OPTIMIZING THE FINANCIAL DOMAIN WITH ROBOTIC PROCESS AUTOMATION: INVOICE DATA EXTRACTION

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Abstract:

Background: The industrialization process has led to the automation of business processes with the goal of economic efficiency. This research was conducted at a trading company that requires an effective administrative process with time efficiency. So this need becomes a reason for the need for technology. Currently, a new technology has emerged that will revolutionize how humans work in companies, namely Robotic Process Automation.

Purpose: This study focuses on first, proposing a model in the scope of financial domain, especially in invoice processing and reconciliation. Second, proposing an RPA solution using UI Path which can be used to improve invoice processing and reconciliation processes.

Design: This study uses the Design Science Research (DSR) methodology, so that the research object is the framework of the design itself. There are several steps taken to build RPA, namely (1) Problem Analysis and Motivation, (2) Determining Solution Goals, (3) Designing and Developing Solutions (4) performance evaluation. From the research, the results show that RPA performance has met expectations in terms of: speed.

Finding/ Result: The findings of this study indicate that there are limitations in implementation due to variations in invoice formats across different companies. As a result, there is a need for ongoing adjustments and regular updates to the system and hardware to accommodate changes in invoice formats and business processes of each company.

Conclusion: According to the study's findings it was concluded that RPA model has a good performance and has already met the side's expectations in terms of speed.

Originality/ value (state of the art): The use of Robotic Process Automation (RPA) in financial processes, notably invoice data extraction, is a cutting-edge technology that improves financial efficiency and accuracy. This study, conducted on an Indonesian trading organization, reveals how RPA may be used to streamline financial workflows by automating repetitive, time-consuming procedures, minimizing human error, and enhancing data management processes.

Keywords: financial domain, robotic process automation, Design Science Research (DSR), data management, invoice formats

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INTRODUCTION

The industrialization process has driven businesses to seek greater economic efficiency through automation, especially as they expand and face increasing demands for streamlined operations. Administrative tasks, in particular, consume significant time and resources when handled manually. This research, conducted at a trading company in Indonesia, highlights the critical need for efficient administrative processes and effective time management. To address these challenges, Robotic Process Automation (RPA) has emerged as a transformative solution, automating repetitive tasks and enabling workers to focus on more strategic activities. The implementation of RPA, such as in invoice data extraction, offers enhanced efficiency and precision, paving the way for improved operational performance and long-term economic benefits.

The advent of digital technology has a profound impact on every aspect of the organization. Digitalization has had a significant impact on the financial sector, with fintech being a prime example. User attitudes and behaviors directly influence the performance of fintech digital services (Baharuddin et al. 2023). This occurs due to the imperative necessity for organizations to effectively adjust to the prevailing technological disruption.

Robotic Process Automation (RPA) and Artificial Intelligence (AI) have revolutionized company operations by offering unparalleled efficiency and optimization prospects. This study examines the impact of combining Robotic Process Automation (RPA) with Artificial Intelligence (AI) on enhancing operational efficiency, lowering expenses, and enabling firms to maintain competitiveness in a constantly changing business environment. Moreover, this study examines the core principles of Robotic Process Automation (RPA) and Artificial Intelligence (AI), their application across many sectors, and the obstacles and prospects that emerge from their adoption (Ribeiro et al. 2021).

The process of industrialization has led to the automation of business processes with the aim of economic efficiency (Moffitt et al. 2018). Transactional tasks will move to integrated business services solutions using robotic technology (Axson, 2015). After the revolution of Customer Relationship Management (CRM) and Enterpise Resources Planning (ERP) has now emerged a new technology that will revolutionize how humans work in companies, namely Robotic Process Automation (RPA) (Santos et al. 2020).

Robotic Process Automation (RPA) is a significant breakthrough in the field of business process management technology. In essence, RPA is a technological solution that empowers workers to program computer software, commonly referred to as "robots," to effectively collect and understand pre-existing applications. These robots are capable of doing tasks such as processing transactions, manipulating data, initiating responses, and interacting with other digital systems. RPA possesses the capability to engage with diverse applications at the user interface level, enabling it to replicate actions commonly executed by human users. RPA tools are specifically engineered to function autonomously from the systems they automate, ensuring seamless operation without any disruptions. This allows for quick implementation and the capacity to easily expand the tool's capabilities (Khankhoje, 2024).

Indika Energy Group is one of the companies in Indonesia that has successfully implemented Robotic Process Automation (RPA) to enhance its back-office processes in finance, including vendor and invoice processing, bank reconciliation, tax reporting, and management reporting (Fadrilan Widjaja, 2020). RPA technology is not intended to replace humans but serves as a transformative solution to accelerate and facilitate these tasks, particularly invoice processing and reconciliation, which require human involvement and are well-measured (Fadrilan Widjaja, 2020). However, the company faces challenges related to the thoroughness and accuracy of documentation, especially concerning bills, while limited human resources often lead to inefficiencies. RPA utilizes software robots to automate repetitive, rule-based tasks within business processes, mimicking human actions to interact with digital systems without requiring significant changes to existing IT infrastructure, thereby allowing employees to concentrate on more complex and strategic activities (Pokharkar, 2018).

Robotic Process Automation (RPA) significantly enhances operational efficiency, reduces errors, and accelerates task completion times, making it widely adopted in industries like finance, healthcare, and manufacturing. It is especially useful for automating data entry, extraction, and rule-based decision-making, resulting in increased productivity, cost savings, and

improved accuracy. However, organizations must address challenges related to compliance, security, and workforce impact when implementing RPA. As RPA evolves, along with Artificial Intelligence (AI), these technologies are expected to play a critical role in helping businesses optimize operations, boost productivity, and reduce costs in today's competitive landscape (Ribeiro et al. 2021).

Previous research has been very extensive in introducing the application of RPA, only a few studies in the literature have introduced RPA to finance domain. For example, Issa et al. (2016) mention audit robots in their discussion of audit automation. Kokina & Davenport (2017) suggested that RPA would be useful for the audit process, but they were unaware of its application in the financial domain. Moffitt et al. (2018) envision the future of auditing by introducing the concept of RPA and discussing its potential use in auditing. Recently, Cooper et al. (2021) interviewed global/national RPA leaders in each of the Big 4 and studied the adoption and use of RPA in the accounting industry.

Research on RPA continues to grow. The financial sector, especially banks, is one of the objects studied for the implementation of RPA and its benefits. Several studies state that RPA in the financial sector, especially banks, provides benefits in terms of efficiency, Accuracy and Compliance, detecting fraud and improving customer experience (Kumar & Balaramachandran, 2018; Langmann & Turi, 2023; Met et al. 2020; Pokharkar, 2018; Stople et al. 2017; Thekkethil et al. 2021; Vijai et al. 2020; Villar & Khan, 2021). The results of some of these studies make a hypothesis whether it is true that the application of RPA can improve the effectiveness, efficiency and accuracy of the documents produced.

Given the high potential for automation in finance and the limited research in this area, researchers are interested in exploring opportunities for innovation in financial business processes through the adoption of Robotic Process Automation (RPA). The study focuses on addressing how to automate invoice data extraction, leveraging RPA software configured with business rules to execute tasks across multiple, unrelated systems without human intervention (IEEE Robotics and Automation Society, n.d.).

The advantages of using RPA (Griffiths, 2016), namely: Accuracy, speed, continuity of service, cost efficiency,

ease of use, flexibility and measurement. Broadly speaking, RPA handles work that is structured, routine and repetitive. Syed et al. (2020) provide even more detailed characteristics regarding the characteristics of the tasks that can be managed by RPA, namely: Procedural, Large number. The deployment of RPA is expected to enhance the precision and efficiency of the invoice process in the company.

This research has two main objectives: to propose a model for optimizing invoice processing and reconciliation by addressing inefficiencies and errors in manual tasks, and to implement a Robotic Process Automation (RPA) solution using the UI Path platform to automate key processes. By integrating RPA with existing accounting or ERP software, the study aims to enhance speed, accuracy, and workflow efficiency in invoice creation while reducing manual intervention.

METHODS

The location of this research is a trading company (for anonymity purposes called PT Organik). The object of study is an object that can be an attribute, trait, or value of an object or activity that has certain variables determined to be studied and inferred (Sugiyono, 2020). The object of research discusses a problem topic to be studied so that it can be said to be targeted in a study. This research focuses on first, proposing models within the scope of financial domain, particularly in invoice processing and reconciliation. Second, propose an RPA solution using the Path UI that can be used to improve the invoice processing and reconciliation process. This research employs the Design Science Research (DSR) methodology, with the research object focusing on the framework design itself.

This study employs a mixed-methods research methodology, integrating qualitative and quantitative methodologies and data to obtain a full comprehension of RPA in corporate operations.

Thematic analysis was employed to examine the obtained data and uncover patterns and themes pertaining to RPA prospects, obstacles, and implementation strategies. The technique of cross-case synthesis was employed to match up and analyze the data of several case studies, with the aim of discerning commonalities and disparities.

DSR primarily aims to design, develop, and refine practical artifacts such as models, frameworks, prototypes, and systems, that can effectively solve specific problems or improve existing practices. These artifacts are not just theoretical concepts but tangible and usable solutions that have practical applications.

DSR follows an iterative and problem-solving approach, where researchers identify a problem, design a solution, implement the artifact, and then evaluate its effectiveness in the context of the problem. The evaluation phase is crucial as it provides feedback and insights that can lead to further improvements or adjustments in the design. This iterative cycle continues until a satisfactory and effective artifact is developed.

One of the key characteristics of DSR is its focus on relevance and applicability. The research process revolves around creating solutions that can be applied in real settings, making it highly valuable for both academia and industry. DSR also contributes to the body of knowledge by generating practical knowledge that emerges from the design and evaluation of artifacts.

Overall, Design Science Research provides a systematic and disciplined approach to problem-solving and knowledge creation, aiming to bridge the gap between theory and practice by producing innovative and usable solutions.

An analysis unit is a certain unit that is taken into account as the subject or target of the research (the target used as the analysis or the focus under study) (Sugiyono, 2020). The unit of analysis can be an object, an individual, a group, an organization according to the focus of its research. The analysis unit in this study is the company PT. Organic (The company is made anonymous).

This research uses the Design Science Research Methodology Thinking Framework. Design Science Research Methodology (DSRM) is a design-oriented approach used in information systems and computer science to develop and evaluate artifacts that address real-world problems. Unlike traditional research methodologies, which focus on observing phenomena, DSRM emphasizes the iterative creation and refinement of practical solutions such as models, frameworks, methods, or software systems. The process involves identifying problems, designing and building artifacts, and evaluating them in real-world

contexts, with insights from each cycle contributing to improved solutions. DSRM ensures that research is both theoretically sound and practically impactful, balancing rigor and relevance. More details on the research procedure can be seen in Figure 1.

RESULTS

The discussion of this study explains how researchers develop robotic process automation (RPA) technology in the field of financial domain. The development of RPA in this study used the invoice process at a trading company (for anonymity purposes called PT Organik).

Analyze the problem and motivation

This stage is the stage of collecting the problems underlying the research, collecting evidence behind the problem, so that the research is very necessary and important to do. Before implementing RPA, it is essential to carefully analyze and understand the existing processes within an organization. Not all processes are suitable for automation, and some may require significant redesign before RPA implementation. Analyzing the problem helps in identifying processes that are repetitive, rule-based, and have a clear set of defined tasks. This ensures that RPA is applied to areas where it can deliver the most value, enhancing efficiency and reducing manual effort.
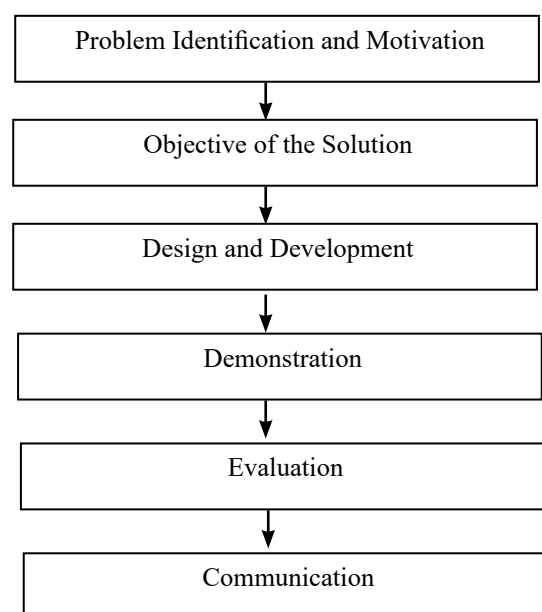

Figure 1. Research Procedure (Hevner et al. 2004)

A thorough analysis of the problem allows organizations to set clear objectives and goals for RPA implementation. Understanding the pain points, inefficiencies, or bottlenecks in current processes helps in defining what success looks like after the introduction of RPA. Motivations for implementing RPA often include improving operational efficiency, reducing errors, increasing scalability, and freeing up human resources for more strategic tasks. Establishing these motivations helps in aligning the RPA initiative with broader organizational goals and ensures that the technology is applied with a purpose.

Analyzing the problem allows organizations to identify potential risks and challenges associated with RPA implementation. This includes considering factors such as data security, regulatory compliance, and the impact on the existing workforce. By understanding the challenges upfront, organizations can develop strategies to mitigate risks and plan for a smoother implementation process. Additionally, a comprehensive analysis helps in setting realistic expectations and timelines for achieving the desired outcomes.

Here are the problems that exist and occur in the company, ranging from operational inefficiencies to management challenges. These issues are thoroughly detailed and categorized in Table 1 for further analysis and understanding.

Table 1. Problems and Solution

Problems and Motivations	Solution
There are so many invoices that come in every day so sometimes there are bills that are missed. The impact of the payment exceeds the set time limit.	Invoice extraction with RPA integrated with Machine Learning so that the bills that go to the email are extracted by the RPA which is later entered into the ERP.

Solution Goal Setting

Goal setting helps the company to articulate the purpose and direction of their RPA initiative. By establishing specific objectives, organizations can clearly communicate why they are implementing RPA and what outcomes they aim to achieve. This clarity of purpose guides decision-making, resource allocation, and overall project planning.

Setting goals ensures that the RPA implementation aligns with broader business objectives. Whether the focus is on increasing operational efficiency, reducing costs, improving accuracy, enhancing customer satisfaction, or achieving compliance, well-defined goals help keep the RPA initiative in sync with the strategic priorities of the organization.

When the company have clear goals, they can prioritize which processes and activities should be automated first. Not all processes are equal, and some may have a more significant impact on achieving the established goals. Goal setting assists in identifying and prioritizing high-priority tasks, ensuring that RPA efforts are directed toward areas that deliver the most value.

Goals act as a guide for decision-making at every stage of the RPA project. From process selection to technology choices and ongoing optimization efforts, having clear goals provides a framework for making decisions that contribute to the achievement of the overarching objectives.

This research is a solution from RPA, in processing invoices to produce the appropriate output. The evaluation will validate whether RPA can cut the time of each extraction.

Solution Design and Development

This stage is a stage to carry out the design and implementation of a study. The design mentioned is a design in the form of BPMN (Business Process Modeling Notation). This stage also designs the minimum needs of software and hardware to be able to run applications resulting from a study. For more details, see Figure 2.

Evaluation

Alpha testing is a test that the author performs at the time of development that aims to test all the features used. Alpha testing focuses on testing the activity function on the workflow. In the Table 2 is a test scenario for the activity used in the invoice document extraction robot. Here's a framework created using the Ui Path (Figure 3).

As previously evaluated, there are an average of 8 invoice cases per day that need to be inputted. Before RPA implementation, the manual input process required 5 minutes per case. Meanwhile, after the introduction of RPA, the input process only takes 2 minutes 50 seconds per case. This means that the time difference that can be saved is 2 minutes 10 seconds or 43% of each case. If the number of cases per day is 8 cases, it takes 40 minutes to complete the manual input process by humans as a whole or it takes 22 minutes 40 seconds or 22.67 minutes after the RPA is implemented. The amount of time that can be saved overall is 17 minutes 20 seconds. Figure 4 illustrates the differences in total input time per day between manual processes and RPA.

Communication

The Communication phase in DSRM is to communicate the findings of the research to relevant parties, specifically financial practitioners, companies, and financial scholars. The findings of this study will be disseminated via a research article that will be published. Implementing RPA yields many advantages for the industry.

1. By automating repetitive tasks, this system streamlines financial processes, leading to faster completion of tasks and reduced processing times. This enables finance teams to be more productive and responsive.

2. This system implementation in finance can result in cost savings by reducing the need for manual labor. With bots handling routine tasks, human resources can be allocated to more strategic roles.

3. This system maintains detailed logs of actions performed by bots, providing a robust audit trail. This enhances compliance with regulatory requirements and internal controls, making it easier for audits.

4. RPA can be utilized to analyze large volumes of financial data quickly. This enables more effective fraud detection and prevention measures to safeguard financial assets.
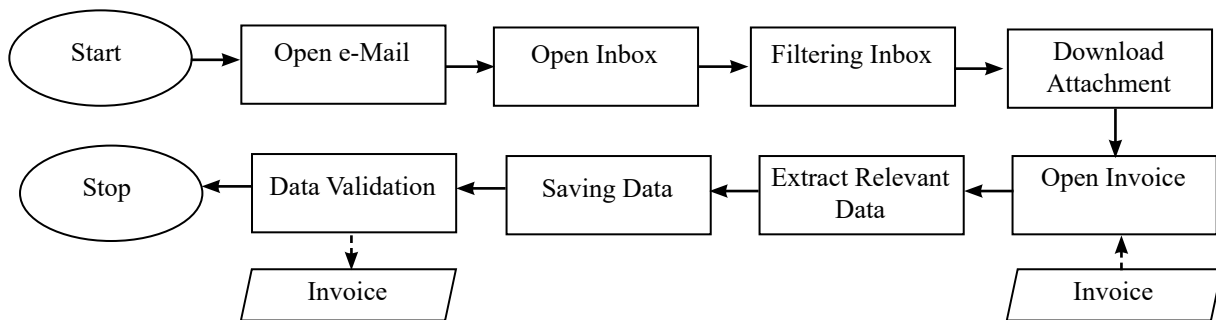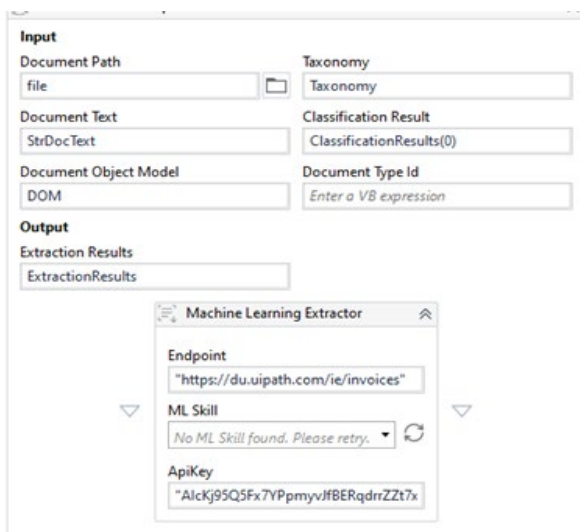

Figure 2. BPMN Invoice Extraction
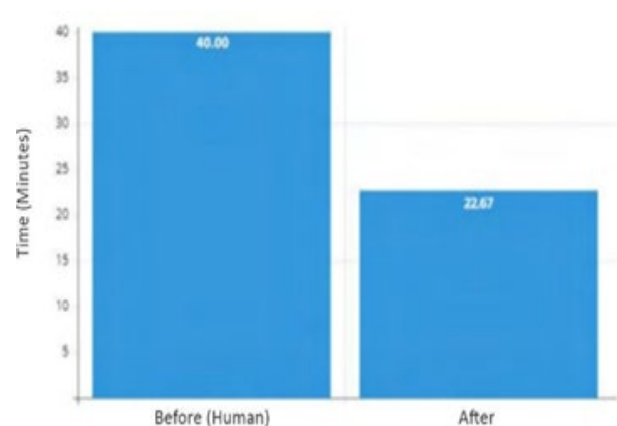

Figure 3. RPA framework with Uipath

Figure 4. Graph of total input time per day before and after RPA introduction

Table 2. Alpha Testing

Activity on Workflow	Test Scenarios	Test Results	
		Appropriate	Non-Compliant
Load Taxonomy	Can specify the form of the document as an invoice document and can specify the data or information to be extracted from the invoice	√	
Digitize	OCR can detect information and text fields precisely	√	
Data Extraction	Can extract data or information from invoices properly and precisely. ML Document Understanding works well without errors	√	
Export Extraction Result	Information or data that has been extracted can be exported with various forms of files	√	
Write Range-Result Extraction	Can write extraction results in the form of excel files with table data from the Export Extraction Result activity	√	

5. The results of this research provide an explanation that creating invoices using RPA is one solution to improve the quality of integrated reporting. Creating invoices using RPA makes the invoice process digital which makes it easier for companies to integrate all reports, one of which is invoices. Integrated reporting itself is a variable that has an impact on company value (Permana et al. 2023).

These results are the same and strengthen from several studies where the RPA process provides several benefits where efficiency will increase, make it easier to review again and reduce the cost and accuracy of the documents created. (Kumar & Balaramachandran, 2018; Langmann & Turi, 2023; Met et al. 2020; Pokharkar, 2018; Stople et al. 2017; Thekkethil et al. 2021; Vijai et al. 2020; Villar & Khan, 2021).

Robotic Process Automation (RPA) holds immense potential to enhance productivity and optimize workflows across diverse sectors. Nevertheless, companies must meticulously strategize and carry out RPA deployments, taking into account crucial elements such as the appropriateness of the processes, the potential to scale, the establishment of governance, and effective change management (Katiyar et al. 2024).

Robotic Process Automation (RPA) offers significant prospects for companies to enhance their company processes. The key opportunities that have been recognized are:

1. RPA automates repetitive and rule-based tasks, freeing human workers to focus on more complex and value-added activities. This increases productivity and efficiency across business functions.
2. RPA reduces labor costs associated with manual processing and eliminates the need for costly system integration. Organizations can achieve significant cost savings by automating high-volume, low-complexity tasks.
3. RPA reduces the risk of human error, ensuring consistent and accurate results. This is especially important in industries such as banking and healthcare, where errors can have serious consequences.
4. RPA allows organizations to maintain a detailed audit trail and ensure compliance with regulations and standards. Bots can be programmed to follow specific rules and procedures, thereby reducing the risk of non-compliance.
5. RPA enables organizations to scale their operations quickly and efficiently. Bots can be quickly deployed to handle increased workloads without the need for additional human resources.
6. RPA generates a vast amount of data on process performance that can be analyzed to identify bottlenecks, optimize processes, and drive continuous improvement.

This system also provides benefits in how employees are facilitated in the problem-solving process. How does this process provide convenience to the required invoice documents which in turn will make it easier for employees to deal with problems that occur regarding invoices.

The implementation of Robotic Process Automation (RPA) in human resource management carries significant managerial implications. By automating routine tasks, such as data entry and basic administrative processes, HR professionals are able to shift their focus towards more strategic functions that directly impact

organizational growth, such as talent acquisition, employee retention, and workforce planning. This shift not only improves the efficiency of HR departments but also leads to higher employee satisfaction, as chatbots and automated systems provide timely responses to staff inquiries, reducing frustration and improving overall workplace experience. Managers should leverage RPA to optimize internal operations, enhance productivity, and improve the strategic capacity of HR functions, ultimately contributing to a more agile and responsive organization.

Nevertheless, the introduction of RPA also poses issues that HR professionals must confront. Efficient execution of Robotic Process Automation (RPA) necessitates meticulous strategizing and adept change management to surmount opposition from personnel who harbor concerns about technological displacement. Effective and unambiguous communication is crucial for elucidating the advantages of RPA and how this technology supplements, rather than supplants, human abilities. Furthermore, it is crucial to take into account ethical considerations and ensure adherence to regulatory requirements, particularly with regards to safeguarding data privacy and maintaining information security.

This system proves that this repetitive process becomes much faster. The speed of this process facilitates other work processes which in turn will increase work efficiency, effectiveness, and productivity.

Managerial Implications

This study also gives some managerial implication such as:

1. The Company that utilizes robotic process automation for invoice data extraction can reduce the amount of time spent on manual data processing. This could save operating costs associated with administrative work while also lowering the risk of human mistake in data processing.
2. Automation enables managers to acquire more timely and accurate financial data. This will increase the quality of information available to decision-makers, allowing financial policies to be more effective and responsive to changing market conditions.

3. The use of automation technologies improves the company and documentation of the financial data tracking process. This makes it easier for businesses to comply with applicable accounting standards and financial regulations while reducing audit risk.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

In general, the implementation of Robotic Process Automation (RPA) in the finance industry brings forth a plethora of significant benefits. RPA automates repetitive tasks, enhancing accuracy and minimizing errors to ensure reliable financial data and reporting. Finance professionals can leverage RPA to increase efficiency in various financial processes, leading to faster task completion and streamlined operations. Moreover, RPA's ability to maintain detailed audit trails and ensure compliance with regulatory requirements empowers finance departments to handle audits more effectively and confidently.

Furthermore, RPA contributes to cost savings by optimizing resource allocation and minimizing the need for manual labor. As finance teams are relieved from mundane tasks, they can focus on higher-value activities such as strategic planning, data analysis, and decision-making, ultimately driving better financial outcomes for the organization. RPA streamlines tasks such as data entry, reconciliation, and invoice processing, enhancing cash flow management for financial institutions and more effective vendor and fraud management. Ultimately, the integration of RPA in finance presents a transformative opportunity for the industry, offering enhanced efficiency, accuracy, and compliance while empowering finance professionals to drive innovation and deliver greater value to their organizations.

In this study too, there are several conclusions in this study. There are several stages carried out to build RPA, namely (1) Problem Analysis and Motivation, (2) Solution Goal Setting, (3) Solution Design and Development (4) performance evaluation. From the study, the results were obtained that the performance of RPA already met the expectations on the side: speed.

Recommendations

The recommendation provided in this study highlights a notable gap in the consideration of pre-processing data errors. Neglecting data pre-processing highlights an opportunity for future research to integrate Artificial Intelligence (AI) in automating the pre-processing of data. In many data-driven fields, errors and inconsistencies can be inherent, impacting the reliability of subsequent analyses and decision-making processes. The integration of AI technologies, such as machine learning algorithms, could enhance the efficiency and accuracy of data pre-processing tasks by automating the identification and correction of errors. Therefore, the suggestion for future research involves developing AI-driven solutions that can autonomously handle data pre-processing, ultimately contributing to more robust and reliable datasets for analysis.

Moreover, Integrating AI into data pre-processing aligns with broader trends in data science and analytics. As organizations increasingly rely on large volumes of data for strategic decision-making, the need for automated and intelligent data processing tools becomes more pronounced. By addressing the pre-processing stage with AI, researchers can streamline the data preparation process, allowing for more focused and accurate analyses. This advancement not only contributes to the scientific rigor of research but also has practical implications for industries seeking to harness the power of data-driven insights.

In the end, the study's suggestion underscores the importance of incorporating AI into the pre-processing of data errors in future research endeavors. Embracing AI technologies in data pre-processing can lead to more efficient, accurate, and scalable solutions, aligning with the evolving landscape of data-driven research and applications across various domains. The integration of AI in this context represents a forward-looking approach that enhances the overall quality and reliability of research outcomes in the era of advanced data analytics. Therefore, there is a need for readjustment and a system that must continue to be regularly updated in terms of systems and hardware in order to adapt to changes in the invoice format and business processes of each company. The results of this study have limitations on implementation, which indicates that there are limitations on implementation. In general, each company has a different invoice format.

CONFLICTS OF INTEREST: The author declares no conflict of interest.

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