

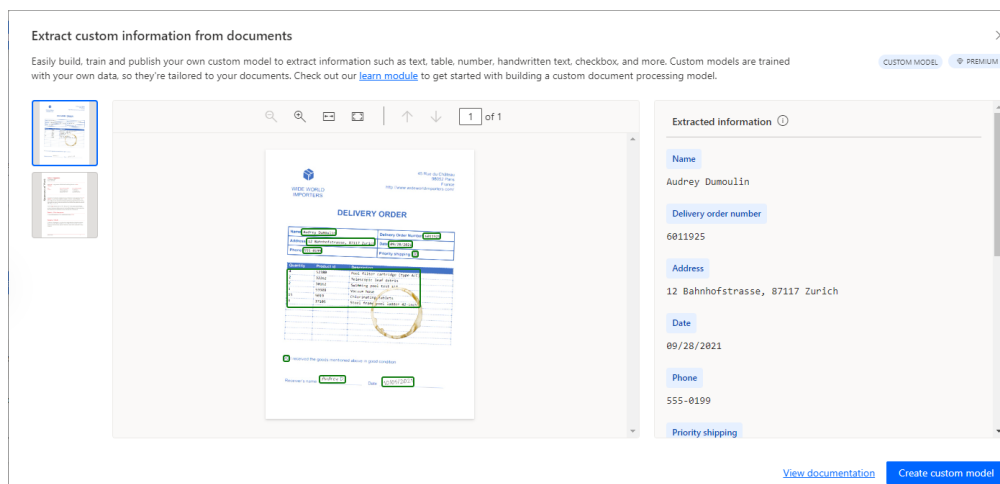


Figure 23. Document processing template

After that, in Figure 24, the document type can be chosen between the three types of documents:

- Fixed template documents
- General documents
- Invoices

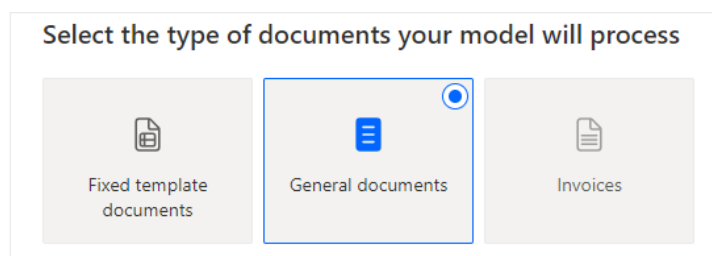


Figure 24. Different document types available for use

For the “Amex/Bank Document Processing”, the “General documents” type was selected. This is the most powerful option for handling long documents, which was necessary given the length and complexity of the documents in this use case. However, the trade-off for

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using this model is that it requires a longer training time, and accuracy scores, after training, are not provided for models trained using the “General document” type.

In contrast, for “SAP Document Processing”, the “Fixed template documents” model was selected. This model is designed for documents with more predictable structures and is ideal for SAP financial documents.

For the “Bank/Amex Document Processing” model, five Amex documents and ten Bank documents were used to train the AI model, as seen in Figure 25

Figure 25. Collection of documents for Bank and Amex documents

. For the SAP Document Processing model, fifteen documents were used, as seen in Figure 26.

Add collections of documents

Add sample documents for your model to study. Put similar documents into the same collection.

Create a collection for each similar documents ⓘ

New collection

Add documents ⓘ

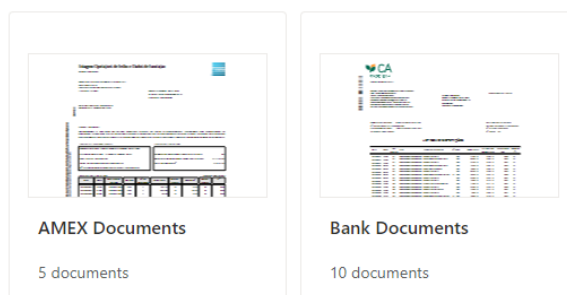


Figure 25. Collection of documents for Bank and Amex documents

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Add collections of documents

Add sample documents for your model to study. Put similar documents into the same collection.

Create a collection for each similar documents ⓘ

New collection

Add documents ⓘ

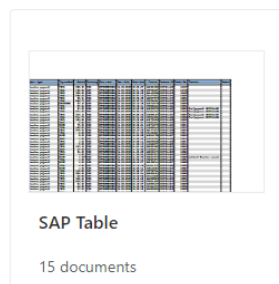


Figure 26. Collection of documents for SAP documents

A Venn diagram was created in Figure 27, to better understand the fields that were mapped from each document, in the "Tag" task, including the cross-document fields. The "Date" and "Amount" fields are common across all three document types: Bank, Amex, and SAP. The "Date" field represents the transaction date and is critical for organizing financial data chronologically. The "Amount" field captures the total value of each transaction. This is one of the most crucial fields, as it represents the monetary sum involved in the transaction.

In addition to the "Date" and "Amount", some fields overlap between the Bank and Amex documents, such as "Service Fee", "Period", and "Hour". The "Service Fee" refers to any charges applied to the transaction, while the "Hour" field records the specific time each transaction took place, allowing for more granular tracking. The "Period" field denotes the accounting period. Note that one day can have multiple periods assigned.

Specific to the Amex document is the "POS ID" field, which serves as a unique identifier for each POS, linking transactions to their respective terminals. Finally, for the SAP documents, this includes exclusively the "Operation Type" and "Payment Method" fields. The "Operation Type" indicates the nature of the transaction, while the "Payment Method" specifies how the transaction was processed, such as through VISA, PPVISA, or cash.

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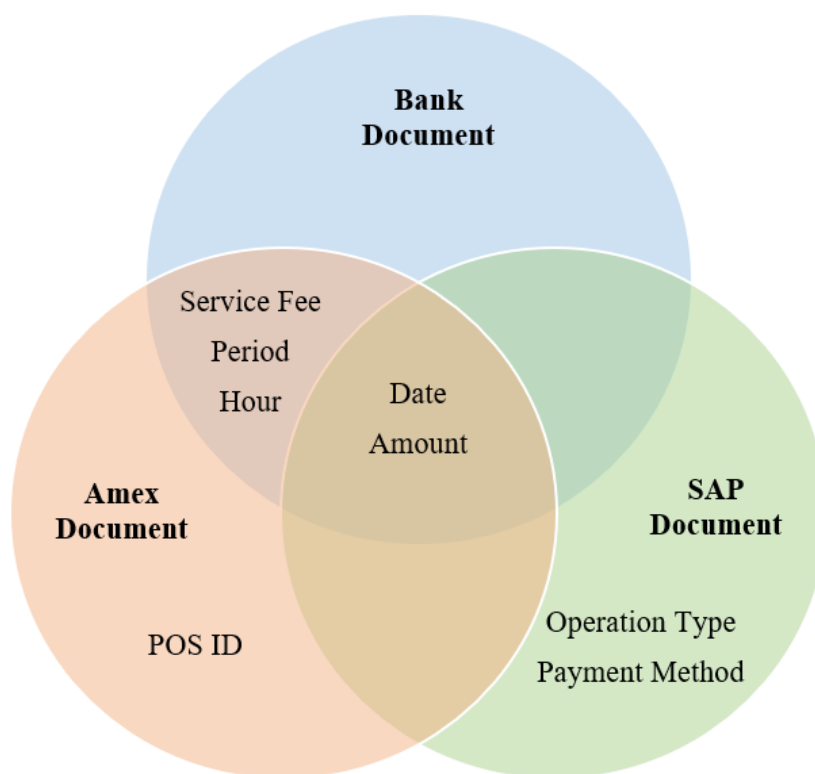


Figure 27. Venn diagram showing the variables used in each type of document

To further illustrate the types of documents processed by the AI models, and all these fields described, three images representing the different document types have been included in the Appendices Chapter. Appendices 1, 2 and 3 represent, respectively, the Bank document, Amex document and SAP document and provide visual examples of the structured fields from which the data was extracted.

As an example, in Figure 28. there's a visual representation of the fields within the bank documents being manually tagged, which involves mapping each line and each column of data in the table. This manual tagging ensured that the model accurately learned how to identify and extract these key fields.

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limit rows and columns

Bank Document

Advanced tagging mode

Ignore first row

Pop-in Off

Off

Comerciante: 002
Nº Pessoa Colect: 002
Estabelecimento: 002
Id Terminal: 0001

Telephone: 238651200
Email: coimbra@iscac.pt
Internet: www.iscac.pt
Linha Directa: Atendimento
pessoal: 213025550
Racional: 808205050 (C
Custo minutos segundo
tarifa 9h-21h) € 0,0354

	Date	Hour	Acc Period	Amount	Service Fee
1	2023/08/31	23:48	61	21,00	0,38
2	2023/08/31	23:48	61	45,00	0,45
3	2023/08/31	23:48	61	27,50	0,28
4	2023/09/02	00:38	62	13,50	0,07
5	2023/09/02	00:38	62	18,00	0,09
6	2023/09/02	00:38	62	49,50	0,50
7	2023/09/02	00:38	62	20,50	0,37

This table continues on next page Done

Date	Hour	Acc	D	E	F	G	Amount	I	Service Fee	J	K	L	M
1	2023/08/31	23:48	61	004530304022643064706	00364 VISA CR E	001	21,00	C	0,38	D	0,06	c)	
2	2023/08/31	23:48	61	004530304022643064706	00355 MASTERCARD DB N	001	45,00	C	0,45	D	0,09	c)	
3	2023/08/31	23:48	61	004530304022643064706	00368 VISA DB E	002	27,50	C	0,28	D	0,07	c)	
4	2023/09/02	00:38	62	004530304022643064706	00355 MASTERCARD DB N	001	13,50	C	0,07	D	0,03	c)	
5	2023/09/02	00:38	62	004530304022643064706	00001 MULTIBANCO	001	18,00	C	0,09	D	0,04	c)	
6	2023/09/02	00:38	62	004530304022643064706	00368 VISA DB E	001	49,50	C	0,50	D	0,03	c)	
7	2023/09/02	00:38	62	004530304022643064706	00489 MASTERCARD CR N-E	A	20,50	C	0,37	D	0,06	c)	
8	2023/09/02	00:38	62	004530304022643064706	00347 VISA DB N	001	37,40	C	0,37	D	0,07	c)	
9	2023/09/02	23:54	63	004530304022643064706	00368 VISA DB E	001	15,00	C	0,15	D	0,02	c)	
10	2023/09/03	23:48	64	004530304022643064706	01003 VISA ELECTRON DB	001	11,00	C	0,11	D	0,02	c)	
11	2023/09/03	23:48	64	004530304022643064706	00368 VISA DB E	002	32,00	C	0,33	D	0,04	c)	
12	2023/09/03	23:48	65	004530304022643064706	IB N-EEA	001	12,00	C	0,12	D	0,02	c)	
13	2023/09/03	23:48	65	004530304022643064706	IB N	001	3,00	C	0,03	D	0,01	c)	
14	2023/09/03	23:48	65	004530304022643064706	00488 MASTERCARD DB N-E	A	16,40	C	0,16	D	0,03	c)	

Click to draw rows or Ctrl + Click to draw columns

Figure 28. Manual tag of columns and rows for the Bank document

This method was consistently applied across all document types in the model, ensuring that the system could accurately interpret and extract the required data from Amex, Bank and SAP documents.

Once the documents were tagged, the AI models were trained. Training for the “Bank/Amex Document Processing” model took longer due to the type of model used and the complexity and length of the documents. However, for the SAP model, the training was faster, and it achieved a high level of accuracy. The “Fixed template” model for SAP reported a 97% accuracy rate, as shown in Figure 29, indicating its effectiveness in handling documents with a predictable structure. As previously stated, the same could not be verified for the “Bank/Amex Document Processing” model since the general document type does not support the accuracy score.

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Models > SAP Document Processing

Document Processing • Fixed template documents • Published • Dona Inês

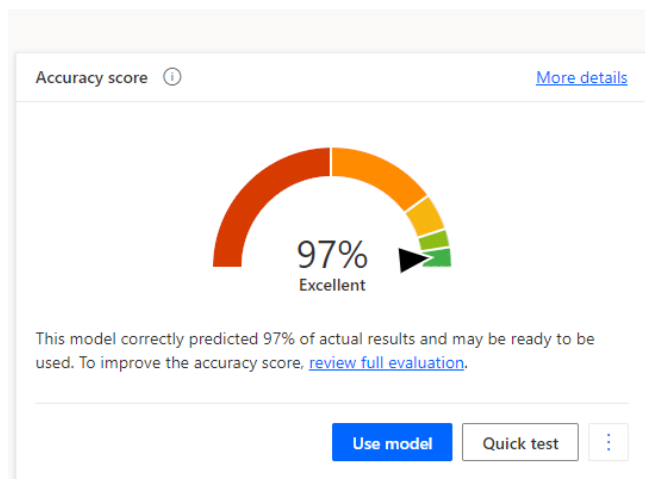


Figure 29. SAP Document Processing model accuracy prediction score

After training and testing, the models were published and integrated into the Power Automate workflow. Once published, these models can be used as desired.

As for the next phase, it involves designing and implementing the workflow to automatically process the financial documents. The workflow begins with a trigger that activates when a new email arrives in the inbox. This initial step is configured to ensure that the flow only processes relevant emails containing attachments. The trigger, titled "When a new email arrives (V2)", seen in Figure 30, is set to monitor the inbox folder specifically. The flow is designed to activate only when an email is sent to "Dona Inês" and comes from "Dona Ines Coimbra". This ensures that only emails from the specified sender are processed, further refining the scope of the workflow.

To make the process even more efficient, the configuration also ensures that only emails marked with high importance will trigger the workflow. This prioritization ensures that the workflow only processes important emails that likely contain the financial documents needed for automated data extraction. Additionally, the workflow is set to include only emails with attachments. This is critical because the primary purpose of the flow is to extract and process data from the attached documents. By using several restrictions, we can use the workflow most effectively only focusing on the necessary emails.

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When a new email arrives (V2)

Parameters Settings Code view About

Advanced parameters
Showing 6 of 9 Show all Clear all

To Switch to Advanced Mode
Dona Inês X
Enter part of a name or email address to find more people

From Switch to Advanced Mode
Dona Ines Coimbra X
Enter part of a name or email address to find more people

Include Attachments
Yes

Importance
High

Only With Attachments
Yes

Folder
Inbox

Figure 30. When a new email arrives (V2)

After the initial email trigger, the workflow proceeds to create three compose actions, as stated in Figure 31. These actions are essential for storing key data that will be used later in the workflow. Specifically, the workflow stores the current year, the current date and time, and the file content of an empty Excel template. This setup is crucial for creating unique Excel files that will be used for importing data into SAP each month.

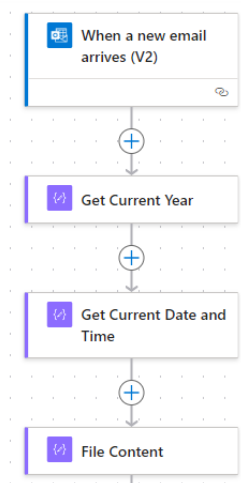


Figure 31. Compose actions related to time information and file content extraction

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To track and count the different types of documents that are sent via email, three integer variables are initialized: “isAmexPresent”, “isBankPresent”, and “isSAPPresent”, each starting with a value of 0. These variables serve as counters to ensure that the appropriate documents (Amex, Bank, or SAP) are processed. Attached below, is Figure 32, showing the variables created.

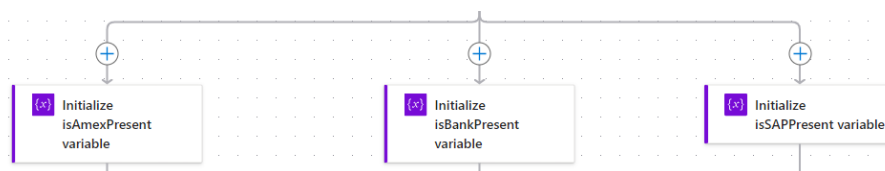


Figure 32. Initialize variables to count the three types of documents sent by email

Since each document type was mapped in AI Builder to extract specific data, it was necessary to store each row of data in an array. This structure ensures that the extracted data is organized and ready for further processing. Additionally, at this stage, the workflow begins to separate the two payment methods, “VISA” and “PPVISA”, from the SAP documents. This separation is important because these payment methods will be handled differently during the subsequent calculation steps and when generating the final Excel file for import into SAP. To accommodate this, four array variables were created: “Amex Document”, “Bank Document”, “SAP Document VISA”, and “SAP Document PPVISA”. These variables can be seen in Figure 33:

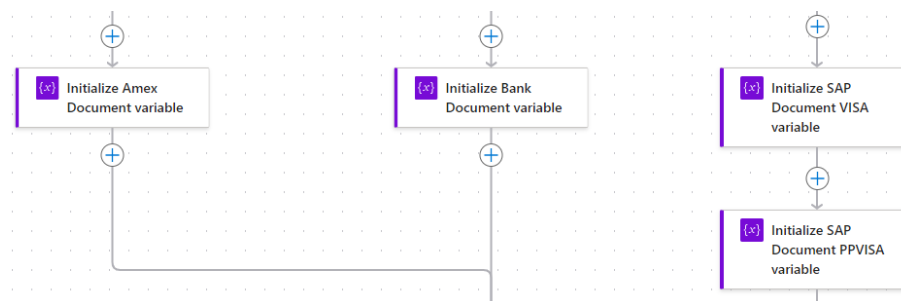


Figure 33. Creation of the four array variables to store each type of document entry

In the next step, a condition is applied to check the counts of the variables tracking the presence of the required documents, to ensure they have been received and processed correctly. The workflow requires exactly one Amex document, one Bank document, and for SAP, the number of documents should correspond to the number of days in the current

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month. To handle this, a group of actions were created to validate that the number of SAP documents matches the days in the month, as seen in Figure 34:

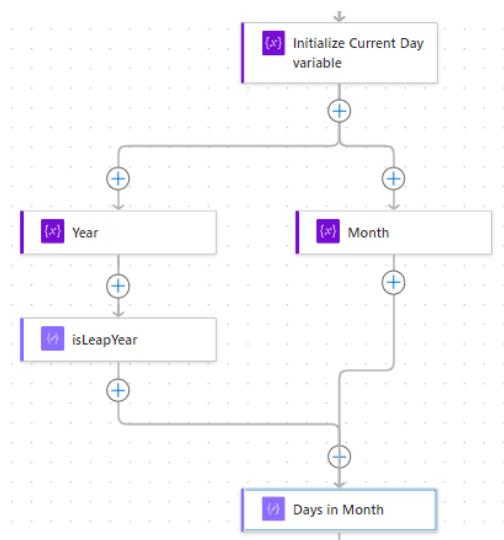


Figure 34. Group of actions to validate that the number of SAP documents matches the days in the month

The variables ensured that today's date, year, and month are stored separately. For the year, a validation is performed to determine whether it is a leap year or not. A leap year is a year that has 366 days instead of the usual 365. A year qualifies as a leap year if it is divisible by 4. However, if the year is divisible by 100, it is not considered a leap year, unless it is also divisible by 400. For instance, the year 2024 will be a leap year because it is divisible by 4 and not by 100, while the year 2000 was a leap year because it was divisible by 4, 100, and 400.

Once we have the relevant data for the year, we can calculate the number of days in the current month using the following expression in Equation 2:

if(equals(variables('Month'), 2), if(outputs('IsLeapYear'), 29, 28), if(or(equals(variables('Month'), 3), equals(variables('Month'), 5), equals(variables('Month'), 7), equals(variables('Month'), 8), equals(variables('Month'), 10), equals(variables('Month'), 12)), 3

Equation 2. Calculation of the number of days in the current month

This expression first checks if the current month is February (month 2). If the month is February, the next step is to check whether the year is a leap year. If the year is a leap year, February will have 29 days. Otherwise, February will have 28 days.

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For all other months, the expression evaluates whether the month is one of those with 31 days, including January, March, May, July, August, October, and December. If the month matches any of these, the result is 31 days.

If the month does not correspond to either February or any of the 31-day months, the remaining months, April, June, September, and November are assigned 30 days.

Now, with all the variables created, it is started the process to count the number of documents of each type that were sent. This way we can ensure that the process contains all the necessary information for a successful import into SAP.

The cycle "Apply to each Email Attachment - count the number of each document type" is responsible for iterating through all attachments in an email and identifying their types based on the document names. This step is essential for distinguishing between different document categories such as Amex, Bank, or SAP, so that the correct number validation can be applied.

An expression using the "contains" function was used to check the name of each attachment, ensuring that it matches one of the predefined keywords used to identify the document type. Specifically, it checks if the attachment name contains either "listagem operações" (which is a common identifier for Amex documents) or "terminal" (typically used for Bank documents). If the document name contains neither of these two keywords, the workflow assumes that the document is a SAP document.

Figure 35 illustrates the overall behaviour of the workflow, demonstrating how the above validations are performed.

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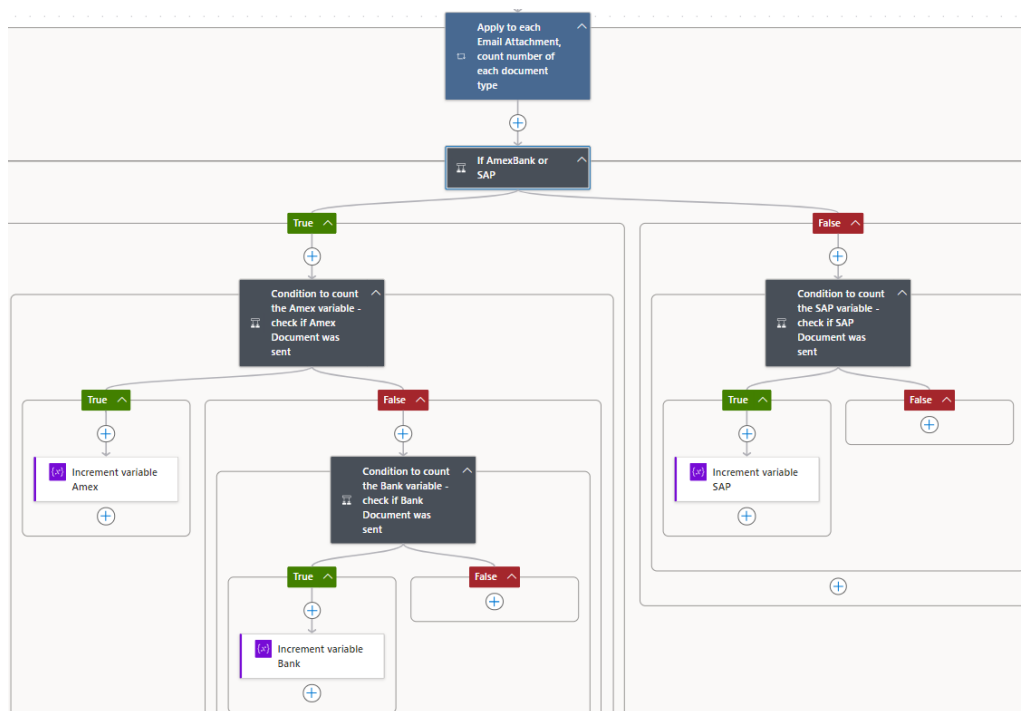


Figure 35. "Apply to each Email Attachment, count number of each document type" cycle

After this, a condition called “Condition to check if all documents were sent with the correct amount” was applied to check if all the required documents were sent in the correct number. This condition is illustrated in Figure 36.

It evaluates the integer variables “isAmexPresent”, “isBankPresent”, and “isSAPPresent”, which were incremented during the previous stage. If all three variables are greater than zero, indicating that the required documents have been sent, the workflow proceeds to the next step. However, if any of these variables hold a value of zero for SAP or Bank, meaning one or more of these documents were not received, or if the value for SAP is less than the number of days in the current month, indicating that the necessary number of SAP documents has not been sent, the workflow terminates with a “Failed” status to prevent further processing with incomplete data.

In this case, an automatic email notification with “High” importance is sent to the user, detailing which document is missing and allowing them to correct the submission and resend the necessary files for processing. The same procedure is followed if too many documents of one type are received.

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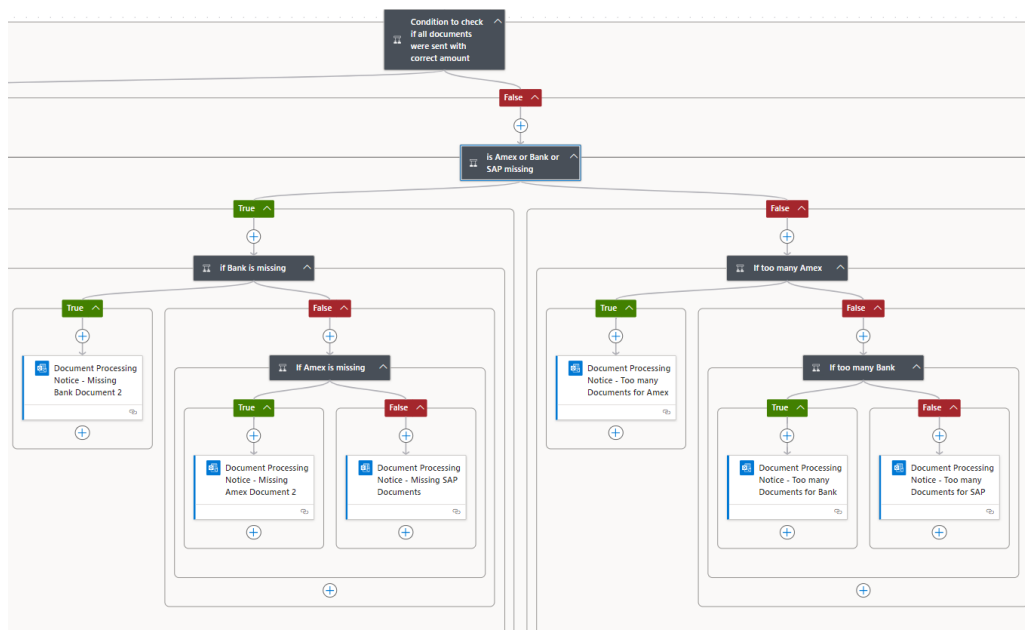


Figure 36. "Condition to check if all documents were sent with correct amount" cycle

Below are attached two examples: one is an email notice sent when there are zero documents of the Amex type (Figure 37), and the other is an email notice triggered for receiving too many documents of the SAP type (Figure 38). In this context, the "Outputs" entry represents the number of days in the current month, which determines how many SAP documents need to be attached.

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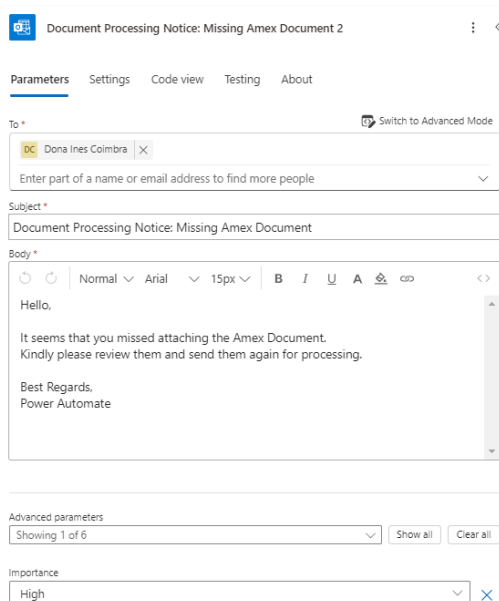


Figure 37. Document Processing Notice: Missing Amex Document

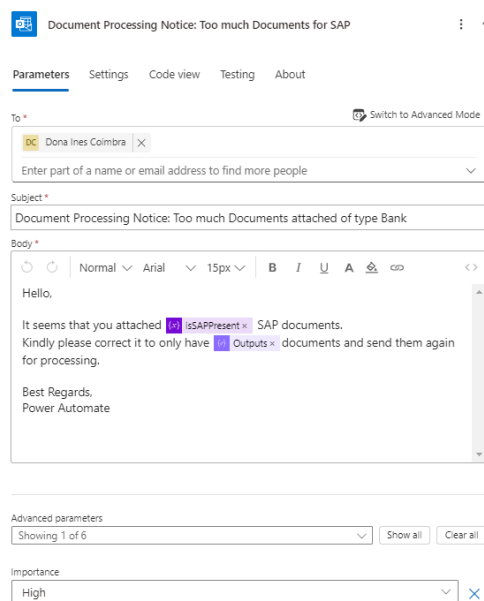


Figure 38. Document Processing Notice: Missing Amex Document

If all the required documents are properly attached, the workflow progresses to the next step for further processing. This document validation step is crucial at this stage to prevent unnecessary consumption of AI Builder credits, which could otherwise be wasted if incomplete sets of documents are submitted. This ensures that the system only processes complete and valid data, improving both efficiency and cost-effectiveness.

With the necessary variables created, the AI models can be applied. Rather than creating a cycle called “Apply to each Email Attachment” from Figure 39, which uses both AI models to analyse each attachment and identify the document type, the same approach was used with the function “contains”. This way we can use a more efficient approach to the AI tool. By using this expression in the Control connector “If AmexBank or SAP”, the workflow was able to efficiently target the “Bank/Amex Document Processing” AI model to handle Amex and Bank documents and the “SAP Document Processing” model for SAP documents based on their filenames.

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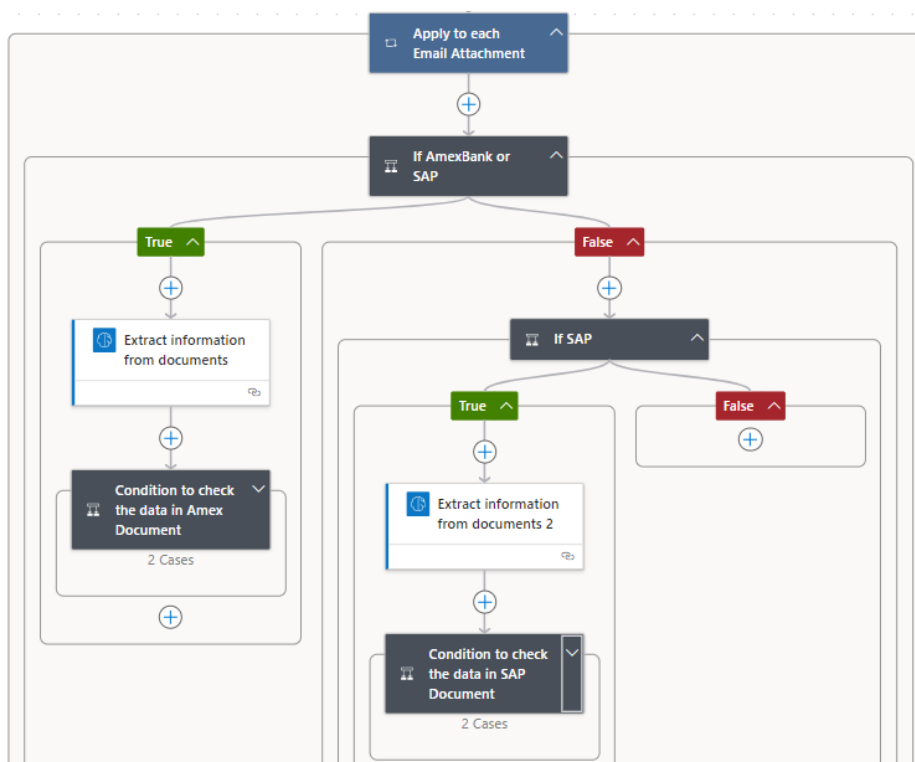


Figure 39. "Apply to each Email Attachment" cycle

If the condition is verified to be "True", meaning the document name contains either "listagem operações" or "terminal", the "Bank/Amex Document Processing" AI model is triggered, as seen in Figure 40.

Extract information from documents

Parameters Settings Code view Testing

AI Model *

Bank/Amex Document Processing

Form Type *

PDF Document

Form *

Attachments Con... x

Figure 40. "Extract information from documents" action that uses Bank/Amex Document Processing" AI Model

This model begins by extracting the mapped data from the Amex and Bank documents.

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Subsequently, in the control “Condition to check the data in Amex Document” from Figure 41, it is validated if the document is effectively a Bank or Amex type.

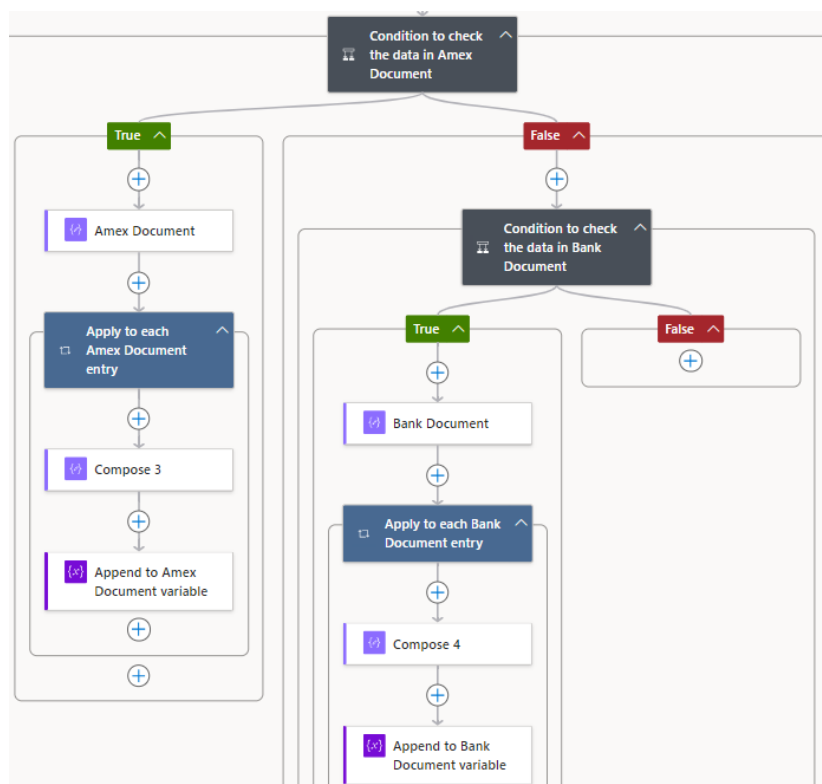


Figure 41. "Condition to check the data in Amex Document" condition

The rows in the documents are stored in the corresponding arrays through the “Append to Amex Document variable” and “Append to Bank Document variable” actions.

In addition to the mapped data with the AI Model, a field named "Total" is created, representing the result of subtracting the “Discount” (“Service Fee” field in the AI model mapping) value from the “Amount”. Another field, "DateTimeSort", is also generated by concatenating the “Date” and “Hour” into a single value. The extracted information is then stored in the corresponding arrays that were initialized earlier in the workflow, ensuring that each document type is processed and organized separately and appropriately.

The arrays for these two types of documents are shown below in Figure 42 and Figure 43:

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{x} Append to Amex Document variable

Parameters Settings Code view About

Name *

Amex Document

Value *

```
{
  "Date": "fx formatDateTime(...) x ",
  "Hour": "fx Hour/value x ",
  "Period": "fx int(...) x ",
  "Amount": "fx Amount/value x ",
  "Discount": "fx Discount/value x ",
  "Total": "fx sub(...) x ",
  "DateTimeSort": "fx concat(...) x "
}
```

Figure 42. "Append to Amex Document variable" variable

{x} Append to Bank Document variable

Parameters Settings Code view About

Name *

Bank Document

Value *

```
{
  "Date": "fx formatDateTime(...) x ",
  "Hour": "fx Hour/value x ",
  "Period": "fx int(...) x ",
  "Amount": "fx Amount/value x ",
  "Discount": "fx Bank Document S... x ",
  "Total": "fx sub(...) x ",
  "DateTimeSort": "fx concat(...) x "
}
```

Figure 43. "Append to Bank Document variable" variable

If the condition seen in Figure 41 in "Condition to check the data in Amex Document" is not verified, meaning it evaluates to False, this indicates that the document does not belong to the Amex or Bank category. The workflow then identifies it as an SAP document, and in this case, the SAP Document Processing AI model is activated, as shown in Figure 44.

G Extract information from documents 2

Parameters Settings Code view Testing

AI Model *

SAP Document Processing

Form Type *

PDF Document

Form *

Attachments Con... x

Figure 44. "Extract information from documents 2" action that uses Bank/Amex Document Processing" AI Model

This model is specifically designed to handle SAP documents by extracting the necessary mapped fields. The extracted data is then stored in either the "SAP Document VISA" or "SAP Document PPVISA" arrays, based on the payment method field extracted from the

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document. To facilitate the validation of the payment method, a condition is applied to the “Payment Method” value mapped through the AI Model. If the method is “VISA”, the entry is appended to the “SAP Document VISA” array, while for “PPVISA”, it is appended to the corresponding “SAP Document PPVISA” array. The rows of data are stored in their respective arrays through the “Append to SAP Document variable VISA” and “Append to SAP Document variable PPVISA” connectors.

Figure 45 illustrates the conditions that determine whether the “Payment Method” is “VISA” or “PPVISA”. This ensures that the data is properly classified into the correct array based on the payment method extracted from the document. This distinction is important as each payment method requires specific handling in the subsequent steps of the workflow.

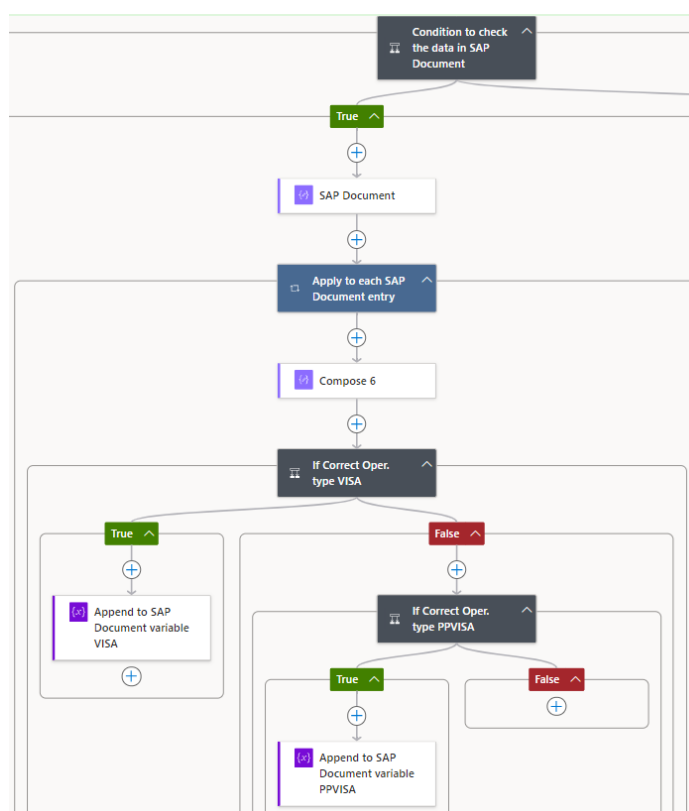


Figure 45. "Condition to check the data in SAP Document" condition

The variables for these two types of entries are shown below in Figure 46 and Figure 47:

Robotic Process Automation (RPA) in Finance and Accounting: A Solution in a Hotel Company

{x} Append to SAP Document variable VISA

Parameters Settings Code view About

Name *

SAP Document VISA

Value *

```
{
  "Doc. Name": " {x} Name x ",
  "Oper. Type": " {x} SAP Table Oper. T... x ",
  "Pay Method": " {x} SAP Table Pay Me... x ",
  "Amount": " {x} float(...) x ",
  "Date": " {x} replace(...) x "
}
```

Figure 46. "Append to SAP Document variable VISA" variables

{x} Append to SAP Document variable PPVISA

Parameters Settings Code view About

Name *

SAP Document PPVISA

Value *

```
{
  "Doc. Name": " {x} Name x ",
  "Oper. Type": " {x} SAP Table Oper. T... x ",
  "Pay Method": " {x} SAP Table Pay Me... x ",
  "Amount": " {x} float(...) x ",
  "Date": " {x} replace(...) x "
}
```

Figure 47. "Append to SAP Document variable PPVISA" variables

The Excel file to be imported into the system is organized by several different entries. These entries correspond to the same ones used in the manual entry process performed by the accountant and are shown in Chapter 5, ensuring consistency. The main difference lies in the source of the information.

The entries are divided into two main groups: debits and credits. The debits represent the accounting amounts derived from the Amex and Bank documents, while the credits are solely represented by the SAP documents.

There are two types of entries for debits: period-based calculations and daily calculations. The period-based entry reflects the net values by period, representing the sum of all gross amounts from the Amex and Bank documents, minus the total of Amex commissions and Bank commissions. The daily entry reflects the sum of commissions from both documents, calculated daily.

Regarding credits, there are also two daily entries. The first is the daily total of all VISA transactions, and the second is the daily total of all PPVISA transactions.

A significant inconvenience in this process is related to when the payment terminal at the reception is closed. In the SAP system, a "day" does not represent a standard calendar day from 00:00 to 23:59. The accounting day ends only when the receptionist closes the

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payment terminal. This discrepancy causes challenges when calculating debits and credits, as the condition in Equation 3 must be validated daily:

$$\text{Credit Amount} - \text{Debit Amount} = 0$$

Equation 3. Equation to validate that the credit amount is equal to the debit amount

For example, a sample of the SAP document from September 18, 2023 can be seen in Table 2. The movements identified by the blue box were recorded on September 19. However, in SAP they occurred on September 18, due to the late closure of the payment terminal.

Oper. type	Pay.method	Amount	Currency	User name	Mov. date	Move.time	Reserv.	Invoice Id	Order No.
Invoice payment	CASH		EUR	HPTDINESREC1	18.09.2023	19:25:38	121966110	6037015525	14138
Invoice payment	CASH		EUR	HPTDINESREC1	18.09.2023	19:25:56	121809330	6037015526	14139
Invoice payment	CASH		EUR	HPTDINESREC1	18.09.2023	19:26:52	121809330	6037015526	14140
Invoice payment	VISA		EUR	HPTDINESREC1	18.09.2023	19:27:08	121809330	6037015527	14141
Invoice payment	VISA		EUR	HPTDINESREC1	18.09.2023	19:27:46	122054805	6037015528	14142
Invoice payment	CASH		EUR	HPTDINESREC1	18.09.2023	19:52:13	122304209	6037015529	14143
Invoice payment	CASH		EUR	HPTDINESREC1	18.09.2023	20:41:18	117983942	6037015530	14144
Invoice payment	CASH		EUR	HPTDINESREC1	18.09.2023	21:20:58	122303269	6037015531	14145
Invoice payment	VISA		EUR	HPTDINESREC1	18.09.2023	21:37:06	122294676	6037015532	14146
Invoice payment	CASH		EUR	HPTDINESREC1	18.09.2023	22:27:52	122309985	6037015533	14147
Invoice payment	CASH		EUR	HPTDINESREC1	18.09.2023	22:28:29	122310198	6037015534	14148
Invoice payment	VISA		EUR	HPTDINESREC1	18.09.2023	22:29:59	122310198	6037015535	14149
Invoice payment	VISA		EUR	HPTDINESREC1	18.09.2023	22:37:27	122008098	6037015536	14150
Invoice payment	VISA		EUR	HPTDINESREC1	18.09.2023	22:43:29	120484580	6037015537	14151
Invoice payment	VISA		EUR	HPTDINESREC1	18.09.2023	23:00:57	121959393	6037015538	14152
Invoice payment	VISA		EUR	HPTDINESREC1	18.09.2023	23:10:21	122106808	6037015539	14153
Invoice payment	VISA		EUR	HPTDINESREC1	18.09.2023	23:43:22	122313118	6037015540	14154
Invoice payment	VISA		EUR	HPTDINESREC1	18.09.2023	23:58:05	122272295	6037015541	14155
Invoice payment	VISA	93,76	EUR	HPTDINESREC1	19.09.2023	02:55:26	122272295	6037015542	14156
Invoice payment	VISA	128,80	EUR	HPTDINESREC1	19.09.2023	03:05:43	122303269	6037015545	14157
Invoice payment	VISA	79,32	EUR	HPTDINESREC1	19.09.2023	03:10:04	120634887	6037015546	14158
Transfer between cash	CASH	1.499,80	EUR	HPTDINESREC1	19.09.2023	03:30:28			14159
Balance	CASH	0,00	EUR	HPTDINESREC1	19.09.2023	03:30:28			14160

Table 2. Sample of the SAP document from September 18, 2023

These transactions were recorded in SAP until 03:10 a.m., which indicates that the terminal was only closed after this time. Even though the transactions are listed as occurring on September 19 in the Bank document, as shown in Table 3, these amounts must be accounted for as September 18 transactions, which means that this discrepancy contradicts the standard rule for calculating daily commissions from the Bank and Amex documents.

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Data	Hora	Per Contab	NIB	Produto Financeiro	Nº Oper	Importância	Tx. Serviço Comerciante	Interchange Fee	Imposto (*)
2023/09/18	15:57	68	004530304022643064706	00486 VISA COMM CR N-EE	001				c)
2023/09/18	15:57	68	004530304022643064706	00391 VISA DB COMERCIAL	N 001				c)
2023/09/18	15:57	68	004530304022643064706	00392 VISA CR COMERCIAL	N 001				c)
2023/09/18	23:15	69	004530304022643064706	00391 VISA DB COMERCIAL	N 001				c)
2023/09/18	23:15	69	004530304022643064706	00364 VISA CR E	001				c)
2023/09/18	23:15	69	004530304022643064706	00363 MASTERCARD CR E	001				c)
2023/09/18	23:15	69	004530304022643064706	00001 MULTIBANCO	001				c)
2023/09/18	23:15	69	004530304022643064706	00496 MCARD CR N-EEA PR	M 003				c)
2023/09/18	23:15	69	004530304022643064706	00494 VISA CR N-EEA PRE	001				c)
2023/09/18	23:15	69	004530304022643064706	00494 VISA CR N-EEA PRE	001				c)
2023/09/18	23:15	69	004530304022643064706	00398 MASTERCARD CR COM	E 001				c)
2023/09/18	23:15	69	004530304022643064706	00484 VISA CR N-EEA	001				c)
2023/09/18	23:15	69	004530304022643064706	00484 VISA CR N-EEA	001				c)
2023/09/18	23:15	69	004530304022643064706	00486 VISA COMM CR N-EE	001				c)
2023/09/19	03:20	70	004530304022643064706	00398 MASTERCARD CR COM	E 001	128,80 C	2,06 D	2,89	c)
2023/09/19	03:20	70	004530304022643064706	00506 MASTER COM TRAVEL	CR 002	173,09 C	2,77 D	3,47	c)
2023/09/19	03:20	70	004530304022643064706	00001 MULTIBANCO	001	1,00 C	0,01 D	0,00	c)
2023/09/19	03:20	70	004530304022643064706	01003 VISA ELECTRON DB	001	118,90 C	0,59 D	0,24	c)
2023/09/19	15:38	71	004530304022643064706	00001 MULTIBANCO	001				c)
2023/09/19	15:38	71	004530304022643064706	00355 MASTERCARD DB N	002				c)
2023/09/19	15:38	71	004530304022643064706	00364 VISA CR E	001				c)
2023/09/19	15:38	71	004530304022643064706	00364 VISA CR E	001				c)

Table 3. Sample of the Bank document from September 19, 2023

The expected behaviour, in the final Excel file, for the same day, is to have one or more entries per period for net values recorded after the closure of POS from the previous day because as mentioned earlier, a single day can have multiple periods, a daily entry for commissions, a daily VISA debit entry, and finally a daily PPVISA debit entry if they exist.

At this point in the workflow, the Excel file where all accounting entries will be recorded is created. Unlike the initial Ought To-Be model, the Excel file is only generated after validating the number of attached documents and extracting the relevant information through AI Builder, and not before. This sequence is followed to avoid creating incorrect and incomplete documents in OneDrive. To achieve the final import into SAP, a “Create File” action in OneDrive was added, as seen in Figure 48. The action generates an empty Excel file in the specified folder path, “/Hotel D Ines Import Accounting”, using the file name “Import_” followed by the current date and time, as captured by the “Get Current Date and Time” action shown previously in Figure 31.

The output in the “File Content” field is populated with the data from the compose action labelled “File Content”, which was initiated at the beginning of the workflow in Figure 31. This ensures that the file created has the appropriate structure and content for import.

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After the file creation, the next step is to use the “Get file content using path” action, as seen in Figure 48. This step retrieves the file content based on its path, ensuring Power Automate has the necessary permissions to access and interact with the file. This action helps resolve any potential permission issues before moving forward with further operations, such as creating a table in the Excel file, that will happen later in the flow.

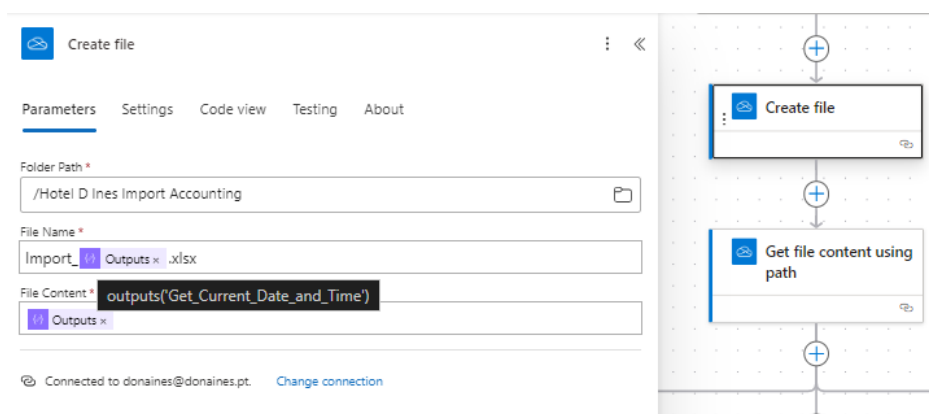


Figure 48. "Create file" action to create an Excel file in OneDrive

At this stage of the workflow, it becomes necessary to execute the calculations mentioned earlier. To ensure maximum efficiency, four parallel processes were created, each representing the operations that need to be performed per day, per period, for PPVISA entries, and VISA entries.

The following description will be a detailed description of Figure 49.

As both daily and period data come from the Amex and Bank documents, a compose function called “Compose Convert to JSON Strings Bank Amex” is used to combine two arrays: Amex Document and Bank Document into a single JavaScript Object Notation (JSON) array. This step ensures that the data from both document types is consolidated for further processing.

For the daily entries related to commissions, four variables were initialized.

“Merged Arrays Date Variable” is an array type of variable used to store the combined and organized array of dates from both document sources, arranged from the earliest to the latest. This sorting process is handled by the next block “Joined Array Dates”, to set the variable value to ensure the dates are ready for calculations.

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“Final Array Dates” variable is initialized as an array type to store the final processed array of dates. After the dates from both sources are merged and joined, the total values are computed, and the sorted dates are stored in this variable. It is specifically used to hold the total daily commissions for each date in the workflow.

“Current Date” variable is a string that tracks the current date during the workflow iteration. It is initialized with the first date from the Merged Arrays Date Variable. The primary purpose of this variable is to keep track of the date being processed at any given moment, which is essential for operations that require date comparisons and calculations, such as determining the total Amount for each day.

“Current Total Date” variable is a float value initialized to store the total commission Amount for each day associated with the current date. As the process iterates through the entries for each day, this variable is updated to reflect the cumulative total for that specific day. This ensures that the workflow can accurately calculate and store day-by-day totals as it progresses.

These variables and processes work together to ensure that the data from the Amex and Bank documents is handled efficiently, with the necessary calculations being carried out for daily and period-based totals. This structured approach guarantees that all relevant information is processed accurately, providing clear and actionable results for each type of document and transaction period.

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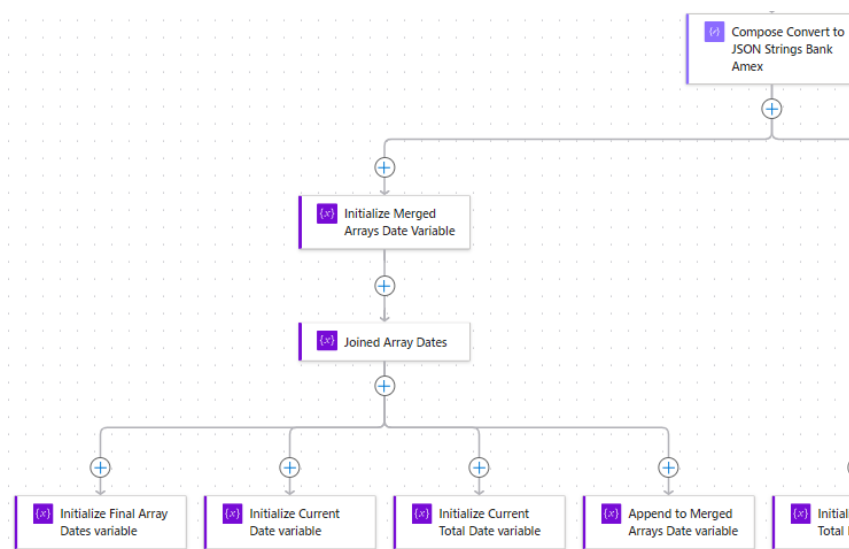


Figure 49. Workflow actions related to Bank/Amex variables for daily calculations

A similar approach is used for the calculations performed by period, in Figure 50. The variables created serve the same purpose and have the same objective as the previously mentioned ones. They are: “Merged Arrays Period Variable” that is used to store a merged array of periods from Bank and Amex entries, “Current Total Period”, which tracks the total Amount associated with the current period being processed and finally “Current period” to store the current period being processed. The only difference is the use of an additional variable called “Current Date for Period”, which is initialized with the first value in the array corresponding to the first date. Although the calculations are being done by period, it is still necessary to store the period's date in each array entry.

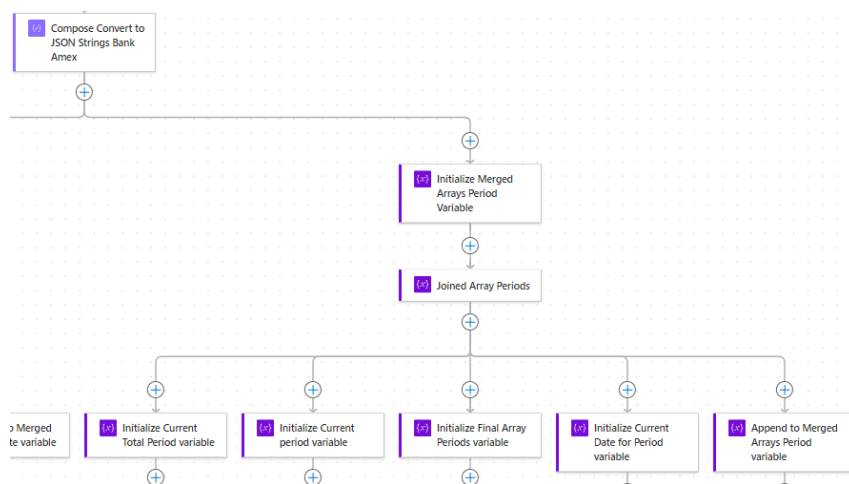


Figure 50. Workflow actions and variables related to Bank/Amex for periodic calculations

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These two workflows include each, an action to append an Amount of 0 at the end of the array called: “Append to Merged Arrays Period variable” for periods and “Append to Merged Arrays Date variable” for dates. This step ensures that the previous value (the last one of the array) can be properly forced in the condition to be appended accordingly to “Final Array Dates” and “Final Array Periods”.

It is important to note that in the two Set Variable actions: “Joined Array Dates” and “Joined Array Periods” the ordering is done through the variable DateTimeSort, created at the beginning, which contains the concatenation of the date and time for each entry. This is crucial because all entries need to be organized by day and time. This approach effectively addresses the issue identified with the terminal's closing. When transitions occur during the early morning, just before the terminal closes, those transactions must be recorded as part of the previous day, so they are stored right next to the last day records, as explained earlier.

In the “Apply to Each Line Date” cycle, each date entry from the “Merged Arrays Date Variable” is processed individually. This cycle ensures that every date is handled one at a time, allowing specific operations to be performed on each, such as calculating totals, comparing values, or appending processed data to the other arrays.

The cycle begins by iterating over each date in the “Merged Arrays Date Variable”, which contains the combined and sorted dates from the Amex and Bank documents. The first action parses each date entry into a JSON object, enabling the workflow to easily access and manipulate the fields associated with that date.

Since at the end of the array it's added a value of 0, it's important to make sure that the last value is appended to the final array. A condition called “Check if Amount is 0 - final append entry for Dates”, makes sure that once the last entry with amount 0 is being processed, the previous one is added.

Following this, a condition named “If Date is not current date” checks whether the current date being processed differs from the previously processed date, which is stored in the “Current Date” variable. If the dates are different, it signals that the workflow has transitioned to a new day, prompting several actions. First, the total commission for the

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previous day is appended to the “Final Array Dates” variable, ensuring that the total for that day is properly recorded before moving on to the next date. Then, the “Current Date” variable is updated to reflect the new date, allowing the workflow to operate correctly on this new day. Finally, the “Current Total Date” variable is updated to account for the total associated with the new date, ensuring the totals are calculated correctly moving forward.

If the date is different from the current date and the hour is less than 05:00, a conditional check for early transactions in “Condition to see if hour is less or eq that 05:00 – Dates”, manages transactions that occurred early in the morning, which might be counted as part of the previous day's totals. This hour, in particular, was used because from all the documents validated, there were no transactions recorded after 5:00, right before the closure of the POS. And it's difficult to track when the receptionist closes the POS, as it can vary daily. If the transaction falls within this time frame, the total is added to the previous day's totals instead of the current date, ensuring that early morning transactions are properly accounted for.

Suppose the current date matches the date being processed (i.e., no transition to a new date is needed). In that case, the workflow adds the Amount from the current entry to the “Current Total Date” variable using the “Add Total to Current Total Date” variable in case same date” action. This ensures that the total commission for that day is continuously updated as the workflow processes each transaction associated with that date. This workflow described above can be seen in Figure 51.

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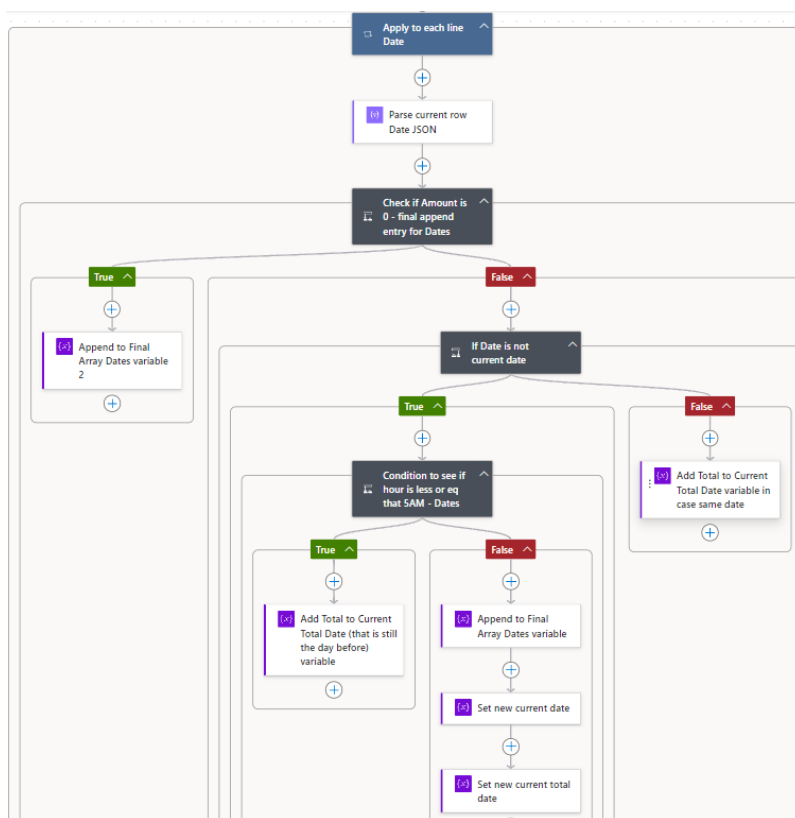


Figure 51. "Apply to each line Date" cycle

For the Period cycle “Apply to each line Period”, in Figure 52, where it can be seen all actions related to this, the same approach is used, taking into account, not only the periods but also the date values of the entries. The cycle starts by parsing each period entry into a JSON object, for the same reasons as in the previous cycle.

Just like what was done with the dates, the same is applied here for the amount of 0. A condition called “Check if Amount is 0 - final append entry for Periods”, makes sure that once the last entry with Amount 0 is being processed, the previous one is added to the final array.

The workflow then checks whether the current period being processed differs from the previously processed period, which is stored in the “Current Period” variable. If the periods differ, this indicates that the workflow has transitioned to a new period, triggering a series of actions. First, the finalized total for the previous period is appended to the “Final Array Periods” variable, ensuring that the results for the completed period are stored before processing the new one. Then, the “Current Date for Period” is set to the

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date of the record currently being processed. Following that, the “Current Period” is updated to match the period of the record being processed. Finally, the “Current Total Period” variable is updated to reflect the total for the new period, ensuring that the workflow tracks and calculates the correct totals as it continues processing.

If a transition occurs before the defined cutoff time of 05:00, the workflow ensures that the data is recorded under the correct date. The process begins by storing any previous unstored period in the "Final Array Periods (store unstored Period) variable" action, ensuring that all data for the previous period is captured before moving to the new one. Next, the "Current Date for Period" is adjusted by subtracting one day from the current date, effectively assigning the period to the previous day. This step is crucial for accurately recording early morning transactions under the prior day's totals, and the function addDays is used to make this adjustment.

The "Current Period" variable is then updated to reflect the correct period while retaining the previously adjusted date. This allows any additional entries for the same period to be correctly added to the "Current Total Period" variable during subsequent steps. Finally, the "Current Total Period" variable is updated to reflect the totals for the adjusted period, ensuring that all entries are processed accurately within the correct timeframe.

Suppose the current period matches the period being processed (i.e., no transition to a new period). In that case, the workflow adds the Amount from the current entry to the "Current Total Period" variable using the "Add Total to Current Total Period in case same Period" action. This ensures that the total Amount for that period is continuously updated as the workflow processes each transaction associated with that period.

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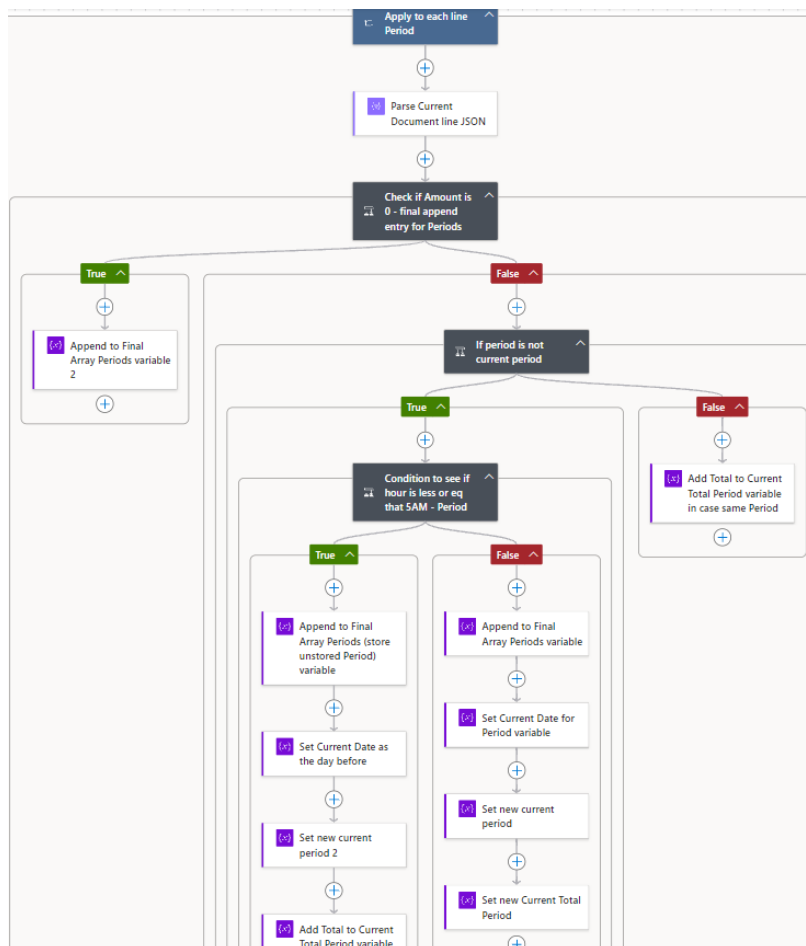


Figure 52. "Apply to each line Period" cycle

Now that the debits have been fully calculated, the focus shifts to the two parallel workflows that handle the PPVISA and VISA credits. Focusing first on the PPVISA entries: any entries related to PPVISA transactions are calculated, using the document name as the key field rather than the date. This approach is essential because SAP document names follow the format “dd-MM-yyyy DETAILS”, ensuring that all entries recorded during a payment terminal cycle from its initiation until the receptionist closes the terminal are properly processed. The workflow calculates the necessary Amounts for each document, with each document representing one transactional day. To enforce the handling of early morning transactions, as shown in the example in Table 2, any transactions occurring during the early hours are recorded in the SAP document for the previous day, ensuring that these entries are properly aligned with the correct transactional period.

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Before the "Apply to Each Line Doc Name PPVISA" cycle begins, several key variables are initialized to prepare the workflow for processing the PPVISA document entries. These variables and actions can be seen in Figure 53 and are essential for organizing, tracking, and calculating data throughout the workflow for PPVISA. Here's an explanation of these variables and their purposes:

The "Merged Arrays Doc Name Variable PPVISA" variable is used to store a combined array of document names from multiple entries related to PPVISA transactions. Since PPVISA transactions may originate from different documents, this variable consolidates all the relevant document names into a single array. The workflow uses this merged array to ensure that all PPVISA documents are processed together.

The "Final Array Doc Name PPVISA" variable is initialized to store the final processed list of PPVISA documents. After the workflow processes the document entries and calculates the totals for each document, the results are stored in this variable. It acts as the final repository for the completed data, holding the totals for each document.

The "Current Doc Name PPVISA" variable stores the name of the PPVISA document that is currently being processed (in the format "dd-MM-yyyy DETAILS"). Initially, this is set to the first document in the merged array. The "Current Doc Name PPVISA" tracks which document is currently being processed, ensuring that the workflow knows when to transition to a new document.

The "Current Total Doc Name PPVISA" variable is used to track the total Amount associated with the current PPVISA document. As the workflow processes each transaction or entry within a document, the Amount from each entry is added to this variable. This variable keeps track of the cumulative total for the document being processed. Once the document is fully processed, the total is transferred to the "Final Array Doc Name PPVISA" variable, and the "Current Total Doc Name PPVISA" variable is reset to calculate the totals for the next document.

This workflow is no exception, as it also includes an operation to append an amount of 0 at the end of the array called: "Append to Merged Arrays Doc Name Variable PPVISA"

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variable”. This step ensures that the previous value can be properly appended to the "Final Array Doc Name PPVISA", maintaining consistency and accuracy in the final totals.

Also, a “Joined Array Dates PPVISA” action was also used here to sort the entries by document name (essentially, with the main goal to sort by date and hour).

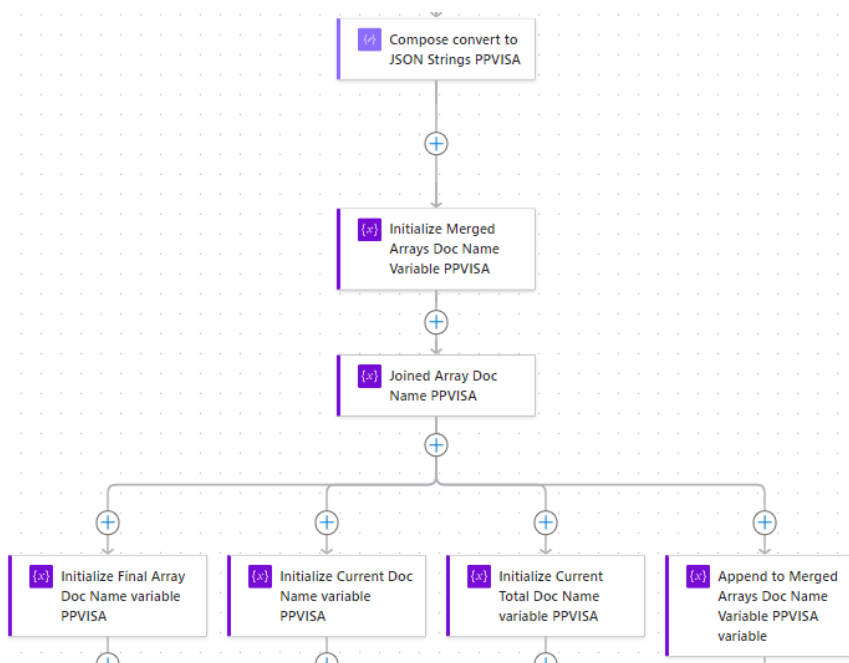


Figure 53. Workflow actions and variables related to SAP for PPVISA calculations

Now that the necessary variables have been initialized, the "Apply to Each Line Date PPVISA" cycle begins its process of iterating over each document entry related to PPVISA. This cycle can be seen in Figure 54.

The first step within this loop is to parse each entry using the Parse JSON action, just like it was performed for the Date and Period cycle. By parsing the entry into a structured format, the workflow can access the key fields of each transaction.

Once the data has been parsed, the workflow checks whether the document name of the current entry matches the document name that is currently being processed, which is stored in the Current Doc Name PPVISA variable. This is a critical decision point, as it determines whether the workflow continues processing the same document or moves to a new one.

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If the current document name differs from the one being processed, the workflow performs several important actions. First, the total Amount for the previously processed document is appended to an array in “Append to array Doc Name variable PPVISA”. This ensures that the totals for each document are stored correctly before moving on. Note that here the Date field being appended is not the date of the transaction. Instead, it’s the date extracted from the variable “Current Doc Name PPVISA” by using a custom expression that reformats the document name into a standard date format. Specifically, the workflow uses the concat function along with substring to extract the day, month, and year from the Current Doc Name PPVISA. The document name is transformed into the format "dd.MM.yyyy". The action extracts the first two characters to represent the day, the next two characters for the month, and then adds "20" before the two-digit year to form the complete year. For instance, if the document name is "19-09-23 DETAILS", the function converts this to "19.09.2023".

Next, the Current Doc Name PPVISA variable is updated in the action “Set new current Doc Name PPVISA” to reflect the new document being processed, and the total amount for the new document is reset to start fresh for the new set of transactions. This structure allows the workflow to seamlessly transition between different documents while keeping track of the totals for each.

However, if the current document name matches the one already being processed, the workflow simply adds the transaction Amount from the current entry to the “Current Total Doc Name PPVISA” variable. This action ensures that the total for the current document is continuously updated as new entries are being processed.

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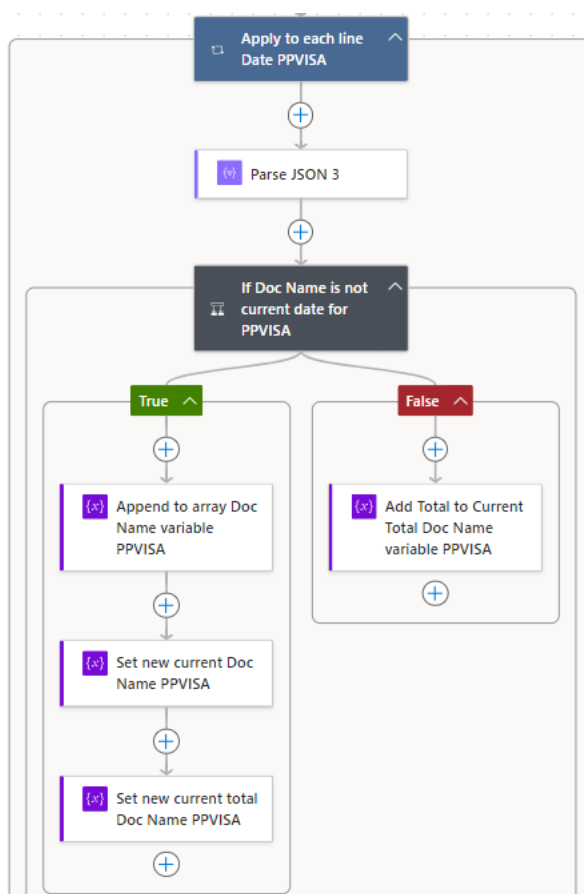


Figure 54. "Apply to each line Date PPVISA" cycle

Finally, for the last parallel workflow, it is handled the VISA transactions. The variables created have the same purpose as the ones made for the PPVISA and can be seen in Figure 55. Here we have the "Merged Arrays Doc Name Variable VISA" variable that is used to store a merged array from multiple entries related to VISA transactions, the "Final Array Doc Name VISA", to store the final processed list of VISA entries, "Current Doc Name VISA" that holds the name of the current VISA entry being processed and finally the "Current Total Doc Name VISA" variable that is used to store the current total Amount.

This workflow also includes an operation to append an amount of 0 at the end of the array, called "Append to Merged Arrays Doc Name Variable VISA". This step ensures that the previous value can be properly appended to the final array, so the previous value can also be appended after processing.

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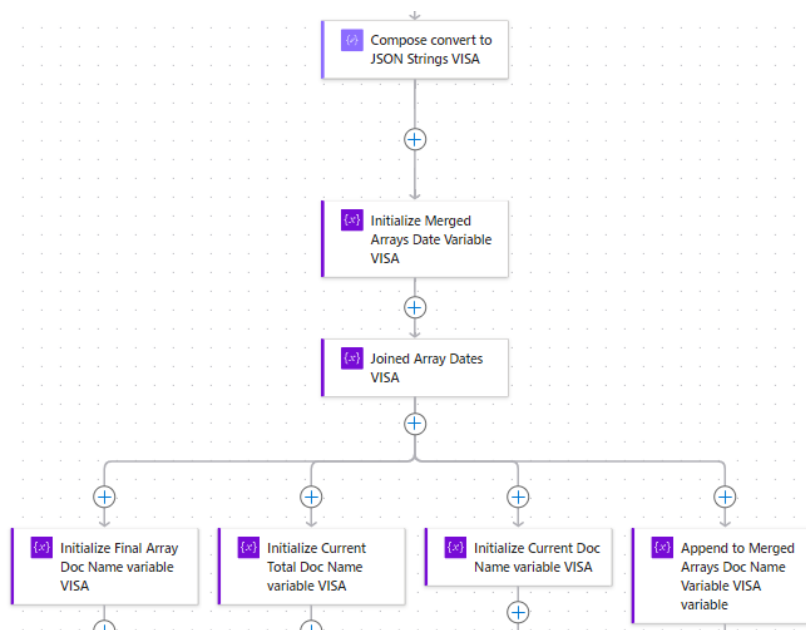


Figure 55. Workflow actions and variables related to SAP for VISA calculations

In the VISA cycle shown in Figure 56, the process is the same as the one used for PPVISA, but with different variable names. The first step involves parsing each entry using the Parse JSON action, just as in the other cycles, to format the data for easy access to fields.

After parsing the entry, the workflow checks whether the document name matches the one currently being processed, which is stored in the “Current Doc Name VISA” variable. If the document name differs, the workflow appends the total for the previously processed document to an array and reformats the document name into a standard date format (“dd.MM.yyyy”). The concat and substring functions are used to extract the day, month, and year from the document name, just as in the PPVISA workflow, ensuring a consistent date format. Once the current document's total is appended, the “Current Doc Name VISA” variable is updated to the new document, and the totals are updated for the next document's transactions.

If the document name matches the current one, the transaction amount is simply added to the “Current Total Doc Name VISA” variable, ensuring that totals for the document are continuously updated as new entries are processed within the same document name.

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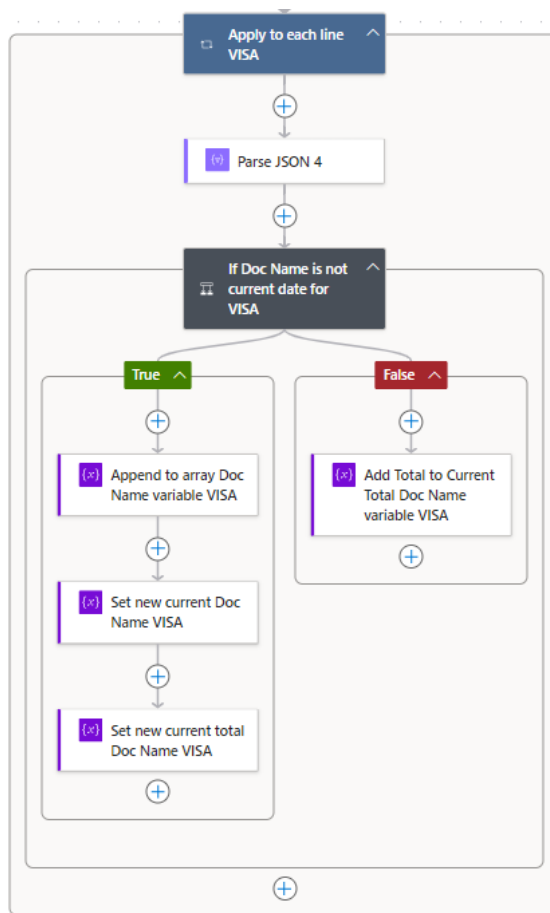


Figure 56. "Apply to each line VISA" cycle

At the end of each of the 4 parallel workflows, it's added a compose action with all four final arrays so at this stage it can be kept track of the final array result. These arrays can be seen in

The formatting of these four arrays is shown in Figure 57, Figure 58, Figure 59 and Figure 60:

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Name *

Final Array Dates

Value *

```
{
  "Date": {x} Current Date x ,
  "Total": {x} Current Total Date x
}
```

Figure 57. "Final Array Dates" variable

Name *

Final Array Periods

Value *

```
{
  "Date": {x} Current Date for ... x ,
  "Period": {x} Current period x ,
  "Total": {x} Current Total Peri... x
}
```

Figure 58. "Final Array Periods" variable

Name *

Final Array Doc Name VISA

Value *

```
{
  "Date": {x} concat(...) x ,
  "Total": {x} Current Total Doc... x
}
```

Figure 59. "Final Array Doc Name VISA" variable

Name *

Final Array Doc Name PPVISA

Value *

```
{
  "Date": {x} concat(...) x ,
  "Total": {x} Current Total Doc... x
}
```

Figure 60. "Final Array Doc Name PPVISA" variable

With all the final arrays containing the necessary information for the amounts to be imported into SAP, the process of building the Excel file begins. The first step involves constructing the "Journal" table shown in Figure 61, which includes all the required columns to align with SAP's data import requirements. This table is generated using the file ID from the "Create file" action as a key parameter, ensuring the file is correctly referenced throughout the process. This step is crucial as it sets the foundation for the structured import into SAP.

Create Table

Parameters Settings Code view Testing About

File *

Table Range *

\$A1:AW1

Advanced parameters

Showing 2 of 2

Table Name

Journal

Columns Names

BUKRS;BLART;BUDAT;BLDAT;XBLNR;WAERS;BKTX;BUZEI;BSCHL;UMSKZ;KUNNR;LIFN;R;HKONT;GSBER;KOSTL;WRBTR;ZUONR;SGTXT;XREF2;NEWBKZTERM;BVTYP;ZFBDT;L ONG_TEXT;MONAT;VATDATE;XMMWST;MWSKZ;FWBAS;XREF1;VBUND;PRCTR;KURSF; WWERT;AUFN;SEGMENT;XREF3;ZLSCH;HBKID;HKTID;WITHT;QSSKZ;QSSH;VERT;V ERTN;MATNR;WERKS;STGRD;STODT;

Figure 61. "Create Table" action

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Once the table structure is in place, a second header is added to the file. This step is essential because it guarantees that the format meets SAP's specific requirements. The second header defines each column clearly, matching the fields needed for successful data integration into SAP. Figure 62 shows, as an example, some of the second header texts assigned to their corresponding column.

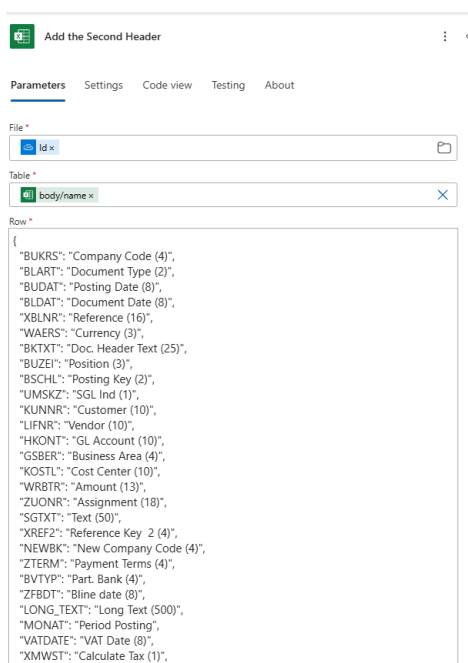


Figure 62. "Add the Second Header" action

Table 4 presents a detailed comparison of the document entries for the four types. Each field in the table corresponds to a specific piece of data required for SAP imports, and the values are either static or dynamically generated, depending on the document type and information.

The company code remains constant across all four document types, set to "PT13", which ensures that all transactions are correctly attributed to the designated company in SAP.

In the document type field, all four entries use "BM", which is a standard code for the financial document type in SAP.

For the posting date, the values are dynamically derived from the processed data. In the case of Dates and Periods, the workflow extracts the relevant date from each entry and formats it to "dd.MM.yyyy", ensuring that the posting date is accurately recorded. For

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PPVISA and VISA, the date is also extracted but formatted using a different function that replaces dashes with periods, ensuring that the date format aligns with SAP's requirements.

The "Document Date" across all four types is set to the current date, using the function `@{utcNow('dd.MM.yyyy')}`. This ensures that the date of document creation reflects the exact day the workflow processes the entry.

The "Reference" field behaves similarly to the Posting Date, where for Dates and Periods, the reference is based on the dynamically formatted posting date. For PPVISA and VISA, the same date extraction and formatting method is used, maintaining consistency in how the reference information is applied. This ensures that each document is properly traceable by its reference date.

The "Currency" field is uniform across all entries, set to "EUR", ensuring that all transactions are recorded in euros.

The "Position" field uses the "Position Counting" variable, which increments each new entry by one. This provides a unique row ID for every line item, a critical requirement for SAP's import process where each transaction must have a distinct identifier. Below in **Figure 63**, it is shown the action to update the "Position Counting" variable for period entries.

Figure 63. "Increment Position Counting by 1 - Periods" action

For the "Posting Key", it is shown different values. For dates and period entries, the posting key is set to "40", which denotes a debit entry in accounting. On the other hand, the PPVISA and VISA entries use "15", representing a credit entry.

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In the “Customer” field, the values are specific to PPVISA and VISA, with "5001001017" representing the customer involved in those credit transactions. This field is left empty for Dates and Periods, as customer information is not required for those types of entries.

The “GL Account” shows different values depending on the document type. For Date entries, "66900000" is used, while for Period entries the account is "57201901". These variations reflect different general ledger accounts based on the type of transaction.

The “Business Area” is consistently set to "1017" for all document types. This indicates that all entries fall under the same Business Area within the company.

In the “Cost Center” field, a value is only provided for “Date” entries, with "PT131017AD" being used. This field is left empty for the other document types, as cost center information is not required for those transactions.

The “Amount” field is calculated dynamically for each document type. The workflow formats the Amounts with the required decimal points and replaces periods with commas, adhering to European number formatting standards.

Finally, the “Text” field is used only for PPVISA and VISA entries, where a dynamic value is generated that includes the current date and time. This text field provides a short description of the transaction, such as "Caixa" with the timestamp, allowing for easier identification of each entry within SAP. For Date and Period entries, this field is not used. All values in the Excel file are handled as string types and this structure ensures that all document types are processed consistently, with the appropriate fields being populated according to the type of entry. It is noted that each entry is prepared in line with SAP’s requirements, ensuring that the import process runs smoothly and accurately reflects the company’s financial data.

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Table 4. Document entries on each field for the four types of entries: Dates, Periods, PPVISA and VISA

Field	Dates	Periods	PPVISA	VISA
Company Code (4)	PT13	PT13	PT13	PT13
Document Type (2)	BM	BM	BM	BM
Posting Date (8)	@{formatDateTime(items('Apply_to_each_-_Dates')['Date'], 'dd.MM.yyyy')}	@{formatDateTime(items('Apply_to_each_-_Periods')['Date'], 'dd.MM.yyyy')}	@{replace(string(items('Apply_to_each_-_PPVISA')['Date'], '-', ':'))}	@{replace(string(items('Apply_to_each_-_VISA')['Date'], '-', ':'))}
Document Date (8)	@{utcNow('dd.MM.yyyy')}	@{utcNow('dd.MM.yyyy')}	@{utcNow('dd.MM.yyyy')}	@{utcNow('dd.MM.yyyy')}
Reference (16)	@{formatDateTime(items('Apply_to_each_-_Dates')['Date'], 'dd.MM.yyyy')}	@{formatDateTime(items('Apply_to_each_-_Periods')['Date'], 'dd.MM.yyyy')}	@{replace(string(items('Apply_to_each_-_PPVISA')['Date'], '-', ':'))}	@{replace(string(items('Apply_to_each_-_VISA')['Date'], '-', ':'))}
Currency (3)	EUR	EUR	EUR	EUR
Position (3)	@{string(variables('Position Counting'))}	@{string(variables('Position Counting'))}	@{string(variables('Position Counting'))}	@{string(variables('Position Counting'))}
Posting Key (2)	40	40	15	15
Customer(10)			5001001017	5001001017
GLAccount (10)	66900000	57201901		
Business Area (4)	1017	1017	1017	1017
Cost Center (10)	PT131017AD			
Amount (13)	@{replace(string(formatNumber(items('Apply_to_each_-_Periods')['Total'], '#####.00')), ',', ' ')}%	@{replace(string(formatNumber(items('Apply_to_each_-_Periods')['Total'], '#####.00')), ',', ' ')}%	@{replace(string(formatNumber(items('Apply_to_each_-_PPVISA')['Total'], '#####.00')), ',', ' ')}%	@{replace(string(formatNumber(items('Apply_to_each_-_VISA')['Total'], '#####.00')), ',', ' ')}%
Text (50)			Caixa @{outputs('Get_Current_Date_and_Time')}	Caixa @{outputs('Get_Current_Date_and_Time')}

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Each type of entry is processed by its dedicated cycle. Every time an entry is added to the table, the position counter is updated by incrementing its value by one. These cycles can be seen in Figure 64, Figure 65, Figure 66 and Figure 67.

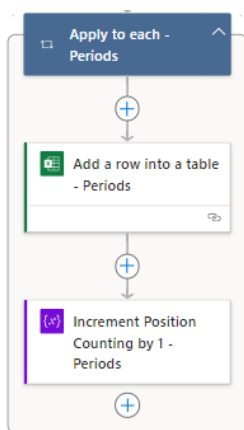


Figure 64. "Apply to each - Periods" cycle

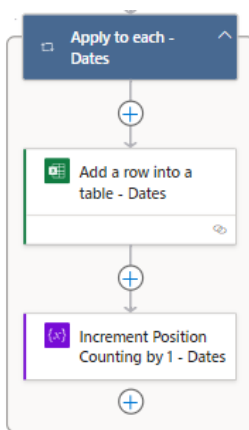


Figure 65. "Apply to each - Dates" cycle

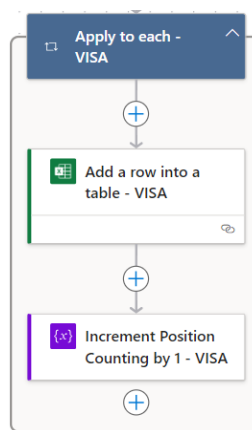


Figure 66. "Apply to each - VISA" cycle

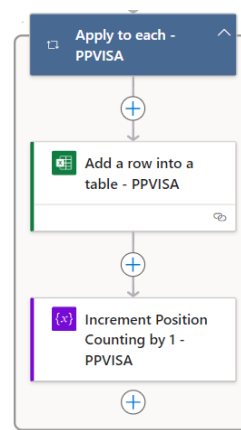


Figure 67. "Apply to each - PPVISA" cycle

An example can be seen in Figure 68, on how it is mapped the variables shown in Table 4 in the cycle from Figure 64.

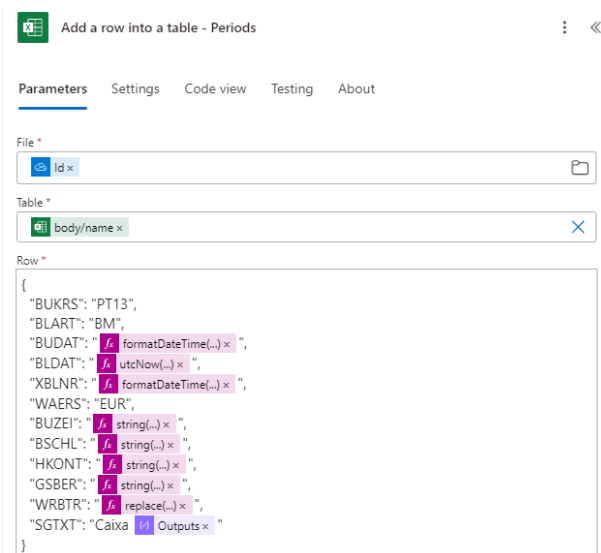


Figure 68. "Add a row into a table - Periods"

Once all the data for import has been added to the Excel file, the file content is extracted in the action "Get file content using path 2", from Figure 69.

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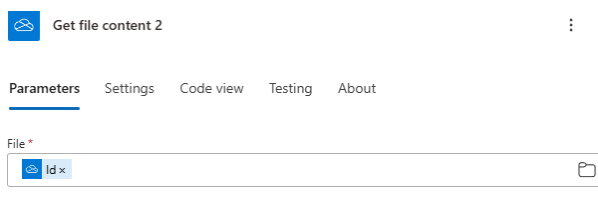


Figure 69. "Get file content 2" action

This allows the file to be attached later to an email, which is then sent to the accountant for further action. The email is sent with high priority and contains the file and relevant content necessary for the import into SAP. This can be seen in Figure 70 and Figure 71.

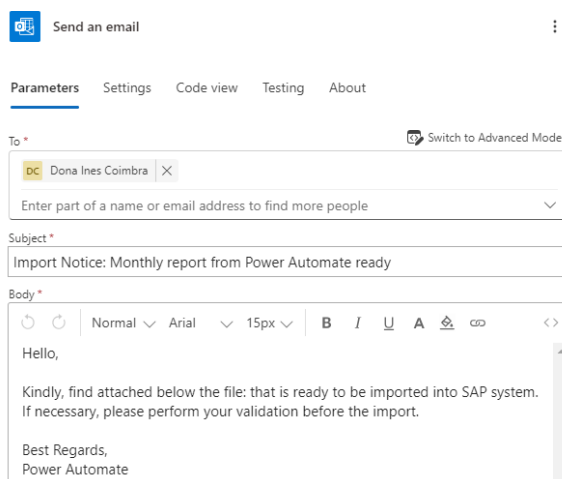


Figure 70. "Send an email" action, showing the email receiver, subject and body of the email

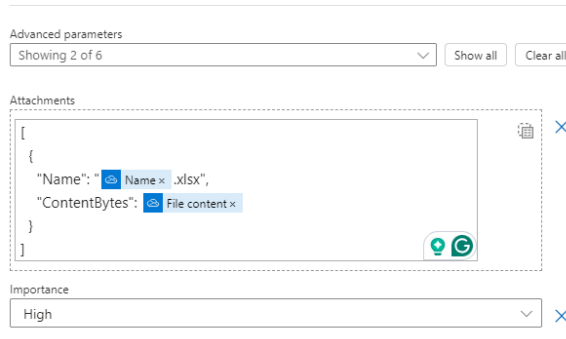


Figure 71. Advanced parameters from the "Send an email" action: Attachments definition and Importance level

At this point, the workflow in Power Automate is completed, and the accountant can access the SAP system and perform the import using the prepared Excel file. This final step ensures that all the processed data is successfully delivered to the accountant so he can import it into SAP.

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8 DEMONSTRATION

Now that the design and development phase is complete, the next step is to move on to the Demonstration Chapter of the DSR methodology. In this Chapter, the focus will be on showcasing how the developed system or solution operates in practice. This involves demonstrating the AI models, workflows, and overall system in a real-world environment, validating that the solution meets the defined requirements and objectives.

In this demonstration, the following files will be used as input data to ensure a simplified workflow demonstration with a reduced number of documents, allowing for a clear illustration of the process and its functionality:

- "19-09-23 DETAILS"
- "18-09-23 DETAILS"
- "Terminal_n_0000827243 Short Version"
- "Listagem Operações Setembro 2023"

For testing purposes, the condition controlling the SAP variable was adjusted. Instead of comparing it to the number of days in the current month, it was changed to compare with the number "2", representing the number of SAP documents being used in the test: "19-09-23 DETAILS" and "18-09-23 DETAILS". Before this, a validation test was conducted using the actual number of days in the current month (September), but only two referenced documents were sent. As expected, the result was an email received by the accountant with the following information from Figure 72:

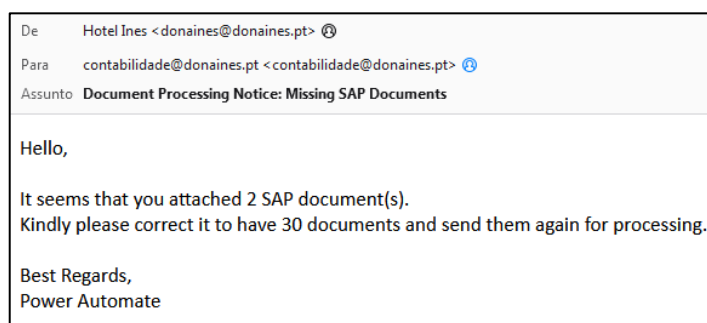


Figure 72. Email received as a result of sending only 2 SAP documents for processing instead of 30

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It was also tested in the scenario where no Amex document was included in the email for processing. In both cases, the process finished, and no information from the attached documents was extracted. This can be seen in Figure 73.

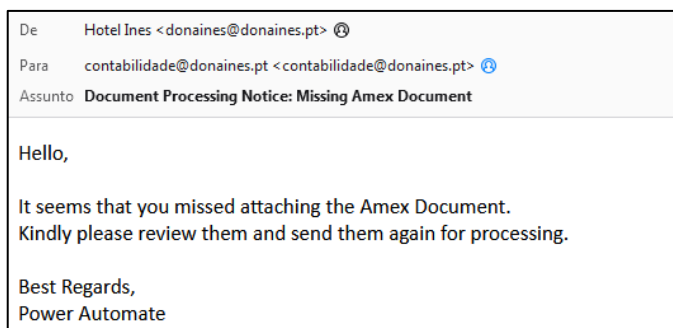


Figure 73. Email received as a result of not sending any Amex document for processing

Starting now with the four documents, the accountant sends an email, with the documents attached, from his professional account to his secondary email account to trigger the workflow.

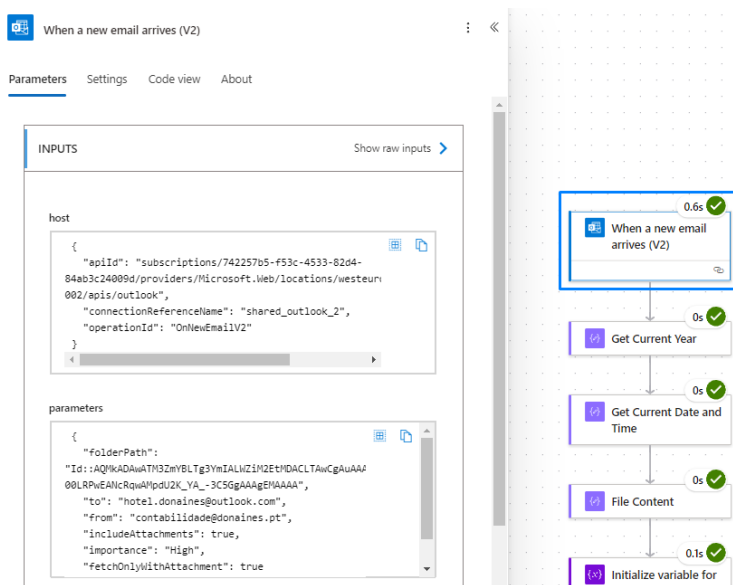


Figure 74. "When a new email arrives (V2)" validation check

All conditions in the parameters section are validated to be true as seen in Figure 74 and the process goes on to create the relevant variables. Each variable and compose function take approximately zero seconds to be generated. An example can be seen in Figure 75:

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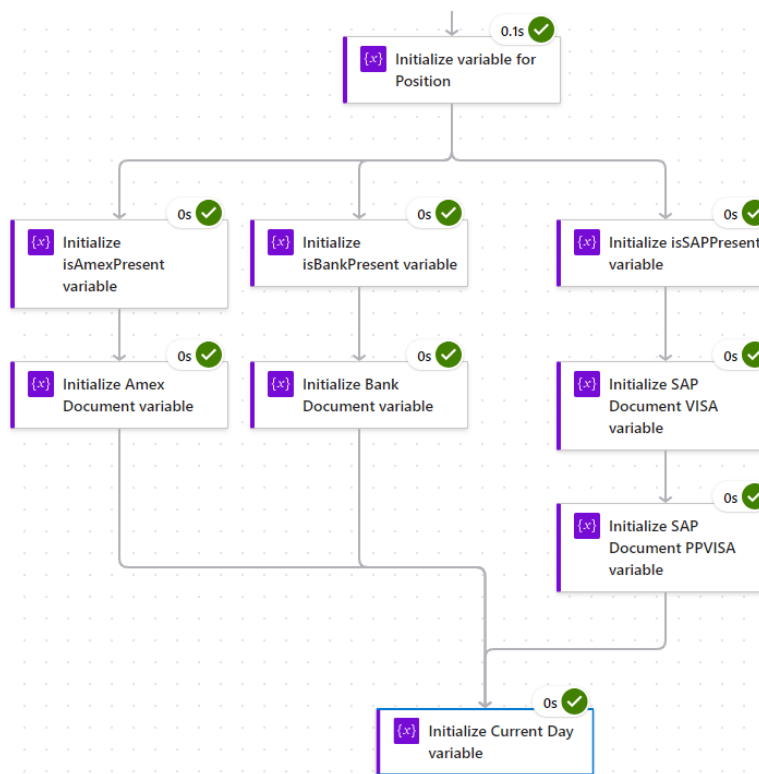


Figure 75. "Variable and compose actions" validation check

The variable counting result was as expected. One count was registered for the "isBankPresent" variable for document one, one count for "isAmexPresent" in document four, and two counts for "isSAPPresent" in documents two and three. These variable counts can be validated in the images attached in the Appendices Chapter under Appendix 4, 5, 6, and 7, where each document's identification is visible.

Once all variables were counted, the workflow proceeded with the validation to ensure that all required documents were present.

In the case where all four document types were attached correctly, and the condition was adjusted to accept only two SAP documents, the process continued to extract the information initially mapped in the AI model. Once all the information was extracted from the documents and the additional variables added, an array was obtained for each document type. For example, there is an entry for the Bank document, which was previously identified as document one. In Figure 76, for this document type, it can be

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validated that the entries were extracted using the action "Extract information from documents", which uses the "Bank/ Amex Document Processing" AI Model.

After extraction, a condition is applied to determine whether the document is of the Bank or Amex type. If it is not an Amex document, it is classified as Bank by default. Once identified as a Bank document, the flow triggers the "Apply to each Bank Document Entry" cycle, where the extracted line is appended to the final "Bank Document" variable through the action "Append to Bank Document Variable". In the same Figure 76, this flow in Power Automate can be validated up to the point where the data is added to the final array.

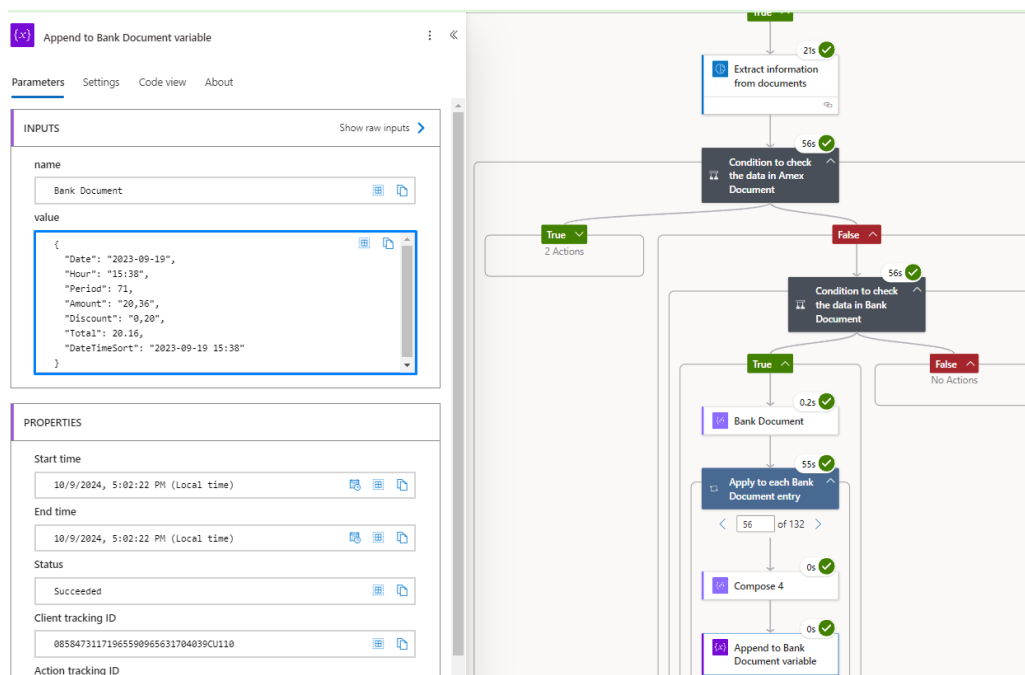


Figure 76. Appended entries in "Bank Document" variable that was extracted with Bank/Amex Document Processing" AI Model

This line corresponds to the following line in the Bank document from Table 5:

2023/09/19	03:20	70	004530304022643064706	00001 MULTIBANCO	001	1,00	C	0,01	D	0,00	c)
2023/09/19	03:20	70	004530304022643064706	01003 VISA ELECTRON DB	001	118,90	C	0,59	D	0,24	c)
2023/09/19	15:38	71	004530304022643064706	00001 MULTIBANCO	001	76,00	C	0,38	D	0,15	c)
2023/09/19	15:38	71	004530304022643064706	00355 MASTERCARD DB N	002	20,36	C	0,20	D	0,04	c)
2023/09/19	15:38	71	004530304022643064706	00364 VISA CR E	001	135,90	C	0,68	D	0,68	c)
2023/09/19	15:38	71	004530304022643064706	00364 VISA CR E	001	6,00	C	0,11	D	0,03	c)
2023/09/19	15:38	71	004530304022643064706	00365 MASTERCARD DB E	001	56,40	C	0,28	D	0,33	c)
2023/09/19	15:38	71	004530304022643064706	00365 MASTERCARD DB E	001	23,50	C	0,24	D	0,29	c)
2023/09/19	15:38	71	004530304022643064706	00398 MASTERCARD CR COM	E 002	420,76	C	6,74	D	9,44	c)

Table 5. Row for period 71 from the Bank document

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It should be noted that the variable "Total" already reflects the subtraction of the "Discount" from the "Amount". This process was executed and validated for all document types, resulting in the four defined arrays: "SAP Document VISA", "SAP Document PPVISA", "Bank Document", and "Amex Document".

One final array can already be demonstrated during the execution of the action "Compose Convert to JSON Strings", which combines the data from both the "Amex" and "Bank" documents, as shown in Appendix 8. It is important to note that in this action, the data is not arranged in chronological order.

The date order will only be applied in the actions "Joined Array Dates", "Joined Array Periods", "Merged Arrays Doc Name Variable PPVISA", and "Merged Arrays Doc Name Variable VISA."

Beginning with the parallel workflow corresponding to the calculation by dates, a demonstration for September 19 can be made. Figure 77, shows entry 71 that still belongs to September 18, 2023, indicating that the "Total" will be added to the "Current Total Date" variable.

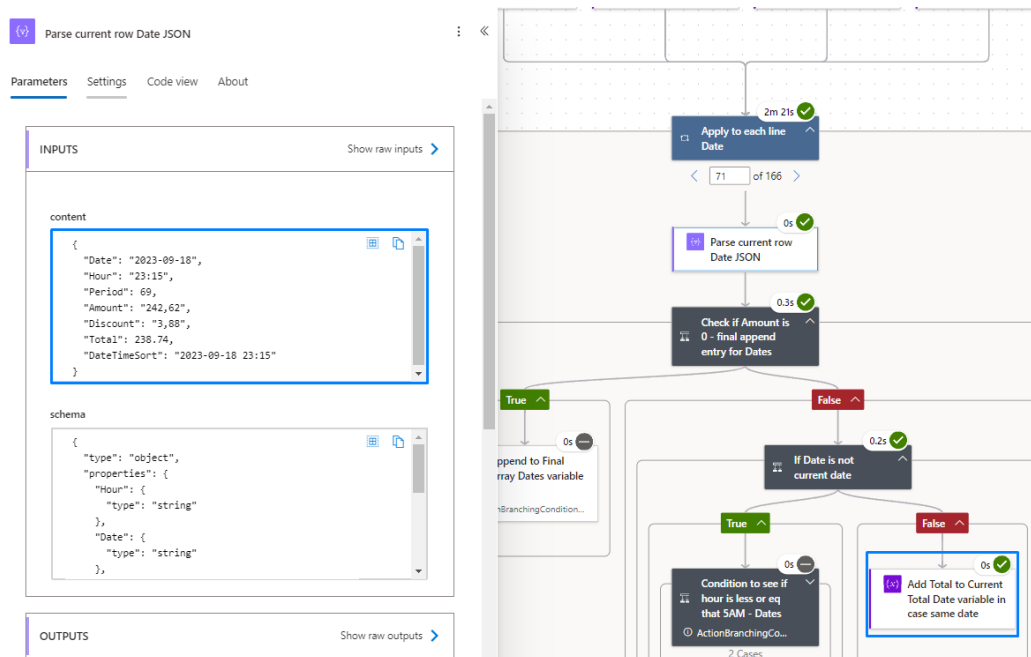


Figure 77. Entry 71 that still belongs to September 18, 2023

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The next line, 72, corresponds to an entry for September 19. However, since this transaction was recorded before 5 a.m., it will still be added to the previous day, as shown in Figure 78.

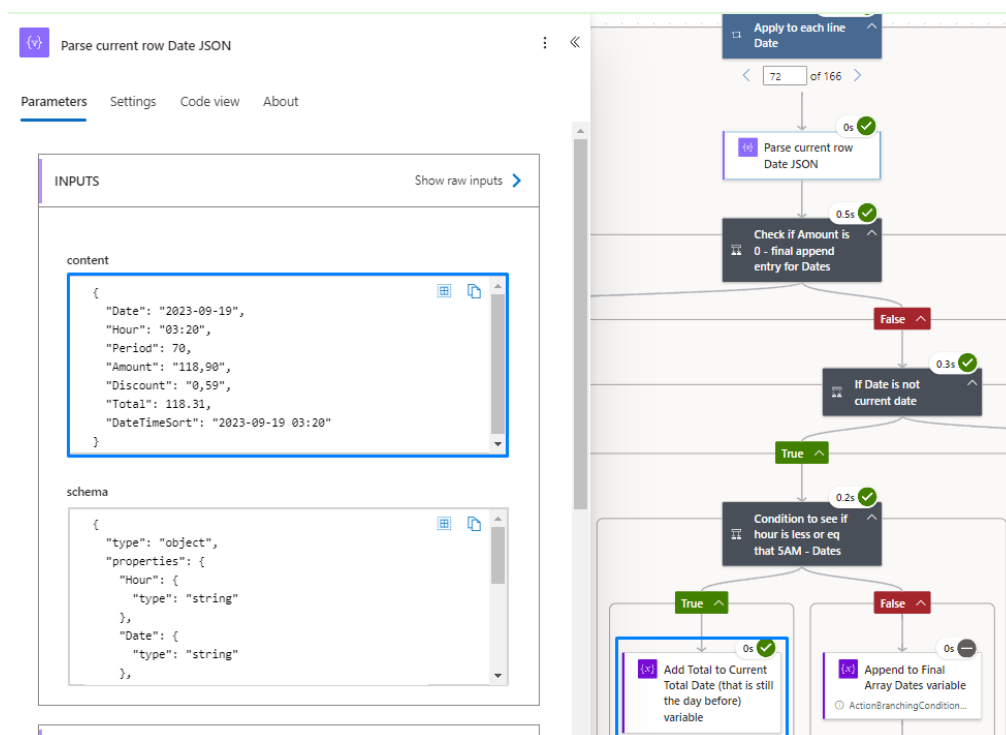


Figure 78. Entry 72 from "Parse current row Date JSON", corresponds to an entry for September 19, 2023 and this variable being added in "Add Total to Current Total Date (that is still the day before) variable"

All transactions that occurred before 5:00. will follow the same process until a record is found where this is not the case. An example is entry 76, where the transaction time is recorded at 15:38. Although the date for this entry is still September 19, like the entry shown in the previous Figure 78, the cycle will not be treated the same because previously, there wasn't any update to "Set new current date" for September 19. This variable only updates to a new date when the transaction has a different date or when the transaction is recorded after 5:00. This is validated in Figure 79.

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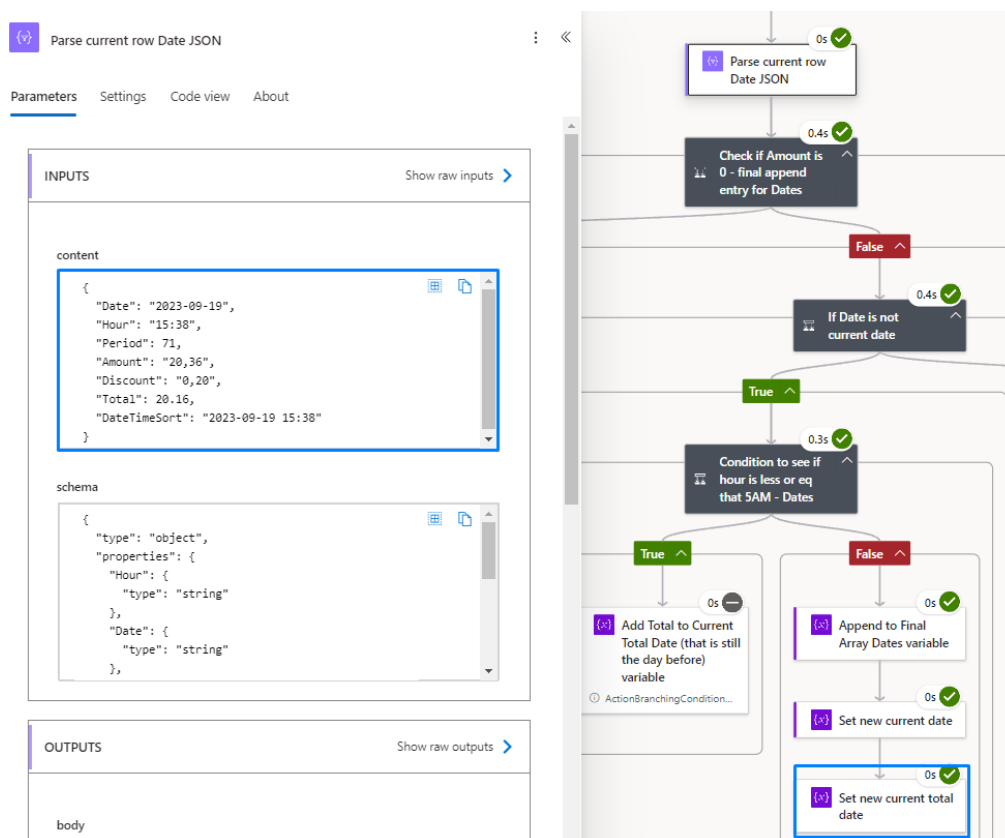


Figure 79. Set new current total date to September 19, 2023

Here, the action "Append to Final Array Dates variable" is executed with the total from the previous day (which is the total from day September 18, 2023), and the new current date is set in the "Set new current date" action, and a new "Current Total Date" is initialized, corresponding to the new total commission for the current day being analysed. These actions can be verified in Figure 80, Figure 81, and Figure 82.

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Set new current total date

Parameters Settings Code view About

OUTPUTS [Show raw outputs >](#)

```
body
{
  "name": "Current Total Date",
  "value": 0.2
}
```

Figure 80. "Set new current total date" action

Set new current date

Parameters Settings Code view About

OUTPUTS [Show raw outputs >](#)

```
body
{
  "name": "Current Date",
  "value": "2023-09-19"
}
```

Figure 81. "Set new current date" action

Append to Final Array Dates variable

Parameters Settings Code view About

INPUTS [Show raw inputs >](#)

name
Final Array Dates

value
{
 "Date": "2023-09-18",
 "Total": 26.03
}

Figure 82. "Append to Final Array Dates variable" action

For the Period workflow, shown in Figure 83, since it uses the same JSON string, the entries are exactly the same. Therefore, for entry 72 shown previously in Figure 78 (and any subsequent entries that were recorded before 05:00), a "Current Date for Period" is set with the previous day's date.

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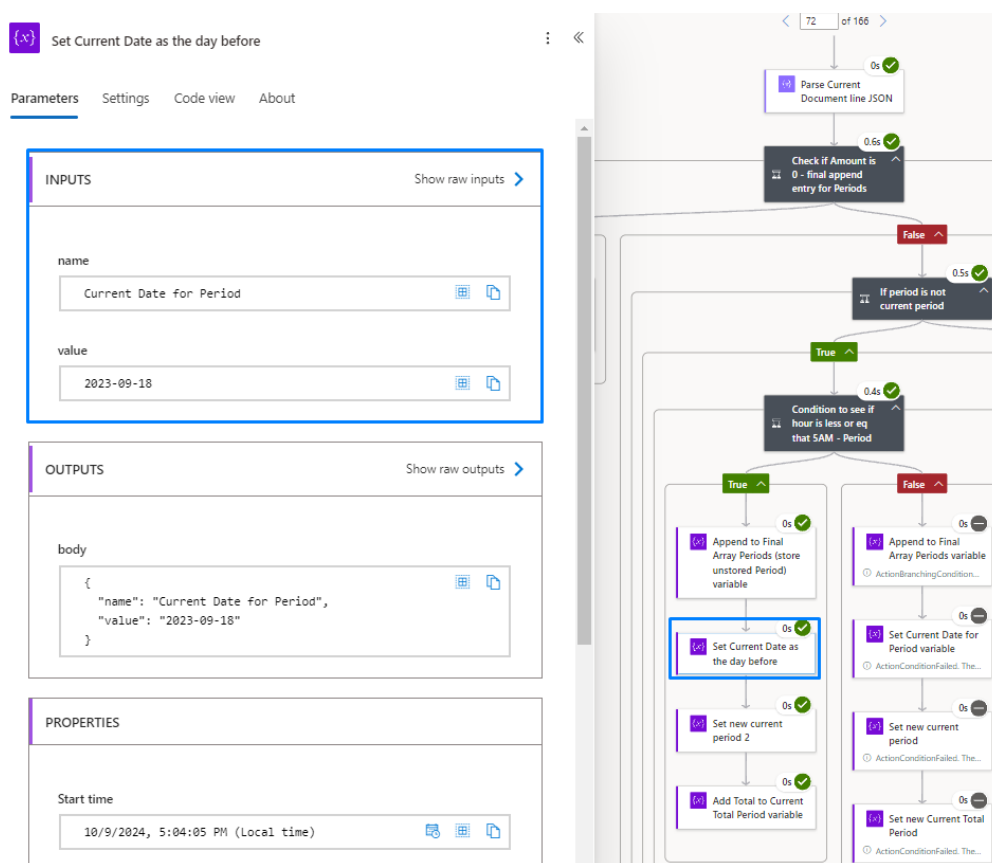


Figure 83. Period workflow setting "Current Date for Period" with the date of the previous day

Before this, as previously explained, it is necessary to have all entries sorted by period in the final array. The action "Append to Final Array Periods (store unstored Period)" is executed to ensure that the previous period is added to the final array. Then, the "Current Period" is set to 70, and the total is added to the "Current Total Period" variable, which will be 0 as it is the first entry being recorded with this period. It can thus be concluded that for accounting purposes, period 70 belongs to September 18, not September 19.

Moving on to the VISA entries, the total values for each day can be verified, regardless of the system registration date. In the document "18-09-23 DETAILS.pdf", transactions from September 19 are recorded. But since the document name is "18-09-23 DETAILS.pdf", the Amounts for these dates are added to the "Total Doc Name variable VISA". In the Figure 84, this can be validated.

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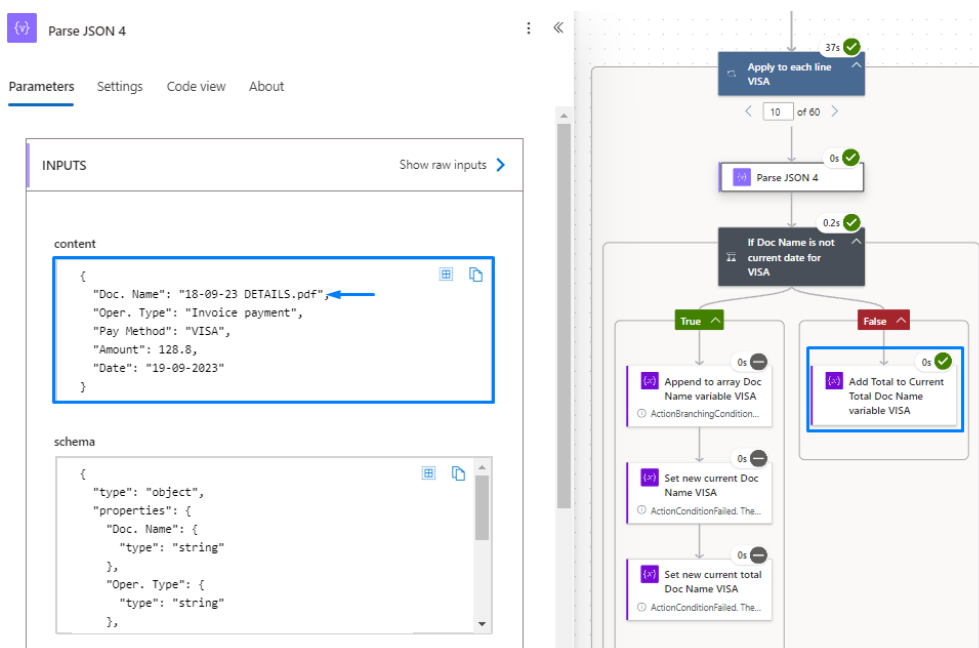


Figure 84. "18-09-23 DETAILS.pdf" entry from September 19

Only when the first entry with "Doc. Name": "19-09-23 DETAILS.pdf" appears, the previous total is added to the "Doc Name variable VISA" array and a new "Current Doc Name VISA" is set (as seen in Figure 85), and a new "Current Total Doc Name VISA" is defined.

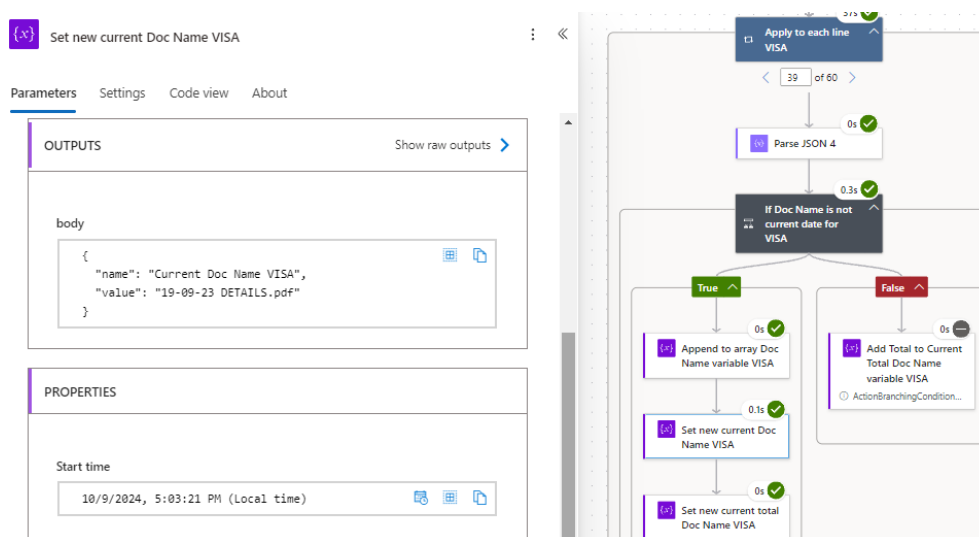


Figure 85. "Current Doc Name VISA" as "19-09-23 DETAILS.pdf"

The process for the PPVISA payment method is the same as demonstrated for VISA, but here are involved all variables described in the previous Chapter and shown in Figure 54.

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At the end of each parallel workflow, the final results can be reviewed, which will later be added to the Excel file for import. These final results can be seen in Figure 86, Figure 87, Figure 88 and Figure 89.

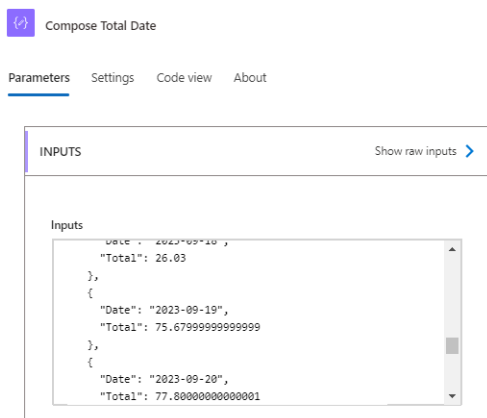


Figure 86. "Compose Total Date" showing a sample of the "Final Array Dates" variable

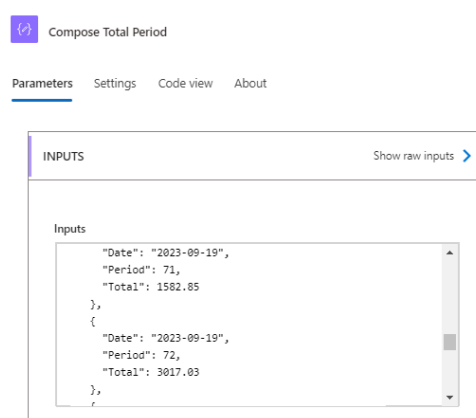


Figure 87. "Compose Total Period" showing a sample of the "Final Array Periods" variable

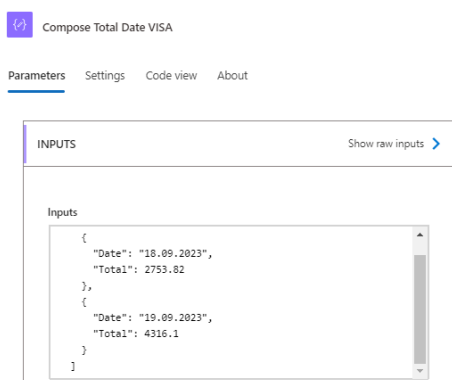


Figure 88. "Compose Total Date VISA" showing a sample of the "Final Array Doc Name VISA" variable

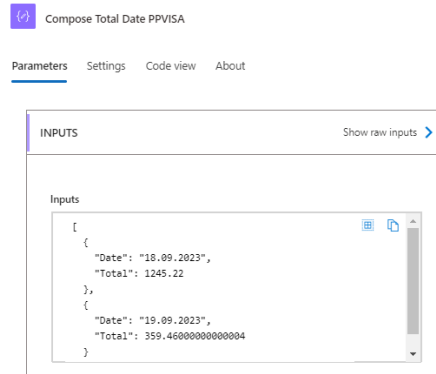


Figure 89. "Compose Total Date PPVISA" showing a sample of the "Final Array Doc Name PPVISA" variable

With the file created in OneDrive, named "Import_09.10.2024_16.01.30" in the folder "Hotel D Ines Import Accounting," as seen in **Figure 90** the table can now be added, along with the second header and the corresponding rows.

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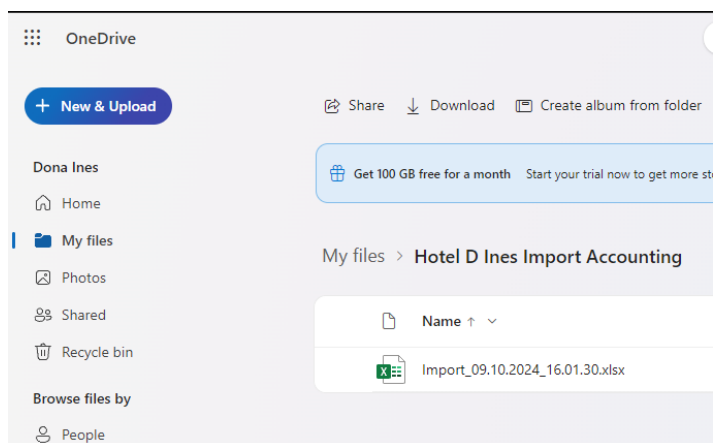


Figure 90. "Import_09.10.2024_16.01.30.xlsx" in the folder "Hotel D Ines Import Accounting"

An example of an entry for the Period in Excel, following the parameters defined in Table 6, is as follows in Figure 91:

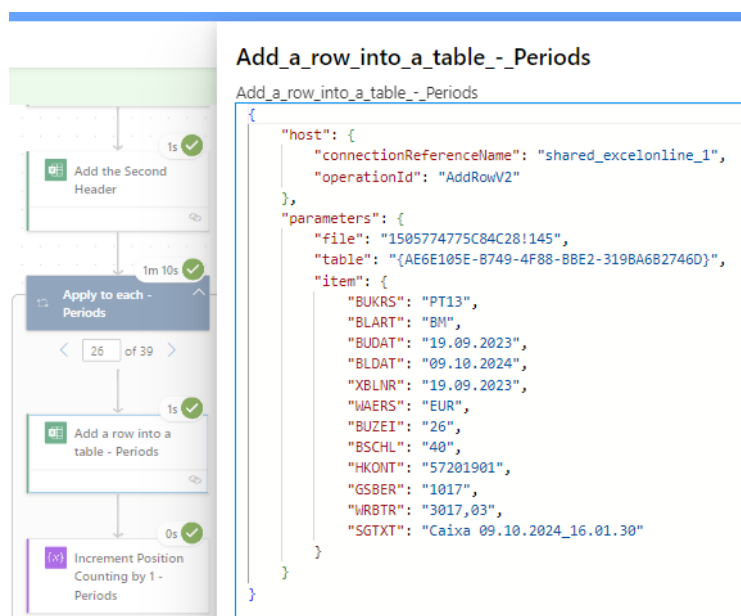


Figure 91. Entry example from "Apply to each - Periods" cycle in Excel

With all the rows added in Excel (seen in Table 6), and filtering only for 19.09.2023, the values match exactly with those imported into the SAP system on that same day, as shown in Table 7. The only difference is in the "Position" column. Previously, the entries were handled daily, so the position counting started from 1 each day. Now, with the entries being handled monthly, the position counting is different.

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BUKRS	BLART	BUDAT	BLDAT	XBLNR	WAERS	BK	BUZEI	BSCHL	UM	KUNNR	LIFR	HKONT	GSBER	KOSTL	WRBTR	ZUO	SGTXT				ZFBOT														
Company Document Posting Da Document Reference Currency (Doc.) Position (3 Posting Key SGL In Customer (10 Vendor GL Account Business Cost Cent Amount 1 Assign Text (50)																						Ref		Neu		Pay		Par		Bl		Line		date	
PT13	BM	19.09.202	09.10.202	19.09.202	EUR		25	40				57201901	1017	1582,85			Caixa 09.10.2024_16.01.30																		
PT13	BM	19.09.202	09.10.202	19.09.202	EUR		26	40				57201901	1017	3017,03			Caixa 09.10.2024_16.01.30																		
PT13	BM	19.09.202	09.10.202	19.09.202	EUR		58	40				66900000	1017	PT131017/75,68			Caixa 09.10.2024_16.01.30																		
PT13	BM	19.09.202	09.10.202	19.09.202	EUR		68	15		5001001017			1017	4316,10			Caixa 09.10.2024_16.01.30				19.09.2023														
PT13	BM	19.09.202	09.10.202	19.09.202	EUR		70	15		5001001017			1017	359,46			Caixa 09.10.2024_16.01.30				19.09.2023														

Table 6. Excel entries for 19.09.2023, with Table 4 requirements after RPA Implementation

BUKRS	BLART	BUDAT	BLDAT	XBLNR	WAERS	KTY	BUZEI	BSCHL	MSK	KUNNR	IFNR	HKONT	GSBER	KOSTL	WRBTR	ZUONR	SGTXT	REF	WIFER	VTY	ZFBOT
Company Code	Document Type	Posting Date	Document Date	Reference	Currency	Order Position	Order Key	Order Customer	Order	GL Account	Business Area	Cost Center	Amount	Amount	Amount	Amount	Text	Text	Text	Text	Text
PT13	BM	19.09.2023	19.09.2023	19.09.2023	EUR	01	40			57201901		1017	1582,85				CAIXASET				
PT13	BM	19.09.2023	19.09.2023	19.09.2023	EUR	02	40			57201901		1017	3017,03				CAIXASET				
PT13	BM	19.09.2023	19.09.2023	19.09.2023	EUR	03	40			66900000		1017	PT131017AD 75,68				CAIXASET				
PT13	BM	19.09.2023	19.09.2023	19.09.2023	EUR	04	15			5001001017		1017	4316,1				CAIXASET				19.09.2023
PT13	BM	19.09.2023	19.09.2023	19.09.2023	EUR	05	15			5021001017		1017	359,46				CAIXASET				19.09.2023

Table 7. Excel entries extracted from SAP by the accountant for 19.09.2023

Now that the file is completed, the workflow processes the final steps, extracting the information from it and sending it as an attachment in a high-priority email directed to the accountant's business account. This is illustrated in Figure 92 and Figure 93, where the accountant confirmed that the email was successfully received in his inbox and that the file is ready for import into SAP.

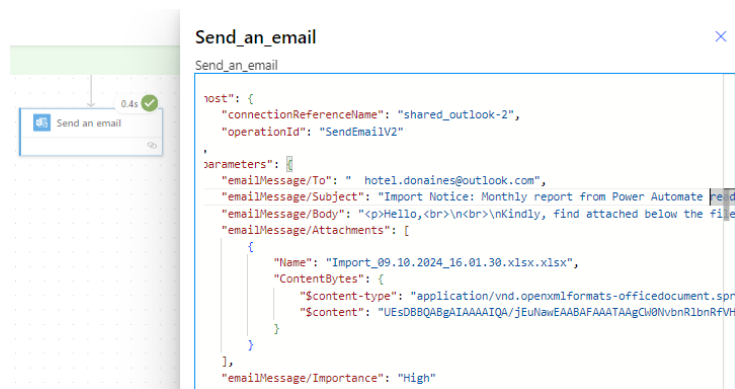


Figure 92. "Send an email" action validation check

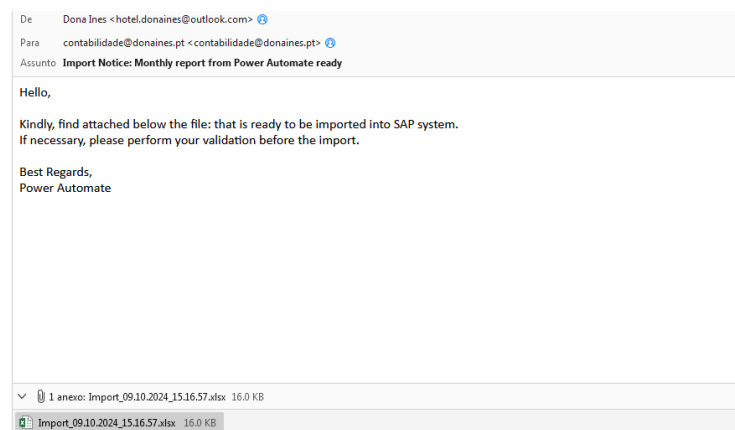
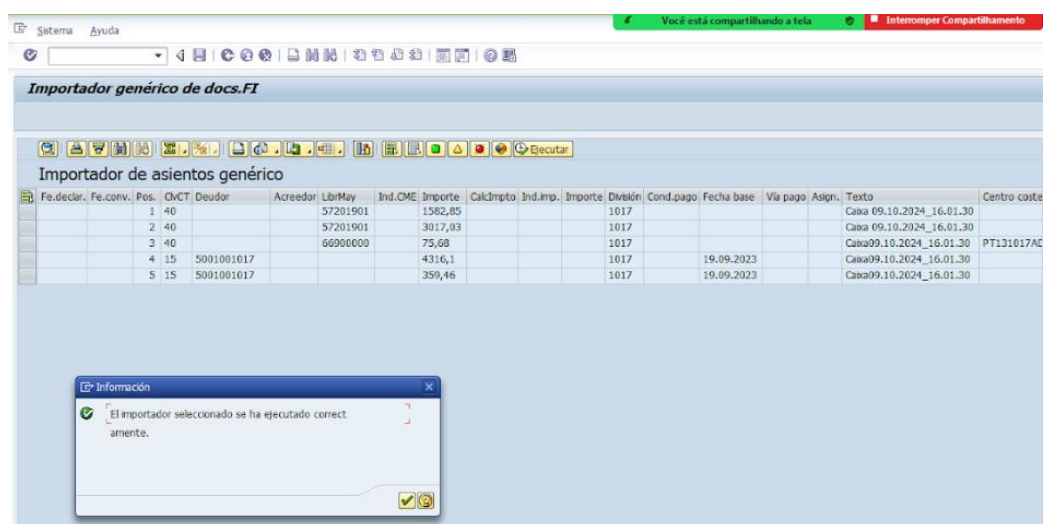


Figure 93. Email received in the accountant's inbox, with the monthly report from Power Automate

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To validate that the file is correctly formatted and ready for import, the accountant imported only the data for September 19, 2023, to minimize the impact on past accounting records. All other rows were deleted, and the position column was adjusted. The file was successfully imported into the system, as shown in Figure 94. Additionally, this figure displays some of the columns populated with information generated by the Power Automate workflow, validating data consistency across entries.



The screenshot shows the SAP 'Importador de docs.FI' window. It contains a table with the following data:

Fe.declar.	Fe.conv.	Pos.	OVCT	Deudor	Acreedor	LibrMay	Ind.CME	Importe	CalcImpo	Ind.imp.	Importe	División	Cond.pago	Fecha base	Via pago	Asign.	Texto	Centro coste
		1	40			57201901		1582,85				1017					Caba 09.10.2024_16.01.30	
		2	40			57201901		3017,03				1017					Caba 09.10.2024_16.01.30	
		3	40			66000000		75,68				1017					Caba09.10.2024_16.01.30	PT131017AC
		4	15	5001001017				4316,1				1017		19.09.2023			Caba09.10.2024_16.01.30	
		5	15	5001001017				359,46				1017		19.09.2023			Caba09.10.2024_16.01.30	

An 'Información' dialog box is open in the foreground, displaying a green checkmark and the message: 'El importador seleccionado se ha ejecutado correctamente.'

Figure 94. File successfully imported into SAP, showing in the background the corresponding entries

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9 EVALUATION

The evaluation of the implemented RPA solution focuses on assessing the efficiency and effectiveness of automating the hotel's finance and accounting processes. The primary objectives of this project were to streamline document processing, reduce manual errors, and improve data accuracy. These objectives were used as the basis for evaluating the success of the implemented solution.

The current As-Is process for handling manual financial documents in the hotel is estimated to take between 12.5 and 17.5 hours per month, which translates to approximately 1.5 to 2.5 full working days. The breakdown of time across various tasks is as follows:

- **Receptionist tasks:** The receptionist spends approximately 5 to 10 minutes daily printing receipts from the POS, extracting daily values for PPVISA and VISA transactions from SAP, and delivering all this information to the accountant's office. This totals around 2.5 to 5 hours per month.
- **Accountant's manual data entry into SAP and commission calculations:** The accountant inputs the transaction data from the receipts into SAP and performs commission calculations using Excel. Both tasks take around 20 to 25 minutes per day, which results in a total of 10 to 12.5 hours per month.

In total, these manual tasks consume around 12.5 to 17.5 hours per month.

When it comes to the RPA implementation, the testing process was carried out in multiple phases. Initially, functional testing was conducted to verify that the automated workflow accurately processed documents from SAP, Amex, and Bank, and correctly extracted the required data using AI Builder. This testing process involved multiple workflows tested separately (a total of 47 workflows), such as, creating Excel tables with two headers, extract file contents, document processing only for Bank and Amex per period, per date and for SAP documents separately for VISA and PPVISA entries, and others. All cycles and actions were performed individually and each time there was no need to use AI Builder, pre-built arrays were used to minimize the AI Builder credits consumption.

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Performance testing followed, comparing the time taken for automated document processing against the time previously required for manual handling. Unfortunately, it was not possible to fully test the workflow with all real-time documents due to the unavailability of AI credits.

However, a test conducted in October 2024 processed a total of 33 documents (31 SAP documents, 1 Amex document, and 1 Bank document). It is important to note that the Bank document used, which typically spans 15 pages, had only 4 pages in this test. As a result, the process did not run under entirely realistic conditions, but close enough to demonstrate the results. The entire workflow took 19 minutes and 33 seconds to process the 33 documents. The breakdown of this time is as follows:

- 2 minutes and 32 seconds were used to extract the information from all documents using both AI models.

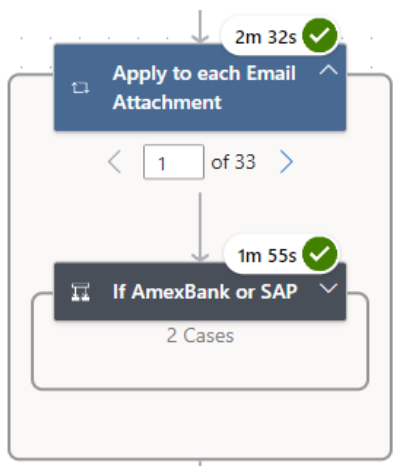


Figure 95. Time spent to extract the information from all documents using both AI models

- 1 minute and 52 seconds to perform the commission calculations per date for 166 lines of data coming from Bank and Amex documents.

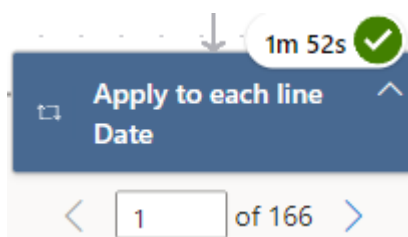


Figure 96. Time spent for commission calculations per dates for 166 lines of Bank and Amex entries

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- 2 minutes and 16 seconds to perform the sum of net amounts per period for 166 lines of data.

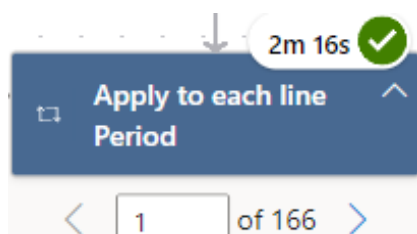


Figure 97. Time spent to sum the net amounts per period for 166 lines of data

- 54 seconds were required to sum all 166 PPVISA entries per document name across all 33 documents.

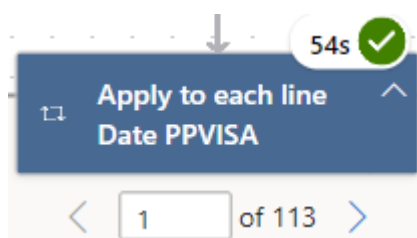


Figure 98. Time spent to sum all 166 PPVISA entries per document name across all 33 documents

- 12 minutes and 24 seconds were spent summing all 1425 VISA entries per document name across all 33 documents.

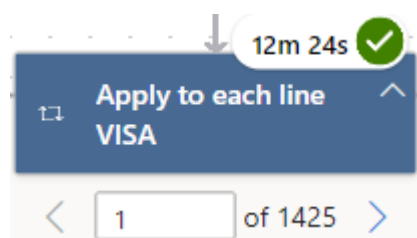


Figure 99. Time spent summing all 1425 VISA entries per document name across all 33 documents

- For all entries being added to Excel, a total of 3 minutes and 22 seconds were consumed. These entries are coming from period calculations and date calculations shown in Figure 100 and VISA and PPVISA calculations as shown in Figure 101.

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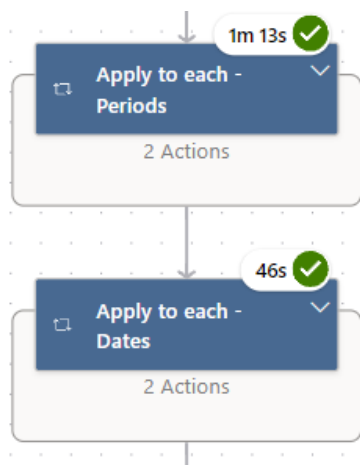


Figure 100. Times spend for periodic and daily entries into Excel

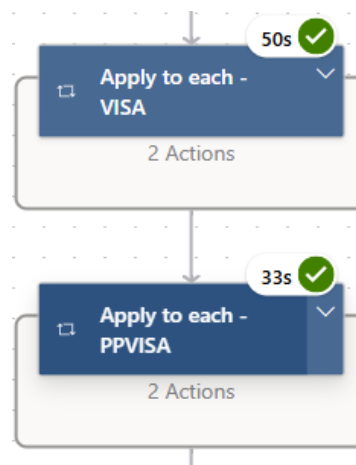


Figure 101. Times spend for VISA and PPVISA entries into Excel

It is important to note that other actions, such as sending emails, creating files, extracting file contents, appending to arrays, etc., also consumed time, but their impact was relatively insignificant compared to cycle-based actions like summing and extracting data.

It is estimated that if the Bank document containing fifteen pages had been used, a total processing time of approximately 25 minutes would have been sufficient to handle all necessary documents. This is primarily because time-consuming tasks are executed in parallel. During the 12 minutes spent processing 1425 VISA rows, a similar amount of data is being processed concurrently for dates and periods. Furthermore, the AI model extraction operates with a parallelism of fifty entries at a time, as seen in Figure 102, significantly optimizing the processing speed when handling a large volume of entries.

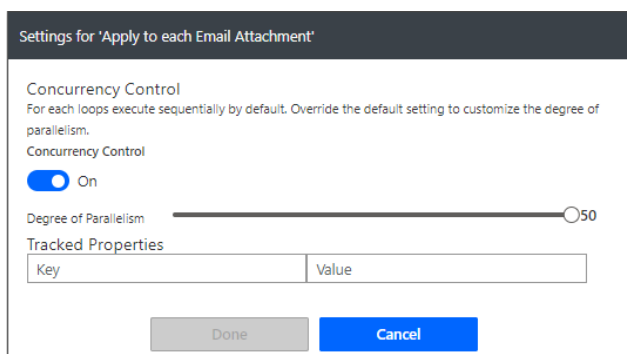


Figure 102. Setting for "Apply to each Email Attachment" showing the degree of parallelism

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Aside from the Power Automate workflow processing time, certain actions are still required from the accountant, such as compiling all necessary monthly reports. The Bank and Amex documents are sent monthly by Crédito Agrícola and Millennium BCP banks, respectively, while the SAP daily document reports must be extracted directly from SAP. Additionally, an email needs to be composed, attaching all these files with the priority set to high. It is estimated that 10 minutes should suffice for these tasks.

Together, they form the To-Be process resulting in an approximate total time of 35 minutes, combining both the automated and manual actions needed for completion.

It can be concluded that the average time for the As-Is process is, according to Equation 4:

$$\text{Average time} = \frac{12.5 + 17.5}{2} = 15 \text{ hours} = 900 \text{ minutes}$$

Equation 4. Average time for the As-Is process

If the To-Be process can take roughly 35 minutes to execute, the efficiency improvement can be calculated as follows in Equation 5:

$$\text{Efficiency improvement} = \frac{900 - 35}{900} \times 100 = \frac{865}{900} \times 100 \approx 96.1\%$$

Equation 5. Efficiency improvement for implementing Power Automate with AI Builder

Thus, the efficiency improvement from manual processing to the automated RPA solution is around 96.1%.

The solution also minimized manual errors, particularly in data entry and validation, with accuracy levels reaching 97% for the SAP documents. Unfortunately for Bank and Amex, it was impossible to test the accuracy since the model used to train these documents doesn't provide any information on accuracy. These results highlight the clear time-saving benefit of automation.

Over a one-month trial period, extended for three months, approximately 510,000 AI Builder credits were used, and the system processed several documents with no critical errors.

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In comparison to the To-Be process with the original As-Is process, several key improvements were noted. The manual handling of documents, which was prone to delays and human error, has been largely eliminated. The automation also reduced the need for constant monitoring, allowing the finance team to focus on more strategic tasks.

Challenges encountered during the evaluation phase included the consumption of AI Builder credits and the need to renew the free trial. The AI Builder feature proved essential for document processing, but its cost must be factored into the hotel's long-term budget. Additionally, minor issues with integration and file access permissions required some manual intervention, though these were resolved during testing.

It is recommended that further user training be provided and that additional enhancements be considered for optimizing the workflow, particularly in the handling of the largest data sets coming from more than one POS system.

Overall, the evaluation demonstrates that the RPA solution successfully met the project's objectives, providing a more efficient, accurate, and streamlined document processing workflow for the hotel.

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10 COMUNICATION

The communication phase of this project is dedicated to documenting and sharing the outcomes and insights obtained from the RPA solution developed for automating the hotel's finance and accounting processes. Throughout the project, regular meetings were conducted with the hotel's accountant to align on requirements, review progress, and ensure the RPA solution met the operational needs and accuracy standards. This document itself serves as an essential piece of communication, encapsulating the project's methodology, development, testing, and evaluation within the framework of the DSR methodology.

Furthermore, the insights and results from this project contribution can extend beyond the organizational stakeholders. By documenting and potentially presenting the findings at conferences or through publication in a scientific journal, this work could serve as a case study for other organizations exploring automation in accounting. This project also aims to reach both the academic community and industry practitioners, showcasing how RPA can support digital transformation in finance by reducing manual tasks and increasing process efficiency. This communication not only highlights the immediate impact within the hotel organization but also contributes to the broader understanding of RPA through different applications.

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11 CONCLUSION

The implementation of an RPA solution utilizing Microsoft Power Automate and AI Builder has proven to be a highly effective strategy for streamlining the hotel's financial document processing. Before the automation, these processes were heavily dependent on manual efforts, requiring the accounting department and receptionists to invest substantial time each month in routine tasks. The introduction of RPA has drastically reduced this workload, cutting down the processing time by around 96.1%, from 12.5-17.5 hours of manual labour per month to just 35 minutes of processing.

The key benefits of this automation are centred on improving efficiency, reducing human errors, and creating a more reliable workflow. By automating the data extraction from SAP, Amex, and Bank documents, as well as streamlining the calculation of commissions and other financial data using external tools like Excel, the hotel has not only saved time but also improved the accuracy of its financial records. This level of accuracy is critical in the hospitality industry, where even small errors in financial data can lead to significant issues in accounting and reporting.

Furthermore, the integration of AI Builder to handle document extraction ensures that even a large number of documents are processed accurately and efficiently. The AI models were trained specifically for this purpose, making them highly reliable in handling these types of documents. This eliminates the need for manual data entry, which was previously prone to errors and inconsistencies. In case it is necessary to improve the accuracy of the AI models, more document templates can be added to further train the model.

While the automation workflow is a significant improvement over the manual processes, there are some areas for future enhancement. For instance, while the system efficiently processes documents each month, there is a need for a consistent supply of AI credits to ensure that the workflow runs without interruptions. The cost associated with AI Builder credits should be considered as part of the long-term financial planning for the hotel, especially as the workflow grows to handle more documents or is expanded to include additional financial processes.

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In addition to improving internal processes, the RPA solution also provides the hotel with greater scalability. As the hotel may expand this technology, the automated system can be adapted. This scalability is one of the advantages of using a cloud-based platform like Microsoft Power Automate, which integrates seamlessly with the hotel's existing IT systems.

Some limitations were encountered in this project, starting with the restricted availability of AI Builder credits. Since the AI Builder platform has usage limitations due to credit restrictions, testing the full workflow with high-volume data was constrained. Additionally, the workflow was only tested with one POS system used at the project's beginning, in September 2023, whereas the hotel currently operates with two and three POS devices at the reception. This setup would require further testing to validate whether the current configuration can handle the multiple POS sources effectively. This is because each POS generates separate periods, meaning that similar periods could be recorded across different days, impacting the synchronization and accuracy of calculations when balancing debits from bank and amex records with the credits derived from SAP.

Another constraint relates to the "Bank/Amex Document Processing" AI model, which, while comprehensive and robust for longer documents, does not provide efficiency metrics. This limitation makes it challenging to gauge the model's overall performance in terms of processing accuracy. Additionally, as the hotel lacks a dedicated test environment, end-to-end testing of the generated files was limited. This lack of a testing environment means that implementing the files directly in production could carry risks.

Finally, the workflow execution is hardware-dependent, requiring a capable computer setup to support the demands of Power Automate. If the machine used lacks sufficient processing power, the workflow risks failure due to timeouts, thereby requiring reliable infrastructure for optimal functionality.

This project serves as a foundation for future initiatives that may incorporate even more advanced AI capabilities or explore automation in other departments. One future improvement would be to merge the two existing AI models (Bank/Amex and SAP) into a single, more streamlined model. This would simplify the workflow by removing the

Robotic Process Automation (RPA) in Finance and Accounting: A Solution in a Hotel Company

need for document validation to determine which AI model should be applied. Noting that using the robust model that does not provide accuracy scores could carry out more bias on accuracy scores. Additionally, future developments could aim to validate whether this workflow can accommodate multiple Bank documents, allowing for the inclusion of more POS terminals. For Amex, a single document would be maintained the same, as this document already consolidates all POS terminals. Finally, establishing a direct connection between Power Automate and SAP would enable the automatic import of files into the SAP system, eliminating the need for manual intervention by an accountant and enhancing the overall efficiency of the workflow.

In conclusion, this project has clearly shown that automation through RPA combined with AI technologies is not only feasible but also highly beneficial for organizations dealing with complex, repetitive financial processes. The improvements in efficiency, accuracy, and scalability make this solution a valuable asset for the hotel, ensuring smoother operations, enhanced financial reporting, and stronger overall business performance. Moving forward, the hotel can continue to refine and expand upon this solution, driving further innovation and success in its operations.

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APPENDICES

Robotic Process Automation (RPA) in Finance and Accounting: A Solution in a Hotel Company

APPENDIX 1. Example of Bank document



Crédito Agrícola
CCAM COIMBRA C.R.L.

Telefone: 239851200 (Chamada para a rede fixa nacional)
Email: coimbra@creditoagricola.pt
Internet: www.creditoagricola.pt
Linha Directa: Atendimento personalizado 24h/7 dias
p/semana-213805660 (Chamada para a rede fixa nacional)/808206060 (Custo 1º minuto 0,07 EUR+IVA; Custo minutos seguintes 0,0277 EUR/min+IVA (dias úteis: 9h-21h) e 0,0384 EUR/min+IVA (restantes horários))

Exmos Senhores
HOTEIS DONA INES LDA
R ABEL DIAS URBANO, 12
COIMBRA
3000-001 COIMBRA

Comerciante: 0022436 HOTEIS DONA INES LDA
Nº Pessoa Colectiva: PT503003980
Estabelecimento: 0007 HOTEIS DONA INES LDA
Id Terminal: 0000827243

Data Emissão: 01/10/2023
Período: 2023/09/01 a 2023/09/30
Nº Extracto 7/2023/010
Nº Página: 1/18

LISTAGEM DAS OPERAÇÕES

Data	Hora	Per Contab	NIB	Produto Financeiro	Nº Oper	Importância	Tx. Serviço Comerciante	Interchange Fee	Imposto (*)
2023/08/31	23:42	17	004530304022643064706	00001 MULTIBANCO	001	C	D		c)
2023/08/31	23:42	17	004530304022643064706	00347 VISA DB N	001	C	D		c)
2023/08/31	23:42	17	004530304022643064706	00353 MASTERCARD CR N	001	C	D		c)
2023/08/31	23:42	17	004530304022643064706	01003 VISA ELECTRON DB	002	C	D		c)
2023/08/31	23:42	17	004530304022643064706	00355 MASTERCARD DB N	001	C	D		c)
2023/08/31	23:42	17	004530304022643064706	00493 VISA DB N-EEA PRE	002	C	D		c)
2023/08/31	23:42	17	004530304022643064706	00494 VISA CR N-EEA PRE	001	C	D		c)
2023/08/31	23:42	17	004530304022643064706	00355 MASTERCARD DB N	001	C	D		c)
2023/09/01	03:02	18	004530304022643064706	00489 MASTERCARD CR N-E	A 001	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00347 VISA DB N	001	C	D		c)
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2023/09/01	15:26	19	004530304022643064706	00489 MASTERCARD CR N-E	A 001	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00496 MCARD CR N-EEA PR	M 001	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00368 VISA DB E	001	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00367 MAESTRO DB EEA	002	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00365 MASTERCARD DB E	001	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00398 MASTERCARD CR COM	E 003	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00347 VISA DB N	001	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00363 MASTERCARD CR E	002	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00364 VISA CR E	002	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00363 MASTERCARD CR E	001	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00392 VISA CR COMERCIAL	N 001	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00398 MASTERCARD CR COM	E 001	C	D		c)
2023/09/01	15:26	19	004530304022643064706	00506 MASTER COM TRAVEL	CR 010	C	D		c)
2023/09/01	23:39	20	004530304022643064706	00355 MASTERCARD DB N	002	C	D		c)
2023/09/01	23:39	20	004530304022643064706	00353 MASTERCARD CR N	002	C	D		c)
2023/09/01	23:39	20	004530304022643064706	00365 MASTERCARD DB E	001	C	D		c)
2023/09/01	23:39	20	004530304022643064706	00001 MULTIBANCO	001	C	D		c)
2023/09/01	23:39	20	004530304022643064706	00363 MASTERCARD CR E	001	C	D		c)
2023/09/01	23:39	20	004530304022643064706	00347 VISA DB N	001	C	D		c)
2023/09/01	23:39	20	004530304022643064706	00494 VISA CR N-EEA PRE	002	C	D		c)
2023/09/02	00:38	21	004530304022643064706	00001 MULTIBANCO	001	C	D		c)
2023/09/02	14:14	22	004530304022643064706	00363 MASTERCARD CR E	004	C	D		c)
2023/09/02	14:14	22	004530304022643064706	00355 MASTERCARD DB N	001	C	D		c)
2023/09/02	14:14	22	004530304022643064706	00494 VISA CR N-EEA PRE	002	C	D		c)
2023/09/02	14:14	22	004530304022643064706	00346 VISA CR N	001	C	D		c)

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APPENDIX 2. Example of Amex document

Listagem Operações de Fecho e Dados de Faturação
Nr.Doc. 224360007

American Express Payments Europe S.L.
Apartado 22515
Loja CTT Praça do Município Lisboa
1132-001 Lisboa

DATA DE EMISSÃO: 04-10-2023
REFERENTE A: SETEMBRO 2023

Exmos. Senhores,

Agradecemos a aceitação de cartões American Express no vosso Estabelecimento. Informamos que processámos as operações listadas em infra na vossa conta bancária, deduzidas da taxa de desconto aplicável a cada transação. Para qualquer esclarecimento, contacte o Apoio a Estabelecimentos American Express pelo e-mail amex.estabelecimentos@millenniumbcp.pt

Dados do Estabelecimento

Comerciante MB: 22436 - HOTEIS DONA INES LDA
Estabelecimento MB: 7 - HOTEL DONA INES
Contribuinte: 503003980
IBAN: PT50004530304022643064706
Nº Estabelecimento American Express: 9550305379

Dados de Operações

Número de Operações American Express 46
Montante de Operações American Express € 9.496,55
Total de Desconto* € -332,42

Detalhe das Operações (Valores em Euros)

Data	Hora	Identificação do TPA	Período	Nº de Operações	Importância	Déb(D) / Créd(C)	Desconto*	Déb(D) / Créd(C)	IF**
2023-09-01	09:31	0000827243	019	1		C		D	N/A
2023-09-03	07:45	0000827243	024	1		C		D	N/A
2023-09-04	16:17	0000827243	031	1		C		D	N/A
2023-09-05	23:04	0000827243	034	1		C		D	N/A
2023-09-06	16:45	0000827243	037	1		C		D	N/A
2023-09-07	16:10	0000827243	039	1		C		D	N/A
2023-09-09	16:57	0000827243	045	1		C		D	N/A
2023-09-10	10:45	0000827243	046	1		C		D	N/A
2023-09-10	11:01	0000827243	046	1		C		D	N/A
2023-09-10	15:35	0000827243	047	1		C		D	N/A
2023-09-10	17:04	0000827243	047	1		C		D	N/A
2023-09-10	17:44	0000827243	047	1		C		D	N/A
2023-09-10	19:47	0000827243	047	1		C		D	N/A
2023-09-11	19:01	0000827243	050	1		C		D	N/A
2023-09-11	19:57	0000827243	050	1		C		D	N/A
2023-09-11	21:53	0000827262	023	1		C		D	N/A
2023-09-12	19:27	0000827243	053	1		C		D	N/A
2023-09-13	17:20	0000827243	056	1		C		D	N/A
2023-09-14	12:32	0000827243	058	1		C		D	N/A
2023-09-15	16:32	0000827243	062	1		C		D	N/A
2023-09-16	10:53	0000827243	063	1		C		D	N/A
2023-09-17	09:44	0000827243	065	1		C		D	N/A
2023-09-19	18:41	0000827243	072	1		C		D	N/A
2023-09-19	18:43	0000827243	072	1		C		D	N/A
2023-09-20	23:44	0000827243	076	1		C		D	N/A
2023-09-21	10:55	0000827243	078	1		C		D	N/A



(Documento Processado por Computador)

www.americanexpress.com/pt

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AMERICAN EXPRESS PAYMENTS EUROPE S.L.

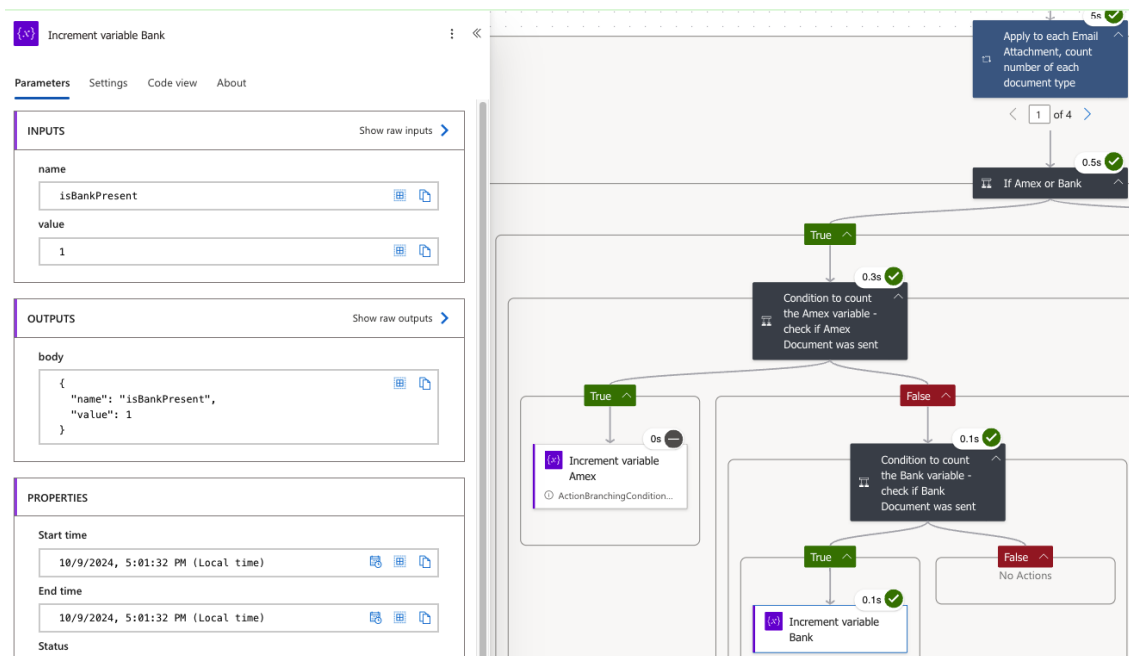
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APPENDIX 3. Example of SAP document

Oper. type	Pay. method	Amount	Currency	User name	Mov. date	Mov. time	Reserv.	Invoice Id	Order No.	Remarks	Number
Invoice payment	TRANSFER		EUR	HPTDINESREC1	19.09.2023	03:41:06	116015525	6037015551	14161	TB 12-09-2023	
Invoice payment	TRANSFER		EUR	HPTDINESREC1	19.09.2023	03:49:32	118906852	6037015553	14162	TB 07-07-2023	
Invoice payment	PFVISA		EUR	HPTDINESREC1	19.09.2023	04:21:53	119901512	6037015556	14163	Pre-payment 6037015556	
Invoice payment	PFVISA		EUR	HPTDINESREC1	19.09.2023	04:33:12	120094669	6037015557	14164	Pre-payment 6037015557	
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	07:35:07	122227890	6037015559	14165		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	08:38:36	117963942	6037015560	14166		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	08:49:30	122310198	6037015535	14167	collect Invoice cancel.	
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	08:50:44	122310198	6037015561	14168		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	08:56:25	122322301	6037015562	14169		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	08:56:45	122322301	6037015562	14170	collect Invoice cancel.	
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	08:57:34	122322301	6037015563	14171		
Invoice payment	TRANSFER		EUR	E00000251441	19.09.2023	09:51:25	110790661	6037015568	14172		
Invoice payment	TRANSFER		EUR	E00000251441	19.09.2023	10:18:34	119890384	6037015571	14173		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	10:42:22	122303269	6037015572	14174		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	10:47:29	122188751	6037015573	14175		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	11:11:20	121009438	6037015574	14176		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	13:20:12	122157809	6037015577	14177		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	13:57:50	120200092	6037015578	14178		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	14:18:32	120981856	6037015579	14179		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	14:19:20	120981856	6037015580	14180		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	14:26:41	122001189	6037015581	14181		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	14:27:39	122001189	6037015582	14182		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	14:55:14	120724318	6037015583	14183		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	14:57:33	113285304	6037015584	14184		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	15:20:47	115811048	6037015585	14185		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	15:31:22	117290227	6037015586	14186		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	16:17:15	120877534	6037015587	14187		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	17:10:08	122356790	6037015588	14188		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	17:38:19	121572533	6037015589	14189		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	17:47:55	117229014	6037015590	14190		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	18:03:04	119901512	6037015591	14191		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	18:11:33	120486367	6037015592	14192		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	18:33:14	122157496	6037015593	14193		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	18:40:13	121148890	6037015594	14194		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	18:42:49	118864121	6037015595	14195		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	18:43:03	118192281	6037015596	14196		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	18:54:52	117321764	6037015597	14197		
Invoice payment	CASH		EUR	HPTDINESREC1	19.09.2023	19:25:52	121691089	6037015598	14198		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	20:14:00	121188571	6037015599	14199		
Invoice payment	VISA		EUR	HPTDINESREC1	19.09.2023	21:30:27	121111154	6037015600	14200		
Transfer between Cash	CASH		EUR	HPTDINESREC1	20.09.2023	00:57:33			14201		
Balance	CASH		EUR	HPTDINESREC1	20.09.2023	00:57:33			14202	Balance (mark of)	

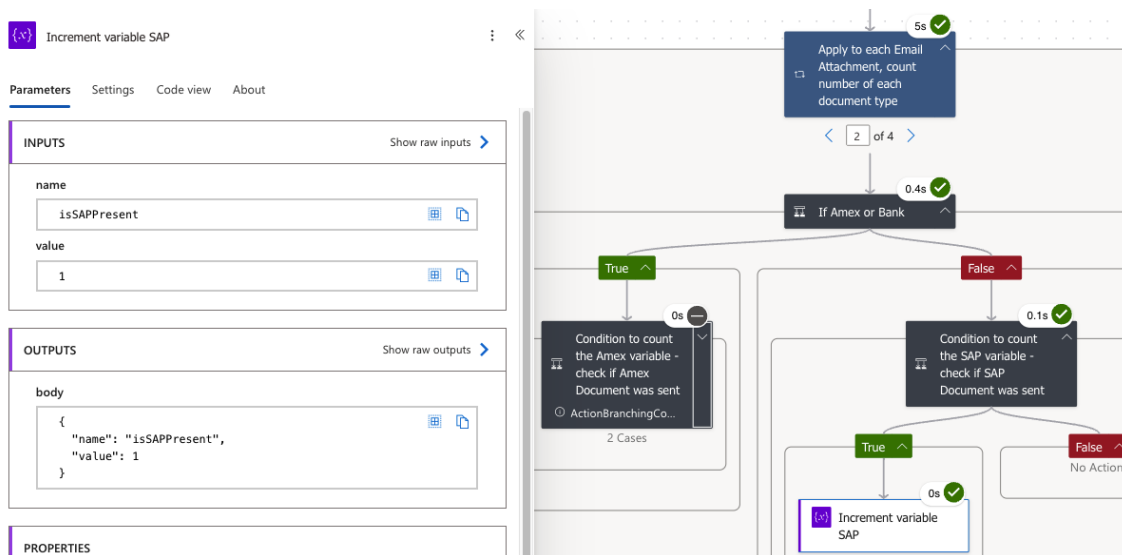
Robotic Process Automation (RPA) in Finance and Accounting: A Solution in a Hotel Company

APPENDIX 4. Increment value for “isBankPresent”, in first document



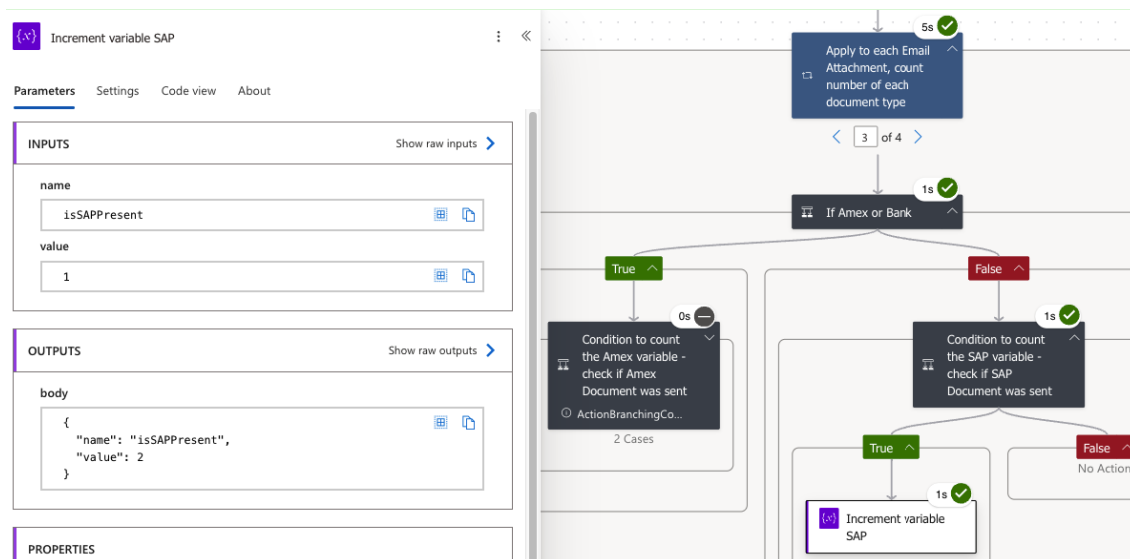
Robotic Process Automation (RPA) in Finance and Accounting: A Solution in a Hotel Company

APPENDIX 5. Increment value for “isSAPPresent”, in second document



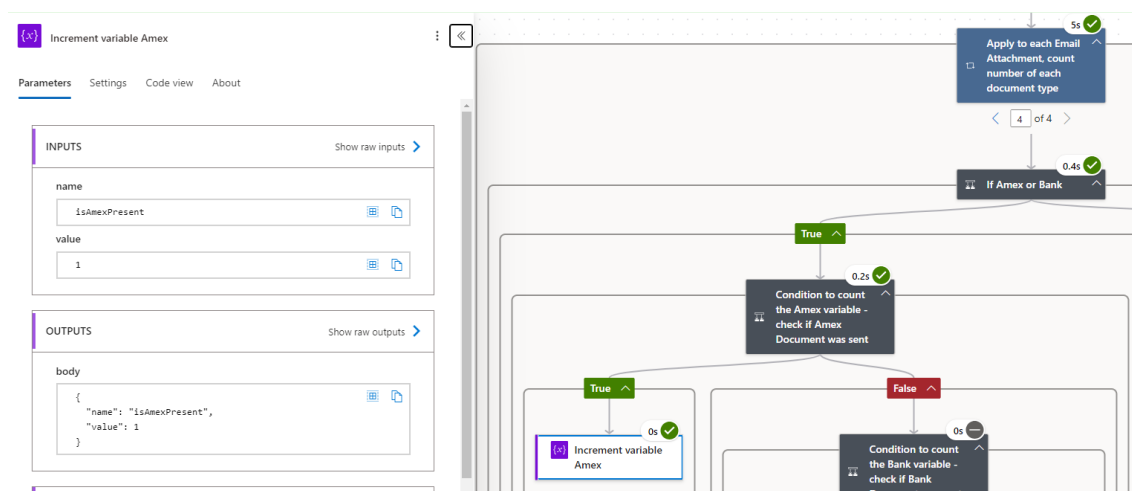
Robotic Process Automation (RPA) in Finance and Accounting: A Solution in a Hotel Company

APPENDIX 6. Increment second value for “isSAPPresent”, in third document



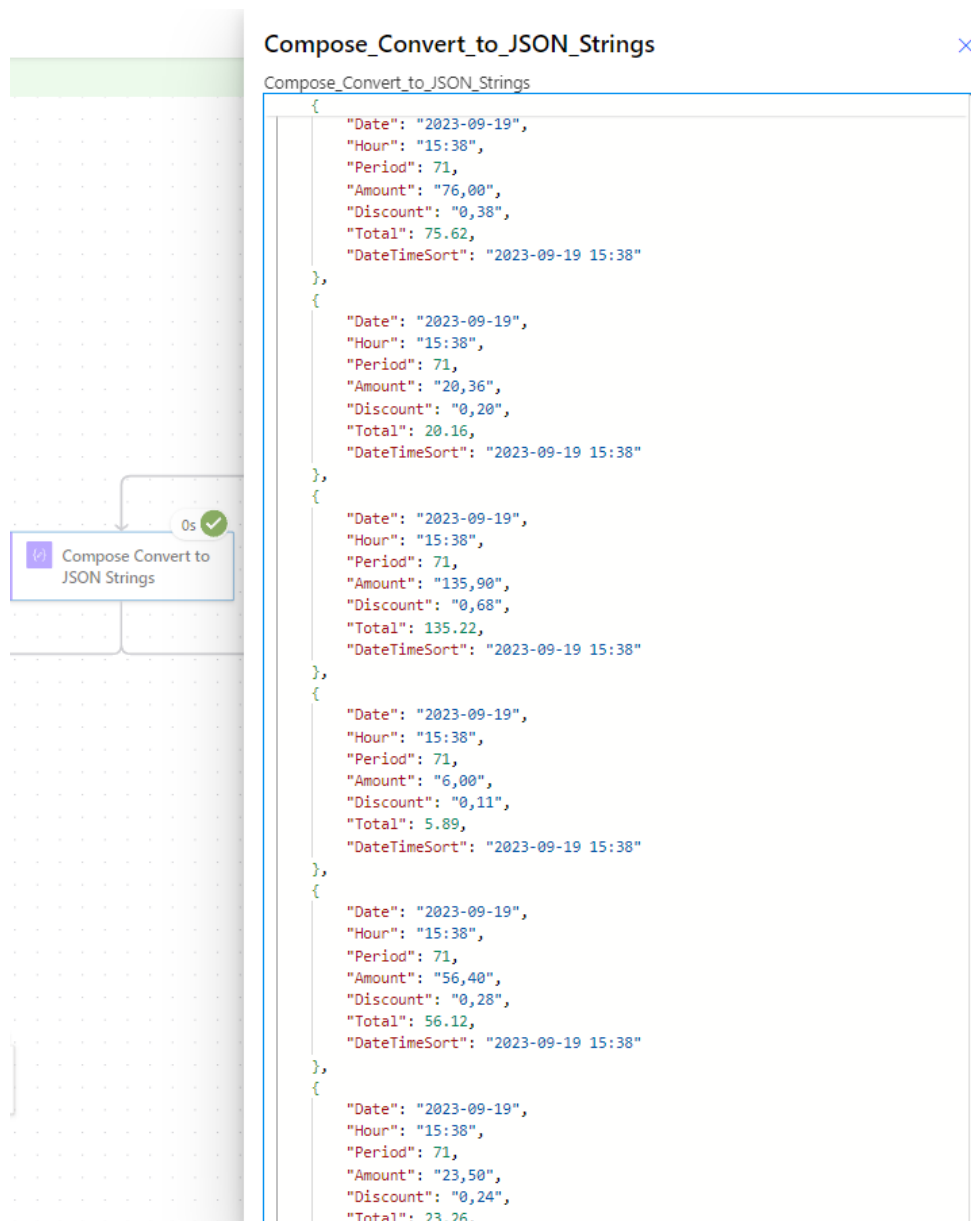
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APPENDIX 7. Increment value for “isAmexPresent”, in fourth document



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APPENDIX 8. Small sample of the JSON String for Bank and Amex entries



Compose_Convert_to_JSON_Strings

```

{
  "Date": "2023-09-19",
  "Hour": "15:38",
  "Period": 71,
  "Amount": "76,00",
  "Discount": "0,38",
  "Total": 75.62,
  "DateTimeSort": "2023-09-19 15:38"
},
{
  "Date": "2023-09-19",
  "Hour": "15:38",
  "Period": 71,
  "Amount": "20,36",
  "Discount": "0,20",
  "Total": 20.16,
  "DateTimeSort": "2023-09-19 15:38"
},
{
  "Date": "2023-09-19",
  "Hour": "15:38",
  "Period": 71,
  "Amount": "135,90",
  "Discount": "0,68",
  "Total": 135.22,
  "DateTimeSort": "2023-09-19 15:38"
},
{
  "Date": "2023-09-19",
  "Hour": "15:38",
  "Period": 71,
  "Amount": "6,00",
  "Discount": "0,11",
  "Total": 5.89,
  "DateTimeSort": "2023-09-19 15:38"
},
{
  "Date": "2023-09-19",
  "Hour": "15:38",
  "Period": 71,
  "Amount": "56,40",
  "Discount": "0,28",
  "Total": 56.12,
  "DateTimeSort": "2023-09-19 15:38"
},
{
  "Date": "2023-09-19",
  "Hour": "15:38",
  "Period": 71,
  "Amount": "23,50",
  "Discount": "0,24",
  "Total": 23.26,
  "DateTimeSort": "2023-09-19 15:38"
}

```