# Robotic Automation of Application Registry Processes in State Organizations

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***Abstract*—Robotic Process Automation (RPA) is the use of software in bots to perform routine tasks that replicate the interactions of a human user with a graphical interface and is currently positioned as a new innovative approach to lighten the high demand for attention requests. This research presents a set of ordered actions to follow, with the purpose of developing an RPA solution applied to a process of the administrative-financial area, which manages to detail each step in a clear and precise way to be performed. For its creation, the Waterfall methodology was used, applied to the development of the RPA solution for the case of an application registration process of a state agency, which fits with the type of user areas where these of automation are usually applied. As a result, it was possible to describe and analyze the process to establish the design to be used in the implementation of the RPA solution, thus determining a procedure to be replicated in cases of similar characteristics.**[1]

***Index Terms*—Bot, business process, innovation, robotic process, waterfall methodology**

## I. Introduction

Nowadays, organizations face the constant challenge of keeping up to date and seek to innovate their processes, products, and services. In the line of business processes, new technologies are applied to ensure this objective. In this context, RPA emerges as a new form of automation, applicable to routine tasks, commonly identifiable in processes of the administrative-financial areas of an organization; obtaining from it, benefits by virtue of being a relatively fast development and implementation technology to improve the effectiveness and efficiency of work teams and employees that integrate it, optimize business processes and improve the identification of requirements of users and or user areas [1, 2]. In addition, it is characterized by not having an invasive implementation with respect to the technological platform and architectures used by the organization [3]. In the context of business processes, RPA can be understood as the configuration of software through a workflow to perform certain routine activities that were previously performed by people, such as information exchange through data files or manipulation of information management systems [4]. Therefore, its use is more favorable in those tasks that require capturing information from various systems in order to transform and manipulate it according to the requirements [2]. Consequently, given the need of any organization to maintain competitiveness and meet their needs, it is widely applied in private and state sectors [5]. The importance of RPA stems from its ability to replicate interactions between humans and computer systems through the capture of actions performed using the mouse and keyboard, the capture of various types of elements of the graphical user interface, and the recognition of images and/or documents, in order to increase performance, reduce costs and minimize the daily workload in the organization where it is applied, adding value to the core processes of the organization [3, 5]. Unlike traditional automation where it highlights the capabilities of automated systems by interacting with applications, databases, or hardware infrastructure [6]; RPA proposes an "outside-in" approach, i.e., it does not focus on improving the information system; instead, the information systems used by the organization remain unchanged [7]. Therefore, RPA is suitable for applying automation in certain types of processes containing highly defined tasks exempt from subjective criteria according to the needs of the organization [8]. Several state organizations, through their administrative-financial areas oriented to the attention and service to the citizen, are adding or updating several services for the attention of the administered, initiating such attention in a request registration process (RRP).

In this regard, it is important to mention the potential benefits that the application of an RPA in the request registration process (RRP) would bring to the document processing area of an entity, such as improved efficiency by reducing the time required to register the request by

Manuscript received June 10, 2023; revised August 5, 2023; accepted September 2, 2023.

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automating repetitive tasks [8], improved performance by promoting greater worker productivity[5], since they can register more requests per day, as well as improved effectiveness since it supports error detection and decreases the error rate [9] by automating the classification of requests, registration of request data to the system, assignment of priority of attention to requests and identification of antecedent requests for the creation of associated files.

A successful case of the application of RPA in the RRP in state organizations is the case of Seattle - United States, where the government has implemented an application automation program for public services, resulting in the elimination of backlogs of utility applications, reduction in hours of manual data entry and reduction of password blocking notifications [10]. In Latin America, specifically in Uruguay, the state e-government agency is developing two pilot projects, one in the Presidency of the Republic to automate the application for accreditation to events, where the RPA, after extracting data from the application, analyzes the applicant's profile and decides to print the accreditation card to the event, and another in the Ministry of Environment (DINAMA) where the RPA will extract data from the procedures of waste management plans and obtain the necessary indicators for their evaluation [11].

The objective of this research is to develop an RPA solution to automate repetitive tasks in a RRP of an administrative-financial area of a state organization, which can have a positive impact, allowing a set of activities such as the classification of records of incoming requests, identification of automatable activities or identification of records not suitable for processing.

## II. Background

### A. Robotic Process Automation

RPA is an emerging software that mimics the human behavior with a graphical interface of some existing system, using functions, tools and applications, with the purpose of replacing repetitive human tasks in pre-selected business processes, allowing the mechanization and control of such actions [3, 5, 12]. Achieving with this, the reduction of errors and the reallocation of employee man-hours to more rewarding and productive tasks [9]. This software obtains the designation of robot based on its operational characteristics and is implemented in information systems through the front-end, using the systems in a similar way to a human employee [8]. Due to the great havoc caused by the pandemic, most state agencies improved their processes using RPA, for example, in managing requests for new appointments, billing, patient admission, screening, in addition to many routine data entry and exit tasks [13]. However, the most important challenge faced by state organizations was the adequacy of the new requirement for remote attention, requiring an integrated development environment, a cloud platform that covers all the requirements for the orchestration of robots in a productive environment, a team of qualified professionals [14]. To guarantee data security during RPA implementation, an information security management system must be applied, in the case of Peru it would be the technical standard NTP-ISO/IEC 27001, so that the risks and impacts associated with probable disasters are identified, this involves complying with the basic principles of trust, integrity, and availability [15].

### B. Robot Service Orchestration (RSO)

RSO is a software used in process automation to control and monitor systems remotely. It facilitates communication between the control system and the user through a graphical user interface, enabling real-time process monitoring and control, RSO be understood as a service provider manager, from which software robots will be executed, controlled and managed, characterized by achieving to provide various methods of launching execution, control and monitoring of the software robot [16]. By making use of this RSO, we can monitor the performance of each robot by providing access and security to the data. In addition, they are also able to optimize the productivity of robots according to previously established demand or importance. Table I shows differences between RPA and RSO. In summary, RSO is a highly flexible, reliable, and scalable automation software with an intuitive user interface and the ability to integrate with other systems.

TABLE I: DIFFERENCES BETWEEN RPA AND RSO

| Features | RPA | RSO |
|---|---|---|
| Identification | You must know what to automate | Tells you what processes to automate and why? |
| Level | Implementation is at pilot level | Implementation is at a tactical, strategic level |
| Scope | Designed to be an excellent bootstrap of tasks | Designed for end-to-end service management |
| Objectives | Addresses “how” companies can automate tasks | Imposes a behavioral change towards improvement and agility, while maintaining command and control |
| Variability | Automates where there is little variability | Serves services with high variability |

### C. Business Process

A business process is a set of activities executed in a specific sequence, receiving inputs provided by people or devices with the objective of producing the expected outputs, determining a consumption of resources (time, costs, man-hours, etc.) in its execution [5]. Among such processes, the RRP aims to review incoming requests, validate data and business rules, register data through technological tools and register requests to proceed to their referral through the corresponding channel. Intelligent Processes are also considered those systems that, from the processing of data and images, can detect behavioral patterns or trends [17–23].

## III. Methodology

The Waterfall methodology is a framework for software development that has a series of phases, and each phase has a series of specific deliverable, the most used models are divided into five phases: requirements

analysis, design, implementation, verification, and maintenance [24, 25]. In favor of achieving the establishment of criteria to address the needs of an organization, it is vital to achieve the identification of tasks that involve the use of an information system; through the exhaustive analysis of all documentation related to the selected process [26]. Then, it is important to include stages that describe and analyze the chosen process in order to build a quality solution [27]. Furthermore, as shown in Fig. 1, for the present study, the scope will be set in the first five stages, from Process Description to Implementation.

Each phase of the methodology has activities that describe a fundamental part for the elaboration of the corresponding deliverables. Inputs that will be relevant to perform the actions that correspond to the next phase. The teamsnever moving from one phase to another until the previous phase has been completed. Considerable planning is required, the client usually reviews the product components at the end of each phase, this method presents enormous risks as the client's interpretation and understanding of the final product may be very different from what was originally understood and produced by the team, something that is often only evident at the end of the project. Therefore, the great challenge of the waterfall method is to complete the project according to the client's requirements, complying with the scope, the estimated deadlines and with the budget set at the beginning of the project.

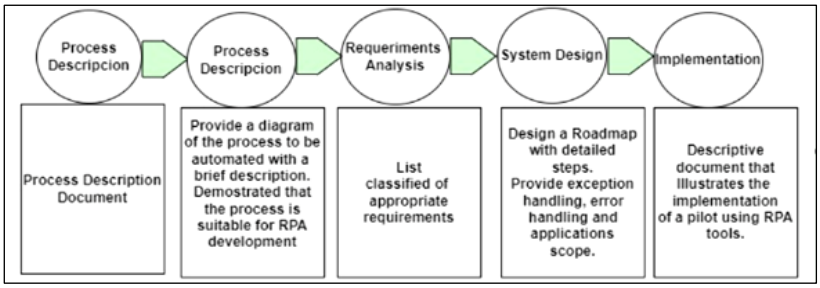


Fig. 1. Stages and objectives of the applied methodology.

### A. Process Description

In this phase it is important to identify those responsible for the process in order to describe in detail the set of tasks that make up the process, with the support of documents that define it (diagram and/or process map) [26]. Process Parameters. These actions allow us to identify the input and output parameters of the analyzed process, establishing the previous and necessary steps for a more detailed analysis. It also allows us to visualize the overall picture of the process. Each parameter will contain a brief and concise description, as well as the necessary requirement for its existence. Process Details. These actions manage to detail the specific tasks and the people responsible for the process in charge of those tasks, respectively. Each of the tasks performed by those responsible for the processes is detailed and listed in a sequential and brief manner, describing them in a simple and understandable way.

### B. Process Analysis

Meetings should be held with the user area so that, with the use of the artifacts built in the process description stage, the set of sequential activities performed by those responsible for the process, containing a high degree of repetitive tasks involving interaction between the user and a graphical interface, can be identified. With the support of those responsible for the process, it is possible to analyze the process, identify the scope of automation with RPA and describe the steps in the workload performed by the employee [3], identifying the sub-process to be automated, in which the RPA solution will be applied.

### C. Requirements

Analysis. In this phase, the objective is to design a list of validation requirements for the case study, reducing ambiguity and uncertainty about how to address them [28]. Such requirements will be characterized by being concise, simple and focused on the chosen business sub-process, which will manage to be elaborated with support from those responsible for the process [26].

### D. System Design

In this phase, the steps of the sub-process are detailed, considering the description of each step, the expected result, and the exceptions. In general, exceptions will be understood as those errors clearly established from the business rules and the actions established to be performed accordingly, being especially relevant for the implementation phase [3, 26]. The actions to be performed by the implemented robot must be described in a comprehensive and detailed way, considering each interaction between the robot and the graphical user interfaces.

### E. System Implementation

The RPA is technology that mimics the way humans interact with software, in that sense in the human-machine interface (HMI), man is replaced with the RPA, creating software programs or bots that can, for example, log in, calculate, and complete the tasks of that event as well as hold a conversation on specific points. RSO allows to integrate and organize RPAs, consequently, RSO is a highly flexible, reliable, and scalable automation software, with a very intuitive user interface and the ability to integrate with other systems.

In recent years, RPA technology has been adopted by various information technology vendors, thus placing UiPath in the top positions of the digital business revolution, characterized by the facilities provided by

achieving rapid implementation of software robots [5], especially in organizations with limited experience in the use of such technology. So, for the implementation phase we will proceed to develop the robot activity flow using UiPath Studio IDE as the chosen RPA tool [3].

## IV. Project Development

For the present study, the application registration process was chosen in an administrative-financial area of a state organization responsible for the administration of pension savings funds. This process includes the reception and registration of applications for early accreditation, pensioner pensions, survivor pensions according to the frameworks and agreements in force at the state level.

### A. Process Description

First, the input and output parameters of the RRP and their associated requirements are identified. Table II identifies the input parameter, which describes the reception of incoming requests by the receptionists in charge, after access authorization.

Second, we detail the tasks of the process and those responsible for each one of them. Table III shows the process tasks, which range from the review and validation of data from incoming requests to the registration or validation of each of these requests. The document receiver and the operative are identified as those responsible for most of the tasks in the process.

To identify the level of efficiency of the mentioned tasks, the system records the start and end times of these tasks; by processing the registered indicators, deficient instances are detected, to which continuous improvement is applied to convert deficient tasks into efficient ones.

TABLE II: APPLICATION REGISTRATION PROCESS PARAMETERS

| Parameters | Description | Requirement |
|---|---|---|
| Input | Receptionists receive requests for free informed Disability(FID) | Access to FID applications |
| Output | Receptionists record od refer FDI requests | Successfully register or derive an FID request |

TABLE III: APPLICATION REGISTRATION PROCESS TASKS

| Tasks | Process Managers | | | | |
|---|---|---|---|---|---|
| | Executive | Secretary | Coordinator | Document Receiver | operational |
| Validate application data and admissibility | | | | X | |
| Prepare return letter | | | | X | |
| Endorse letter and deliver for signature | | | X | | |
| Receive letter and deliver for signature | | X | | | |
| Review and sign return letter | X | | | | |
| Deriving return letter | | X | | | |
| Register LDI requests | | | | X | |
| Review sources of information | | | | X | |
| Form file | | | | | X |
| Send the generated physical documents | | | | | X |
| Transfer file to ILD Line | | | | | X |
| Assign files, if applicable | | | | | X |
| register employers | | | | X | |
| Review sources of information | | | | X | |
| Send the generated physical documents | | | | X | |
| Refer request to the ILD Line | | | | X | |
| Submit a request for a copy of documents | | | | X | |

### B. Process Analysis

The activities with the highest incidence of repetitive tasks are identified and in coordination with the person responsible for the user area, the sub-process where the robotic automation of processes will be applied is chosen. Fig. 2 shows the chosen sub-process, which covers the activities of registration of requests and review of information sources.

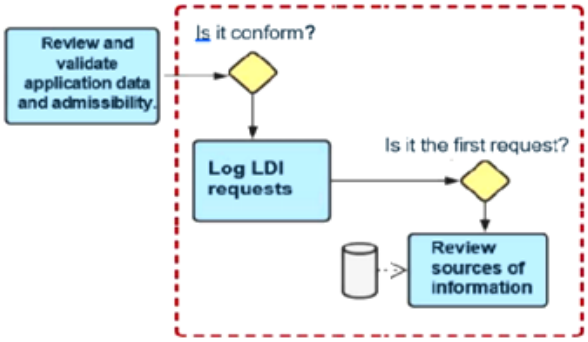


Fig. 2. RPA development.

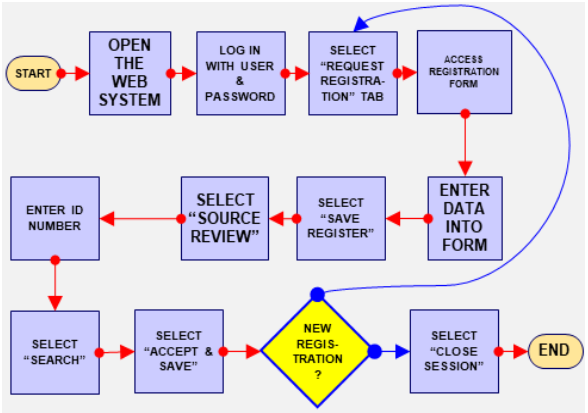


Fig. 3. Employee's manual workload process

Fig. 3 details the activities performed by the human employee in the chosen sub-process, which consist of, shift by shift, registering a request from each customer and reviewing the sources of information to validate the information provided. The need for the automation of this sub-process is perceived and verified as it has a constant and significant manual workload that impacts on the productivity of the area.

### C. Requirements Analysis

In this phase, we proceed to establish a series of validation requirements. Table IV details the chosen validation criteria: deployment, functionality, efficiency, control, and exceptions. Additionally, the actions that the robot must be able to perform in relation to the fulfillment of each associated criterion are described, ranging from the installation of the robot in the corresponding modules to the robot's responses in case of exceptions.

TABLE IV: LIST OF VALIDATION REQUIREMENTS

| Validation Criteria | Description: "A robot can…" |
|---|---|
| Deployment | ▪ Be installed in the attention modules designated for the ONP's Benefits Management Area.<br>▪ Be compatible with the browser of choice.<br>▪ Be run in a test environment (QA). |
| Functionality | ▪ Open web applications and log in using username |

| | |
|---|---|
| | and password.<br>▪ Identify components and images in the web application and perform manual tasks such as clicking.<br>▪ Read data from an Excel file.<br>▪ Perform actions based on predefined rules. |
| Efficiency | ▪ Perform tasks more accurately and faster than a human user.<br>▪ Fully replicate manual tasks in the process. |
| Control | ▪ Stop execution in case of exceptions.<br>▪ Add changes to the process with ease and little development effort. |
| Exceptions | ▪ Add exceptions according to new requirements of the user area.<br>▪ Give an answer to each case of exception |

TABLE V: DETAIL OF THE SUB-PROCESS STEPS

| N | Step Description | Expected Result | Exceptions |
|---|---|---|---|
| 1 | Open the web system for "request attention" | GUI of the web application system. | Control exception in case the system is not available. |
| 2 | Log in. Parameters: user and password. | Access to the main system screen. | Control exception in case of incorrect user or password. |
| 3 | For each new applicant list item, follow steps #4 through #11. | | Control exception in case no new elements to be processed are found. |
| 4 | Retrieve customer data from the request Excel file. | Client data. | Control exception in case of failure to read Excel file. |
| 5 | Access the request registration option by clicking on the "Register Request" tab. | The "Request Registration" interface. | |
| 6 | Access the request registration form by clicking on the "Registration Form" option. | The request registration form. | |
| 7 | Enter the client's data in the form. | Form with data entered. | |
| 8 | Click on the "Save Register" option. | System message" Request registration successful". | Control exception for incorrectly formatted customer data. |
| 9 | Access the source review option by clicking on the "Source Review" tab. | The "Source Review" interface. | |
| 10 | Enter the ID number in the text field. | Text field with client ID number. | |
| 11 | Click on the "Search" option. | System message "Accept and save". | Control exception for ID number not found. |
| 12 | Select the "Close Session" option. | System message "Session closed". | |

### D. System Design

In this phase we detail the steps that the robot will perform in compliance with the chosen sub-process; in Table V we observe the list of steps that go from the entry to the Request Attention web system to the registration of requests and/or review of data sources before the output of the system. Also described are the expected results at each step and the exceptions identified associated with them, such as unavailability of the web system, failure to read data files, data entry with incorrect format, etc.

### E. System Implementation

Finally, we performed the implementation of the software robot through the UiPath tool, developing the automation flow in three main stages that meet the expectations raised in previous phases.

First, in Fig. 4, we observe the sequence of actions that allow the reading of incoming request data to achieve the classification according to the type of user request, to establish a prioritization in the order of attention to them, giving priority, in this case, to the type of request "Activation".

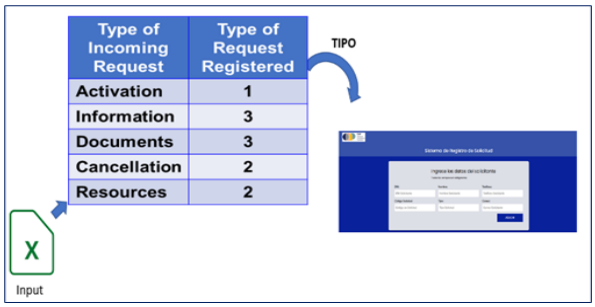


Fig. 4. Classification stage of incoming requests.

Second, in Fig. 5, we observe the sequence of actions that allow the identification of incoming requests that are rejected and stored in a data sheet for their respective derivation and reprocessing in other instances.

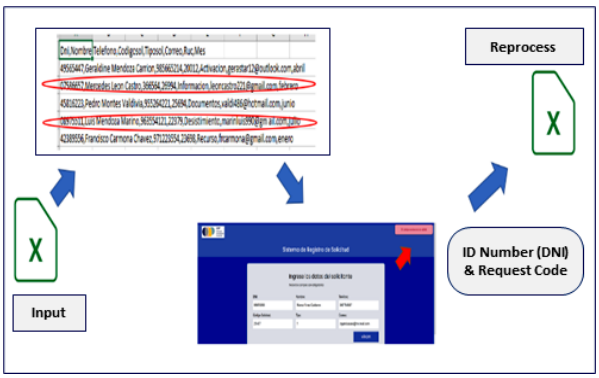


Fig. 5. Stage of identification of rejected applications.

Third, in Fig. 6, we observe the sequence of actions that allow the review of data sources for each registered request, to identify those users with a history of care for the preparation of an associated file.

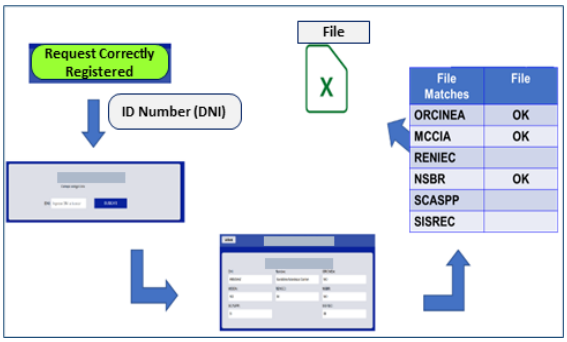


Fig. 6. Source review stage for identification of background for care.

The execution of each of these stages is summarized in automation flows, as shown in Fig. 7, elaborated with the support of the UiPath Studio IDE and in compliance with the validation requirements and the steps described in the system design phase.

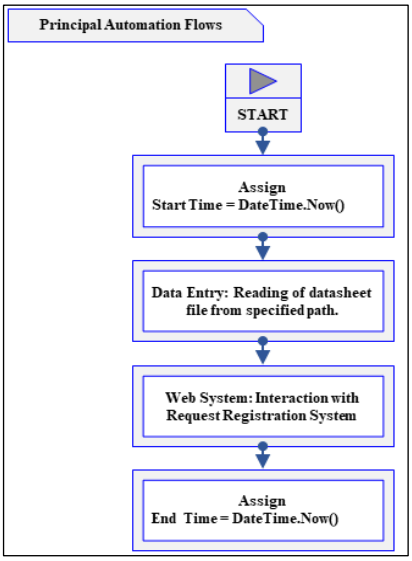


Fig. 7. Stage of automation.

The application of each phase in the development of the RPA solution was carried out in close collaboration with the business specialist of the user area and those responsible for the process; especially in the phases of description and analysis of the process, since they summarize the understanding of each activity of the process individually and its dynamics, establishing the basis for the design and subsequent implementation of the software robot.

Based on the data collected during the execution of manual processing and the subsequent automated process, the benefits of robotic automation are summarized in table VI, these are related to greater coverage and speed in the services provided, which is reflected in the continuous improvement of customer satisfaction.

TABLE VI: COMPARATIVE ANALYSIS BETWEEN METHODS

| Parameters | Manual | Automated |
|---|---|---|
| 1 efficiency | 4.85 minutes | 0.36 minutes |
| 2 Number of applications registered per day | 35 | 100 |
| 3 Failures per day | 5% | 0% |
| 4 Customer satisfaction | Not very satisfied | Very satisfied |

It is necessary to highlight that the challenges of adopting an RPA can be divided into social and human aspects, lack of knowledge of the technology for how to adopt and maintain it and how to govern it. On the other hand, the social and human aspect in terms of what generates the fear of losing the job, for this reason communication is important [29].

In terms of methods that organizations can use to ensure data security during the robotic automation process the security of RPAs, must go hand in hand with security automation. If an alert appears it is instantly determined if action is required based on similar incidents to automatically remediate the problem [30]. It is understood that artificial intelligence today plays an important role in security, recognizing patterns, trained to ensure security, as well as a policy of good practices based on ISO 27001, which will improve information security.

When implementing robotic automation for the request registration process in Peru, it is important to consider the regulatory and legal considerations established in the Organic Law on Protection of Personal Data and Guarantee of Digital Rights (Law No. 29733). This law sets forth principles and provisions for the proper handling of personal data, including its collection, storage, use, and transmission [31]. The objective of this law is to protect the fundamental right to personal data protection, in accordance with Article 2, numeral 6 of the Political Constitution of Peru [32].

Robotic automation of the request registration process compares extremely favorably to traditional manual data entry methods used by state organizations in terms of efficiency, registration capacity, and error reduction, as indicated by the results. Efficiency: Robotic automation significantly reduced the time required for the request registration process. While manual processing took an average of 4.85 minutes per request, robotic automation reduced it to just 0.36 minutes. Registration capacity: Robotic automation allowed for a notable increase in daily registration capacity. While the manual method averaged 35 requests per day, robotic automation was able to process an average of 100 requests daily. Error reduction: Manual processing had an average error rate of 5% per day, whereas robotic automation managed to reduce this rate to 0%, virtually eliminating errors in the registration process.

## V. CONCLUSIONS

The RPA solution can be framed coherently and consistently in the stages of the waterfall methodology. Likewise, the need to expand on the description and analysis of the process, by including two additional initial phases, does not detract from the results obtained in subsequent phases; on the contrary, it establishes a sequence of phases adaptable to any organization for the development of an RPA solution.

The relevance of having clear and precise information about the process, with the support of those responsible for it, was reflected in the quality of the deliverables developed in each phase of analysis and design and directly affect the result obtained when implementing the RPA solution; therefore, to achieve the successful implementation of new technologies, such as RPA, which directly affect the activities of the employees of the user areas of an organization, it is necessary to involve them for an efficient collaborative work with the specialists of the area, and thus guarantee the achievement of positive and satisfactory results.

The robotic automation solution for document reception processes allowed optimizing the document delivery process, in the same way the initiative evidenced will create in similar areas an internal competitive advantage.

The digital transformation in the public sector is feasible through the progressive implementation of innovative solutions that help to generate a better user experience and is aligned to the determined response times and objectives of the area.

Regarding the efficiency of RPA and manual processes, it can be stated that repetitive tasks are performed by an RPA with greater speed and security, more documents are processed without errors (higher productivity). It allows the detection of errors during the process. Increased customer satisfaction.

The natural trend in intelligent process automation will involve AI, machine learning, text reading and understanding, Optical Character Recognition (OCR), Natural Language Processing (NLP), decision engines, computer vision and others.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

Percy De-La-Cruzand and Miguel Carhuavilca have made the main contribution; Hugo Vega and Santiago Moquillaza have made the methodological and content corrections; Adegundo Cámara, Ernesto Cancho, and Gisella Maquen contributed with binding background; all authors had approved the final version.

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