14th Annual International Conference on Industrial Engineering and Operations Management Dubai United Arab Emirates (UAE), February 12-14, 2024

Publisher: IEOM Society International, USA DOI: 10.46254/AN14.20240550
Published: February 12, 2024

Intelligent Automation in the Operational Processes of a Collection Company in Mexico: A Strategic Approach for Pharmaceutical Companies

Victor Martin Maldonado Benitez, Gabriela Guadalupe Escobedo Guerrero
ESCA Santo Tomás, Instituto Politécnico Nacional
México City, México
vmaldonadob1500@alumno.ipn.mx, gescobedog@ipn.mx, gabrielaeg@hotmail.com

Brenda Esmeralda Moreno Garduño
ESCA Santo Tomás, Instituto Politécnico Nacional,
México City, México
bmorenog1500@alumno.ipn.mx

Abstract

The objective of this article is to present the results of the implementation of Robotic Process Automation (RPA) technology in the operational collection processes of an agency specializing in the recovery of overdue accounts receivable, to highlight the benefits for the company and its customers. The type of research was experimental through a multifactorial design that based on Hernandez and Fernandez (2014) manipulated more than one independent variable. The research was conducted in two phases: 1. Review and analysis of available technologies for the development of RPAs and 2. the implementation of operational processes. The result was that the use of digital robots significantly reduces the processing and sending of invoices to debtors, resulting in a lower financial impact to customers because they collect invoices 15 days faster, allowing them to have more working capital, as well as improving business relationships with customers. In this way, this research lays the foundations of proven and tested information technologies to increase profitability and operational efficiency in companies, and a proportion of the budget is allocated to innovation and development (i+D) or digital transformation so that the technological gap existing in companies in Mexico can be drastically reduced.

Keywords

Artificial Intelligence, Robotic Process Automation, Account Receivables, Computer Science, Digital Transformation

1. Introduction

The sanitary confinement due to the SARS-CoV-2 virus had a relevant social and mainly economic impact, causing macroeconomic changes on a worldwide scale, and affecting all economic sectors, as well as all types of businesses. The supply of goods and services was strongly affected, causing a clear reduction in demand. This historical event caused the economy of many companies to deteriorate, considering quantitative and qualitative effects, which are reflected in the financial information, considering the accounting and tax regulations, to mention a few, leading to the fact that companies found themselves with Accounts Receivable that eventually became Uncollectible Accounts, in essence, those whose recovery became impossible due to their complexity (Becerra et al., 2021).

The operational continuity of companies depends crucially on the availability of liquidity. One of the most significant paradoxes in organizations is the discrepancy between excellent sales volume and inefficient collection management (Gómez, 2007), which leads to severe problems in cash flow management.

Currently, there are no automated systems with user-friendly interfaces that facilitate operational processes and focus on accounts receivable management, and business units do not invest in systems, technology, or in increasing the number of personnel assigned to the credit and collection area, leaving this critical department aside and underestimating the importance it deserves (Mora, 2020). The management of overdue accounts receivable is a problem faced by all companies worldwide.
More than 50% of sales between companies around the world involve credit and with data from Atradius (2020), it is estimated that 47% exceed the agreed terms. In Mexico alone, this represents more than 500 billion dollars.

The root of this problem lies in the abundance of exceptions and external factors, which causes the collection cycle to become excessively lengthy and difficult to standardize. This results in a highly complex and inefficient receivables management process, a recurring challenge that affects organizations of all sizes.

Accounts receivable are the most undervalued asset by companies, to the point that some lack an exclusive department for collection activities. According to the Bank of Mexico (2021), 67% of companies in Mexico are financed through their suppliers, and when they fail to comply with the established payment terms, organizations find themselves in the need to request financing, generating significant financial stress. This scenario involves the payment of interest, and the lack of liquidity can lead to financial collapse and eventual bankruptcy of these business entities.

Currently, the collection process is very complex, and companies see it as a black box process, i.e. they do not have visibility of the stage of the process and do not have a specific collection date, which causes them to collect their overdue invoices up to 180 days after their issuance.

Faced with this challenge, one business solution that has gained considerable relevance in recent years is robotic process automation (RPA). This technology uses software robots to automate business tasks that would normally be performed by humans (Perdana et al., 2023).

RPAs learn the autonomous and repetitive tasks performed by humans, the only difference is that they can operate 24/7 without error, and any downtime time waste is eliminated (Huang and Vasarhelyi, 2019) due to their logic-based programming and structured programs for executing digital tasks at the user interface level (Plattfaut and Borghoff, 2022).

Contrary to popular belief, robotics does not involve physical robots or complex machinery performing operational processes. Instead, digital bots that can be easily configured and trained for various tasks are used (Kokina and Blanchette).

Increased productivity translates into faster task processing times compared to the traditional (manual) approach and the ability to process more tasks per unit of time compared to traditional methods. Employees' enthusiasm increases when they can spend more time on more complex and creative tasks that add value, rather than focusing their attention on routine, boring, and simple tasks. (Moreira et al., 2022)

In finance, RPAs have become popular both in academia and in recent practice (Bakarich and O'Brien, 2021). Some accounting firms have started to adopt RPA technology, aiming to automate monotonous and repetitive business tasks such as bank reconciliations and analytical procedures (Moffitt et al., 2018).

On the other hand, implementing RPA in the operations area can improve accuracy; as well as the management and monitoring of automated operational processes, helping operations management shift their focus to value-added work such as customer care; improve the quality of service and consistency of the data and information they deliver to the customer; and optimize levels of analytics (Ping et al., 2018)

1.1 Objectives

The objective of this work is to present the results of the implementation of Robotic Process Automation for collection procedures specifically for the pharmaceutical industry due to its high sales volume, as well as the financial impact of collecting overdue invoices on time. To achieve this objective, the following steps are defined:

- Analysis of the different RPA tools
- Highlight the productivity impact that bots had on the collection agency.
- Highlight the savings achieved by increasing productivity.

2. Literature Review

The COVID-19 health emergency disrupted the current mode of operation of many organizations, which were forced to deploy their disaster recovery programs to stabilize and guarantee their processes and operations (Altigan, 2020). It is worth mentioning that business continuity is the ability of a company to guarantee essential functions before, during, and after a crisis, catastrophe, collapse, pandemic, or disaster (Margherita and Heikkila, 2021).

As a consequence of the SARS-VOC-2 pandemic that has persisted around the world since the early 2020s, companies have found themselves in a completely new reality and have experienced the need to face new management, organizational, technological, and financial challenges. As a countermeasure to these challenges, most companies have included in their strategic plans to perform their operations remotely and/or hybrid because there is a need to work remotely, and the constant quest to reduce operating costs has encouraged the search for new information technologies that are innovative and facilitate essential operational processes (Siderka, 2021).

Current robotic technologies are reviewed and discussed in different categories, followed by identification of the technological readiness level of the representative work. In which future research trends and core technologies are highlighted, such as artificial intelligence, 5G, big data, wireless sensor networks, and human-robot collaboration (Wang and Wang, 2021).

In economies facing higher levels of trade risk, companies need to protect their accounts receivable from the risk of non-payment, as much as 53% of the total value of all B2B (Business to Business) credit sales in Mexico in 2021 alone. However, 44% of companies reported a deterioration in customer payment practices during the year. Late payments affected 50% of the total value of all credit sales and 8% of invoices were written off as uncollectible (Atradius, 2021).

Business units are actively implementing collection strategies and new measures to counter the challenges posed by B2B credit risk. Although there was a decrease in late payments of close to 15% in 2023 (Atradius, 2023), it is not enough to maintain a financially healthy cash flow.

Technology is advancing by leaps and bounds and with the development of artificial intelligence technology, the widespread application of robotic process automation in the financial field has become an inevitable trend (Qiu and Fang, 2020).

According to Kokina and Blanchette (2019) as RPA initiatives are a considerable trend in some organizations, financial services, move from exploration to implementation (PwC, 2017b), providing an opportunity to gather empirical evidence of the use of digital labor in finance, identifying emerging solutions based on the reach and learning of bots. Importantly, this technology employs software bots that can be considered "digital workers," each using their own computer station, username, and password, like a human employee.

According to E&Y (2017b) cited by Kokina and Blanchette (2019), The market size for robotic process automation by 2021 was estimated at $2.9 billion in 2021. However, based on Grand View Research (2023) the market value in the U.S. alone will exceed $12 billion in 2028 which represents a 345% increase from its previous valuation. This exponential growth is driven by RPA service models, where an RPA-as-a-service segment accounted for over 61% of the market share in 2020 and is growing at the highest rate.

From the lens of the IT governance framework (Wilkin and Chenhall, 2019) argues that RPA implementation must be supported by an effective governance mechanism.

It is vitally important to organize and methodically implement bot governance that ensures that IT is aligned with business processes. The search, evaluation, selection, and deployment of tools, as well as the selection of the right processes to be automated improve the performance and security of individual RPA projects, which in turn also extend to the overall automation and digital transformation landscape of the entire enterprise (Slapničar et al., 2023).

The goal is therefore to effectively orchestrate digital process collaboration, with people and robots across the enterprise so that all stakeholders can be aligned with the automation strategy (Wilkin and Chenhall, 2019). In addition, the organization must integrate its data governance program with its IT governance initiatives so that RPA data can be easily and securely managed reducing potential risks that may impact business operations.

Robotic automation of processes has been widely adopted in many sectors, and incredibly the financial sector is included and is used to automate well-defined, monotonous and repetitive tasks (Huang and Vasarhelyi, 2019), eliminating any waste of downtime due to its logic-based programming and structured programs for the execution of digital tasks at the user interface level (Plattfaut and Borghoff, 2022); However, its implementation in operational collection processes represents a challenge because SMEs in Mexico do not have the resources and technological infrastructure to employ them.

3. Methods

The methodology used for the development of this research was carried out in 3 phases, which are detailed below:

1. Identification of RPA technologies, i.e., thoroughly search for suppliers that develop digital bots, programming languages, and libraries, to mention a few.

2. According to Openbots (2023), an RPA implementation can take up to 20 weeks, and, depending on the complexity of the process, it is possible to automate all or part of the process, which is called an assisted bot.

3. At the end of the implementation, information records were obtained and analyzed, and a study of times and movements was carried out to determine if there was any improvement in the collection process, as well as to determine the financial impact that the pharmaceutical organizations had when delivering invoices to debtors within the established time.

4. Data Collection

The case study was conducted in a collection agency in Mexico that offers debt collection services to more than 30 national and international companies, including 5 of the largest pharmaceutical companies in the world. However, as a result of the pandemic, these companies had a significant increase in their sales volume, according to Orús (2023), global revenues amount to more than 1.5 billion dollars.

However, it should be noted that the payment processes in some hospitals, both public and private, are not very efficient, i.e., they are so bureaucratic and cumbersome that they lengthen the collection process by up to 88 days.

The impact of collecting an invoice 58 days after the credit term is granted represents a liquidity risk for companies because operating costs and expenses must be covered.

One of the various causes of non-payment of invoices is the fact that the process of sending invoices to debtors is too bulky and manual.

The concern on the part of operations management arose when it was realized that the executive in charge of sending invoices was overwhelmed by the high volume of invoices. On average, he was receiving around 2,000 invoices per day. Despite having an assigned resource with an 8-hour workday, he was only able to send approximately 300 invoices, equivalent to 15% of the total volume received. However, due to factors such as pressure, distraction, and workload stress, the percentage of invoices sent successfully was significantly reduced to 12%, i.e. only 60 invoices (3%) had an error in the sending process.

The general process for sending invoices is presented below in Figure 1:

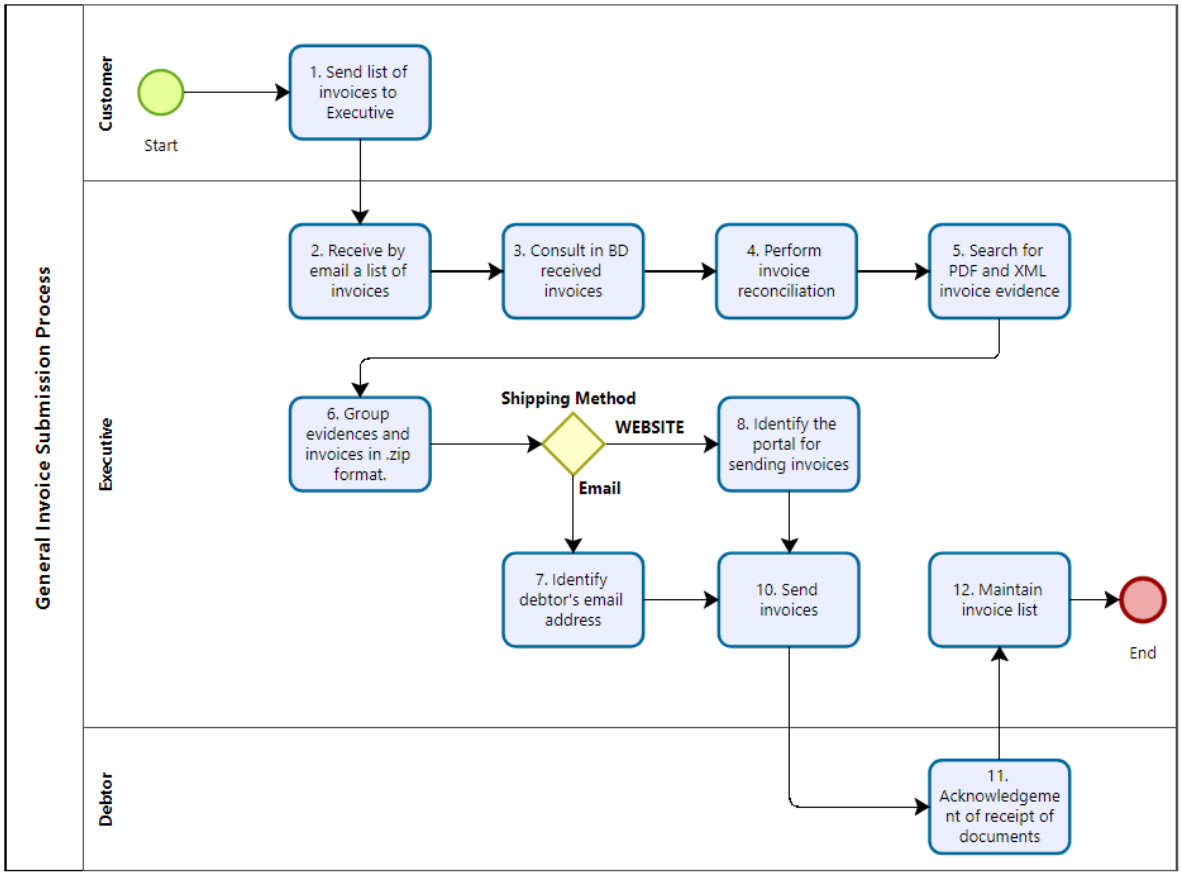

Figure 1. General Invoicing Process

Note: The diagram shows the general process of sending invoices which as shown is too manual and cumbersome.

When the flow chart of the process of sending invoices was drawn up, it was identified that the general process was too manual and monotonous and that a distraction on the part of the executive was crucial in the successful sending of invoices, since the serial number of the invoices are very similar and could be sent to the wrong debtor, which would generate strong conflicts due to the handling of sensitive information.

After the analysis, it was detected that there are two ways to send invoices; therefore, new parameters were defined to automate the tasks, such as adding tables with the debtors' e-mail addresses, e-mail subject, e-mail body, and the requirements requested to receive invoices.

In the case of web portals, the architecture of 350 invoice upload portals was analyzed, identifying the level of automation applicable to each of them, i.e., whether it would be a fully automated or assisted robot. Each portal has different characteristics, batch or unitary document loading capacity, etc (Figure 1).

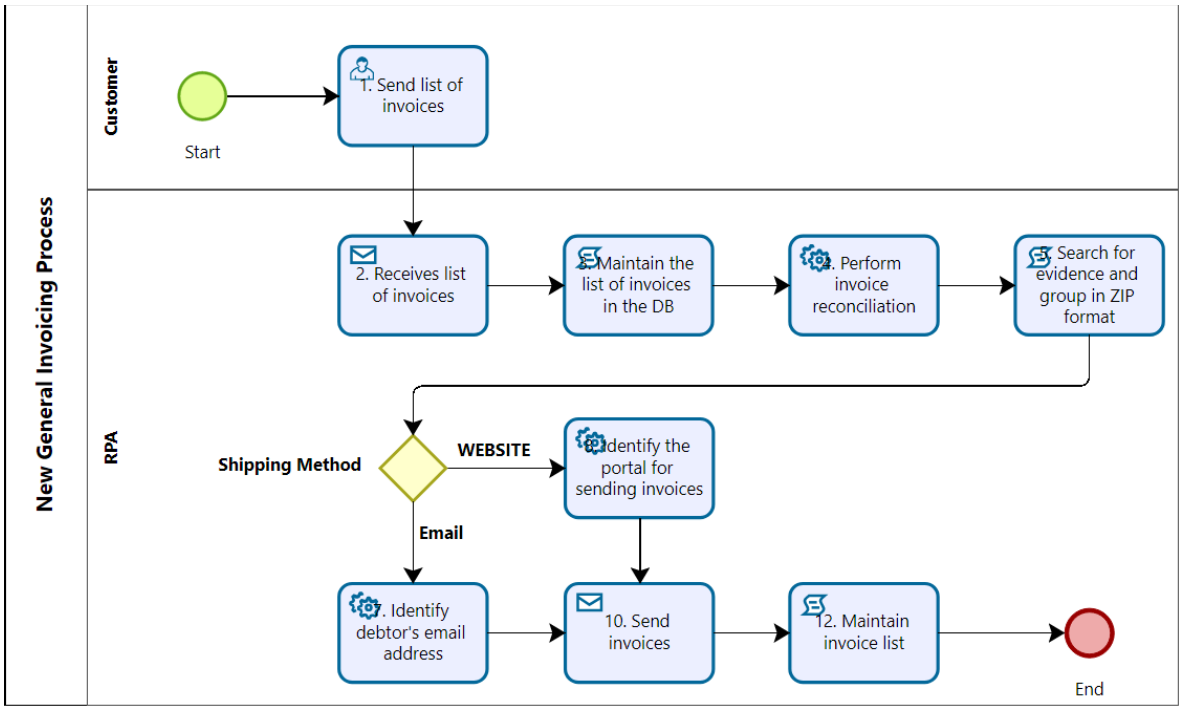

Figure 2. Invoicing Process with RPA Technology

Note: By performing a time and motion analysis, we obtained an optimized and automated general process for sending invoices.

The above flowchart shows the automation of tasks, the client sends the batch of electronic invoices, and a script is executed in the database, in which the new records are inserted and then an automatic reconciliation is performed, after the reconciliation the bot with the folio number of the invoice searches in the database the attached documents PDF, XML documents as well as some evidence, grouping it in a compressed document in. zip format, based on the client's ID number the RPA consults the database of debtors to define the sending process if it is by web portal, it consults the credentials as user and password for uploading invoices, on the other hand if it is by email, it searches the database for sending by email, identifying the recipient, subject, body of the email and attached documents.

Currently, some companies are responsible for developing RPAs tailored to customer needs, however, the minimum investment per digital robot amounts to $ 150 on average, which is not sustainable for the collection agency because they must generate more than 350 robots. That is why extensive research was conducted for the company to develop its digital workers(Figure 3).

Figure 3. Magic Quadrant for Robotic Process Automation
Source: (Gartner, 2023)

Although there is a wide variety of RPA solutions available on the market, we approached 4 of the industry leaders and a Python programming language library (Table 1).

Table 2. Comparative table of RPA tools

Tool	Expert advice	Cost	Scope
a. UI Path	Optional however it is recommended that users have access to certification courses.	From 420 USD per month.	Database queries, and automation of software operations.
b. BluePrism	Optional however it is recommended that users have access to certification courses.	From 74 USD per month.	Database queries, and automation of software operations.
c. Power Automate	Users can access free certification courses.	From 153.64 USD per month.	Automation of software operations.
d. OpenBots	Optional however it is recommended that users have access to certification courses.	From 99 USD per month.	Database queries, and automation of software operations.
e. Selenium	Free access to the library.	NA	Database queries, and automation of software operations.

Source: a. (Ui Path, 2024), b. (BluePrism, 2024), c. (Microsoft, 2024), d. (OpenBots, 2024), e. (Selenium, 2024)

After making the comparative table, the business model of the Ui Path, BluePrism, and Microsoft tools, charge a subscription per robot, unlike Openbots which charges per hour of execution, the convergence between these tools is

that it is a drag-and-drop software, in other words, they offer a very simple interface to handle for the development of workflows. On the other hand, Selenium is an open-source tool, and a person with programming knowledge can develop bots with a higher level of complication because its development is fully through code and not through a user interface.

This is why we chose to use OpenBots and Selenium tools to generate the RPAs that will be responsible for automating the sending of invoices to debtors in the pharmaceutical industry.

A sample was taken from a batch of 2,320 invoices in which the main causes are shown in the following Pareto Diagram (Figure 4):

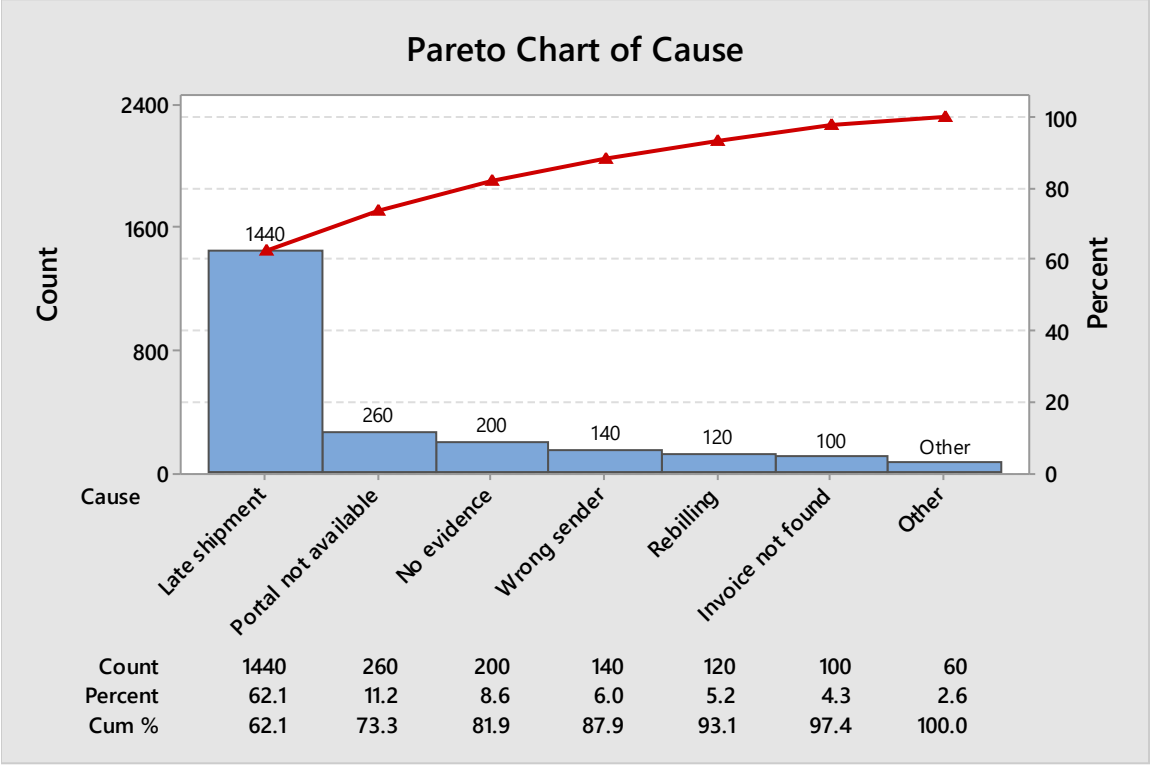

Figure 4. Pareto Chart of Cause

Note: Pareto analysis to identify the 80-20 ratio of delays in invoice delivery

The diagram shows the late sending of invoices to debtors as a symptom of delays in collection, because it is a manual activity of crossing information, which an executive in his 8-hour workday can only send 12% correctly, sending only 278 invoices, and it took him 8 days to send the entire batch.

5. Results and Discussion

5.1 Numerical Results

After the implementation of the RPAs to the process of sending batches containing 2,000 invoices to debtors, the following results were obtained (Table 2):

Table 2. Automated Shipping VS Manual Shipping

Method	Shipping Time	Successful Invoices Sent
Manual	64 hours	88%
Automated	03 hours	98%

This means an efficiency of 2,133%, i.e., invoice batches are sent in an automated manner 21.33 times faster.

The financial impact to the collection agency's customers, assuming an average pharmaceutical industry turnover of $120,000,000, with an average interbank rate based on BANXICO (2024) of 30% per annum is calculated as follows in Table 3:

Table 3. Financial Data for Interest Calculation

Concept	Data	Unit
Amount	$120,000,000	USD
Interest Rate	*30%*	*annual*
Interest Rate	3%	monthly
Periods	18	months
Future Value	$187,159,046	USD
Interest	$67,159,046	USD
Financial Cost	**56%**	

To verify the interest calculation based on (Vidaurri, 2017), the future value equation we have:

$$VF = VA\,(1+i)^n$$

Substituting the values in the equation

$$VF = 120{,}000{,}000\,(1.3)^{18}$$

It is obtained:

$$VF = 187{,}159{,}046$$

Assuming that the pharmaceutical industry needs financing of US$120 million to continue its operations, US$187 million, 1.56 times the amount requested, will have to be paid.

5.2 Graphical Results

Delays in the payment of invoices have a significant impact on the business, because the longer debts remain in the unpaid status, the lower the possibility of recovering the full amount outstanding (Atradius, 2021). Likewise, delinquency exerts significant pressure on the average collection period indicator better known as DSO (Days Sales Outstanding).

The overdue portfolio recovery rate for the agency's clients was close to 49% due to the above-mentioned causes; however, with the support of the automation of invoice sending to debtors, the percentage of overdue portfolio recovery increased significantly by 36 points and is on the rise (Figure 5).

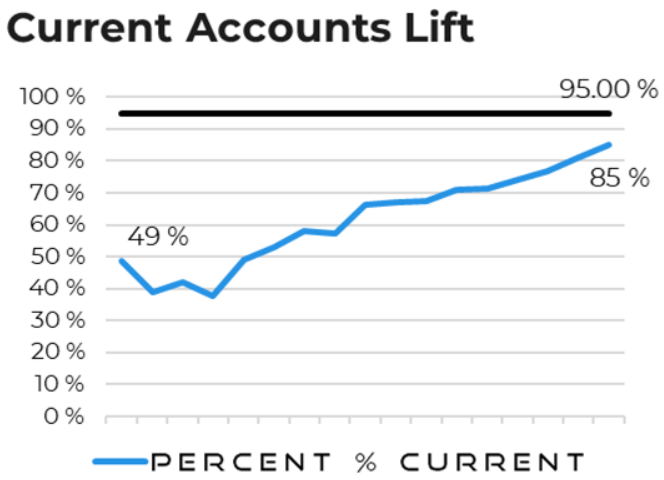

Figure 5. Current Accounts Lift

The recovery of overdue accounts receivable was satisfactory since the pharmaceutical industry was collecting its invoices in a range of 50 - 88 days, however, the sending of invoices was reduced from 8 days to 3 hours, reducing the DSO to only 30 days with a downward trend of collecting invoices every 28 days (Figure 6).

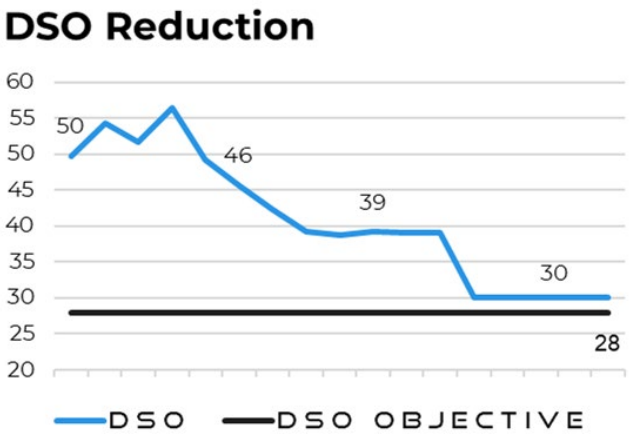

Figure 6. DSO Reduction

5.3 Proposed Improvements

One of the challenges faced by the development team was that some portals have a security captcha to validate that the task is being performed by a human, some artificial vision plugins were used with a success rate of 12% of the portals that requested them. This type of add-ons hosted on the web pages may represent a stopper within the tasks to be executed or otherwise, the bots require assistance to complete the activity. However, we are in the process of searching for continuous improvement in the technologies applied.

5.4 Validation

Subsequently, a satisfaction survey was conducted with the pharmaceutical industry customers to determine whether the implementation carried out was adequate to meet their demands.

The results of the NPS (Net Promoter Score) survey were obtained in Figure 7.:

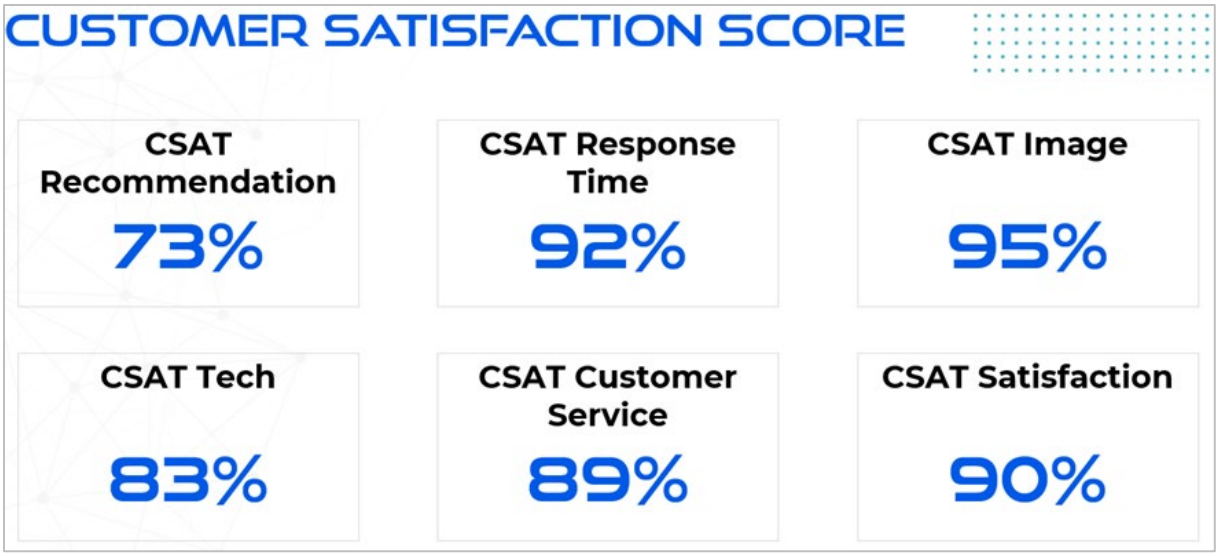

Figure 7. Customer Satisfaction Score

The results were very positive for the collection agency, 73% of customers would recommend it to their colleagues, the response time of attention is excellent with 92%, the corporate image is in high standards due to public acceptance with an imposing 95%, and in terms of technology stands out with 83%, the hypothesis is that by implementing digital robot technology reached 90%, customers in the pharmaceutical industry are satisfied with the service at 90%.

6. Conclusion

Robotic process automation significantly simplifies monotonous and repetitive tasks in various industries, allowing people's time to be focused on higher-value activities such as strategy, and analysis and even providing more efficient customer service.

Collections management emerges as a critical area for all organizations, as non-compliance with collection time can lead to serious financial problems. In such cases, companies often resort to applying for lines of credit, which involves the payment of high interest and fees, negatively impacting the companies' profitability or, in the worst-case scenario, leading to the company's bankruptcy. This study highlights that, before the implementation of RPAs, companies managed their collections every 88 days. Subsequently, thanks to the intervention of the bots, a successful remittance of 98% of the invoicing volume was achieved, reducing the collection period to every 30 days and obtaining a net recovery of 85%, compared to the initial 49%.

In the specific case of this Mexican company, the implementation of automation not only represented a significant improvement in the process of sending invoices to debtors but also marked the birth of a new product that is now offered to other companies in sectors such as logistics, food, and beverages, among others.

References

Atilgan, Ö. COVID-19 and Crisis Management. *In COVID-19 and New Business Ecosystem*, pp. 141 - 153, 2020

Atradius. *Mexico: does doubling of write-offs signify deep economic stress? Atradius Payment Practices Barometer.* Ciudad de México. 2020

Atradius. *USMCA: late payments affect nearly half of B2B trade*. Retrieved from Barómetro de Prácticas de Pago: https://atradius.com.mx/publicaciones/payment-practices-barometer-usmca-2021-late-payments-affect-nearly-half-of-b2b-trade.html. 2021, July 07

Atradius. *B2B payment practices trend, Mexico 2023*. Retrieved from Businesses are actively implementing strategies and measures to alleviate the challenges posed by B2B credit risk.: https://atradius.com.mx/publicaciones/payment-practices-barometer-b2b-payment-practices-trends-mexico-2023.html. 2023, December 31.

Bakarich, K. M., and O'Brien, P. E. The Robots are Coming … But Aren't Here Yet: The Use of Artificial Intelligence Technologies in the Public Accounting Profession. *Journal of Emerging Technologies in Accounting, vol.* 18, pp. 27 - 43. 2021.

BANXICO. *Evolución del Financiamiento a las Empresas durante el Trimestre Abril– Junio de 2021.* Banco de México, Ciudad de México. Retrieved from https://www.banxico.org.mx/publicaciones-y-prensa/evolucion-trimestral-del-financiamiento-a-las-empr/%7B7F3AFEC9-A775-BC0B-1640-5950FAAE46E3%7D.pdf. 2021.

BANXICO. *Tasas de Interés en el Mercado de Dinero - (CF101).* Retrieved from Sistema de Información Económica: https://www.banxico.org.mx/SieInternet/consultarDirectorioInternetAction.do?accion=consultarCuadro&idCuadro=CF101&sector=18&locale=es. 2024, January 14.

Becerra Molina, J. E., Jaramillo Calle, C. Y., Astudillo Arias, P. Y., and Velasteguí López, L. E. Impactos Contables del Covid 19 en torno de los negocios de la región vol. 6. *UNIVERSIDAD Y SOCIEDAD Revista Científica de la Universidad de Cienfuegos, vol. 13 no.*6, pp. 306 - 317. 2021.

Blue Prism. *Somos SS&C Blue Prism*. Retrieved from ¿Por qué SS&C Blue Prism?: https://www.blueprism.com/es/. 2024, January 12.

Cooper, L., Holderness, K., Sorensen, T., and Wood, D. A. Robotic Process Automation in Public Accounting. *Accounting Horizons*, pp. 15 - 35. doi:http://dx.doi.org/10.2139/ssrn.3193222. 2019.

Gartner. *Magic Quadrant for Robotic Process Automation.* Retrieved from 2023 Gartner® Magic Quadrant™ for Robotic Process Automation: https://www.gartner.com/doc/reprints?id=1-2EDXTGOY&ct=230705&st=sb. 2023, August 02.

Gómez, A. H. Administración de Cuentas por Cobrar. In A. H. Gómez, *Administración de Cuentas por Cobrar* (pp. 1 - 26). Bogotá. 2007.

Grand View Research. *Robotic Process Automation Market Size, Share and Trends Analysis Report By Type, By Application, By Deployment, By Organization, By Region, And Segment Forecasts, 2023 - 2030*. Retrieved from Market Analysis Report: https://www.grandviewresearch.com/industry-analysis/robotic-process-automation-rpa-market. 2023.

Huang , F., and Vasarhelyi, M. A. Applying robotic process automation (RPA) in auditing: A framework. *International Journal of Accounting Information Systems, no.35*. doi:https://doi.org/10.1016/j.accinf.2019.100433. 2019.

Kokina , J., and Blanchette, S. Early evidence of digital labor in accounting: Innovation with Robotic Process Automation. *International Journal of Accounting Information Systems, no. 35*. doi https://doi.org/10.1016/j.accinf.2019.100431. 2019.

Margherita, A., and Heikkilä, M. Business continuity in the COVID-19 emergency: A framework of actions undertaken by world-leading companies. *Business Horizons*, pp. 683 - 695. doi https://doi.org/10.1016/j.bushor.2021.02.020. (2021).

Microsoft. *Power Automate*. Retrieved from Automatización y optimización de procesos empresariales: https://www.microsoft.com/es-es/power-platform/products/power-automate. 2024, January 24.

Mora, F. Importancia y manejo de cuentas por cobrar. Revista Mexicana de Contabilidad. *Administración y Economía*, pp. 22-33. 2020.

Moreiraa, S., Mamedeb, H. S., and Santosc, A. Process automation using RPA – a literature review. *Procedia Computer Science vol.219 no.23 pp. 244–254,* 2023.

OpenBots. *OpenBots Academy*. Retrieved from Process Discovery and Analysis: https://academy.openbots.ai/courses/process-discovery-and-analysis-with-openbots/.01 December 2023.

Orús, A. *La industria farmacéutica en el mundo - Datos estadísticos*. Retrieved from Stata: https://es.statista.com/temas/11580/la-industria-farmaceutica-en-el-mundo/#topicOverview. 2023, Decembre 31.

Perdana , A., Lee, W. E., and Kim , C. M. Prototyping and implementing Robotic Process Automation in accounting firms: Benefits, challenges, and opportunities to audit automation. *International Journal of Accounting Information Systems, vol. 51*. doi:https://doi.org/10.1016/j.accinf.2023.100641. 2023.

Ping, C., and Dai, J. Research on the optimization of general ledger management of financial shared service centers based on RPA taking ABC Group as an example. *Friends of Accountants, no. 16*, pp.141 - 146. 2018.

Plattfaut , R., Borghoff , V., Godefroid, M., Koch , J., Trampler , M., and Coners, A. The Critical Success Factors for Robotic Process Automation. *Computers in Industry, vol. 138*. doi:https://doi.org/10.1016/j.compind.2022.103646. 2022.

Qiu, Y. L., and Fang Xiao, G. Research on Cost Management Optimization of Financial Sharing Center Based on RPA. *Procedia Computer Science vol. 166, no.22, pp. 115 - 119.* doi:10.1016/j.procs.2020.02.031. 2020.

Sampieri, R. H. Metodología de la Invetigación. In R. H. Sampieri, *Metodología de la Invetigación* , pp. 634. CDMX: McGraw Hill. 2014.

Selenium. *Selenium automates browsers. That's it!* Retrieved from Selenium: https://www.selenium.dev/. 2024, January 24.

Siderska , J. The Adoption of Robotic Process Automation Technology to Ensure Business Processes during the COVID-19. *Sustainability, vol. 13, no.*8020, pp. 1 - 20. doi:10.3390/su13148020. 2021.

Slapničar, S., Axelsen, M., Bongiovanni, I., and Stockdale, D. A pathway model to five lines of accountability in cybersecurity governance. *International Journal of Accounting Information Systems, vol. 51 no.* 100642,. doi:https://doi.org/10.1016/j.accinf.2023.100642, 2023.

Ui Path. *Start your automation career today*. Retrieved from Ui Path Academy: https://www.uipath.com/rpa/academy. 2024, January 12.

Vidaurri, H. M. *Matemáticas Financieras.* Ciudad de México: Cengage Learning. 2017.

Wang, X. V., and Wang, L. A literature survey of the robotic technologies during the COVID-19 pandemic. *Journal of Manufacturing Systems, no. 60*, pp. 823-836. doi https://doi.org/10.1016/j.jmsy.2021.02.005. 2021.

Wilkin, C., and Chenhall, R. H. Information Technology Governance: Reflections on the Past and Future Directions. *Journal of Information Systems, vol. 34, no.* 2. doi:DOI: 10.2308/isys-52632. 2019.

Biographies

Victor M. Maldonado-Benítez is an Industrial Engineer from UPIICSA - IPN and holds an MBA from ESCA UST IPN and a Master's degree in Industrial Engineering specializing in Business Organization and Industrial Projects. In the field of research, he has participated in social projects, so he has a global vision of organizations. Likewise, he has among his main certifications SCRUM Agile Methodologies and Lean Six Sigma Black Belt. He has led Technology projects such as the implementation of RPA's, Artificial Intelligence models, Data Analysis and Visualization, development of projects with blockchain technology, and participation in attracting capital worldwide achieving a fundraising of 1.5 MM Dollars. He currently works as a Project Manager in one of the most important clearing houses in Mexico.

Gabriela Guadalupe Escobedo Guerrero. She has a degree in Industrial Administration from UPIICSA-IPN; graduated with a Master's Degree in Politics and Management in Technological Change at CIECAS-IPN and has a Ph.D. degree in Administrative Sciences obtained from the ESCA UST-IPN; He has a Member of the National Research System (SNI) CONACyT with the distinction: Researcher Candidate. Since 2007 he has been at the ESCA-UST, where he has taught undergraduate classes in both modalities (face-to-face and distance). She is currently a researcher and teacher in the Postgraduate Studies Section of the ESCA UST-IPN; He has taught at the Master's degrees in Business Administration (MAN) and in the MAES

Brenda E. Moreno-Garduño has a degree in Business Administration and Entrepreneurial Development from ESCA UST-IPN. Currently, she has a Master's in Business Administration for Sustainability at the ESCA UST IPN. Her experience is focused on business consulting; she has participated in projects with SMEs. In addition, she has participated in multiple courses and workshops that complement her academic and work life. She participates as a research fellow and collaborates in the publication of chapters of books about innovation and sustainability.