Unlocking the Potential of Radio Frequency Identification (RFID) based Robotic Process Automation (RPA) as a Smart Solution to Improve the Effectiveness and Accuracy of Modern Industrial Logistics Case Study at PT Pos Indonesia (Persero)

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Abstract

The implementation with Robotic Process Automation (RPA) at PT Pos Indonesia (Persero) in the shipment handling process seeks to improve efficiency and operational effectiveness. However, RPA often can cause errors when shipment sorting, and then these errors do impact how satisfied customers can be. Usually, these errors concern shipment data read from a wrong website. This study, therefore, focuses on evaluating the efficiency as well as effectiveness after then before RPA implementation. The study analyzes the Robotic Process Automation's (RPA) impact upon the effectiveness and the efficiency of sustainable operations at PT Pos Indonesia (Persero) both before and after RPA implementation. A qualitative approach is the method that is used in this study. Data was collected from delivery discrepancy websites also observations at the Indonesian State Logistics Company operational department. In order to identify whether RPA met company expectations, the analysis compared operational efficiency and effectiveness levels both before and after RPA implementation. Regarding RPA system performance, this study is expected to contribute perceptions to PT Pos Indonesia (Persero). The study will also allow them to design strategies for improvement and address existing challenges. PT Pos Indonesia (Persero) should continue to evaluate as well as develop the RPA system. They also should improve the quality of the data and should integrate supporting technologies so that they can minimize errors in delivery and improve satisfaction of the customer.

1. Introduction

The advent of Industry 4.0 has sparked a digital transformation across various sectors, including logistics. Logistics companies must now be fast, accurate and efficient, as well as sustainable. As a pioneer in national postal and distribution services, PT Pos Indonesia (Persero) faces significant challenges, including increasing shipment volumes, the need for real-time tracking and customer expectations

regarding the accuracy and speed of deliveries. In practice, PT Pos Indonesia (Persero) continues to encounter various issues in its operational delivery processes. According to data from a business research company, demand for courier services is projected to increase further by 2025, driven by e-commerce growth and the rising demand for goods delivery, particularly for short-distance shipments. The global courier services market is expected to reach 485.4 billion US dollars by 2025, representing a compound annual growth rate (CAGR) of 5.9% (Abdi, 2025). (Abdi, 2025). This increase requires PT Pos Indonesia (Persero) to implement faster and more efficient systems for delivering goods. However, many of PT Pos Indonesia's (Persero) operational processes are still carried out manually, including the recording of delivery data, the sorting of packages and the handling of late claims. Currently, only around 60% of packages have an accurate real-time tracking status at PT Pos Indonesia (Persero), with delays in the tracking status input process causing the delivery process to be affected. This certainly impacts customer satisfaction levels. According to the company's 2023 performance report, around 15–20% of packages are delayed due to suboptimal handling processes. In 2023, Indonesia's Logistics Performance Index (LPI) ranked the country 63rd out of 139 nations, reflecting ongoing challenges in logistics efficiency. According to a Deloitte study, companies in the logistics sector and other industries that implement automation technology experience cost reductions and improvements in quality by reducing human error (Acoba et al., 2019). Therefore, implementing Robotic Process Automation (RPA) technology could be a practical solution for addressing delivery delays at PT Pos Indonesia (Persero).

In addition, PT Pos Indonesia (Persero) feels the need to improve system integration with various major e-commerce platforms, such as Tokopedia, Shopee, Lazada, and Bukalapak, in order to increase its market share in the digital market and gain recognition among users of e-commerce platforms, which are currently booming. Manual data synchronization causes delays in delivery status updates. Studies show that RPA enables businesses to work faster and more efficiently, including in tracking the status of goods shipments in real time (Geekgarden, 2025).

Based on various phenomena that have occurred recently, the implementation of Robotic Process Automation (RPA) in logistics service providers such as PT Pos Indonesia (Persero) is a strategic step aimed at improving effectiveness, efficiency, and competitiveness in the logistics industry. RPA can accelerate package processing, improve data recording accuracy, optimize delivery routes, expedite customer claim resolution, and enhance integration with global market systems. Therefore, this study will analyze how the implementation of RPA can have a significant impact on digital transformation at PT Pos Indonesia (Persero), based on existing case studies.

1.1 Literature Review

Operation Management

Operations management is the discipline of managing and optimising the processes required to produce goods and services. According to Heizer, Render and Munson (2020), it encompasses a range of activities, including planning, organising and implementing, as well as controlling the resources used in the production process. In this context, operations management plays a key role in ensuring the production process runs smoothly and also serves as a strategic tool for achieving a competitive advantage (Heizer et al., 2020). Suryono Efendi, Djoko Pratiknyo and Edi Sugiono (2019) define production as the process of creating goods or services. Production can also be understood as an activity or process that converts inputs into outputs. Meanwhile, operational management refers to processes or activities that aim to produce products by transforming inputs into outputs. Production and operations management can also be defined as activities that organise and coordinate the effective and efficient use of various resources to produce products or increase their value (Efendi, 2019).

Operations management is formed from two main concepts: management and operations. 'Operations' itself refers to a series of activities that aim to transform inputs into outputs in the form of goods and services. Thus, operations management can be defined as the organisation and management of the various resources involved in these transformation activities — ranging from human resources and materials to technology and information — to produce outputs that align with consumer needs and expectations. The main objective of operations management is to ensure this transformation process runs efficiently and effectively to provide added value to customers and optimally meet market demand (Edo & Hendayani, 2023).

Supply Chain Management

Supply chain management (SCM) is an integrated system that connects various entities, including suppliers, manufacturers, distributors and retailers, with the aim of ensuring the smooth flow of goods and information, optimising operational costs, avoiding stock imbalances and improving distribution efficiency and customer satisfaction (Sutarman, n.d.). According to Abdirad et al. (2021), companies should apply the concept of SCM in an effort to meet market demands. SCM involves a series of production processes and activities, from procuring raw materials from suppliers and adding value to convert these materials into finished products, to storing inventory and shipping these products to retailers and consumers. Effective SCM can produce cheap, quality products in a timely manner, enabling companies to meet market targets and reap the benefits. In addition, Dumitrascu et al. (2020) state that there are three types of flow that need to be managed in a supply chain network. The first is the flow of goods moving from upstream to downstream (Yusuf Muhammad & Soediantono, 2022).

SCM is a strategic approach to managing the production and delivery of goods and services in order to increase customer value and reduce operating costs. This perspective highlights the role of SCM in creating added value for customers and enhancing a company's competitiveness (Heizer et al., 2020). Good SCM enables companies to reduce production costs, increase distribution speed and optimise inventory management. Companies such as Amazon and Toyota, for example, have successfully implemented effective SCM, enabling them to meet market demand quickly and efficiently. Additionally, SCM helps companies to deal with global challenges such as fluctuating raw material prices, supply chain disruptions and volatile market demand. Digital technologies such as big data, the Internet of Things (IoT) and artificial intelligence (AI) are enabling SCM to evolve and provide more adaptive and innovative solutions (Heizer et al., 2020).

Information accuracy and visibility in the supply chain are two closely related factors. High accuracy ensures the precision and reliability of exchanged data, while good visibility enables real-time tracking and observation of all activities and processes, improving coordination, reducing errors and facilitating the identification and resolution of disruptions (Azis & Irjayanti, 2024). SCM practices refer to the approaches used to align the various parties in the supply chain - such as suppliers, manufacturers, distributors and retailers - to ensure that products or services reach the end consumer efficiently. Effective SCM practices can improve operational efficiency, reduce costs and boost customer satisfaction (Widyanesti & Masyithah, 2018).

Robotic Process Automation (RPA)

Robotic Process Automation (RPA) is a technology designed to mimic human interaction with a desktop graphical user interface (GUI). RPA software is used to perform structured, routine and repetitive computer tasks. RPA utilisation is most effective when applied on a large scale. Although RPA is a new technology with unrealised potential, it can mimic human activities on a computer more quickly and accurately than humans can. These robots can work non-stop, 24/7, without experiencing fatigue or performance degradation. RPA enables the replication of the way humans perform repetitive tasks within an application, such as entering data or handling transactions. However, RPA's goal is not to replace humans in an industry or company, but rather to improve employee output. As such, RPA serves as an effective and powerful assistant to humans (Fernando & Harsiti, 2019).

Robotic Process Automation (RPA) offers a fresh approach to the transportation and logistics sector. Robots are intelligent machines used in various industrial sectors, particularly automated manufacturing plants. They reduce human workloads, create skill standards and cutting-edge methods in business processes, and provide effective solutions for the transport sector. The complex situation in the business market puts pressure on the transportation industry in the supply chain to provide services that meet international standards at an affordable cost. Combining RPA with artificial intelligence (AI) enables manual processes to be replaced by software robots. AI can learn and speed up the classification process by analysing unstructured data, while RPA operates in a more organised manner (Gružauskas & Ragavan, 2020).

RPA can automate a variety of manageable tasks and give AI access to large amounts of data. This technology is used not only in warehouses and on production lines, but also in logistics administration offices, adding value to the delivery process. "RPA is a future-proof technology that can be used to automatically process repetitive or high-volume tasks." It is often associated with AI due to its ability to quickly and precisely complete a series of tasks and parts of work, while robotic processes help to address issues in transportation and logistics. In order to remain competitive, every company must invest in new technologies and applications that can enhance the efficiency and agility of their business processes. RPA facilitates a deep understanding of business processes and removes constraints in global-standard business operations, so it is more than just a technology. Transportation companies that

manage global supply chains in a constantly evolving and dynamic business environment face immense pressure to provide high-quality services at low cost. However, many of the operational processes within these organisations, such as accounting, human resource management and shipping, are filled with document-focused tasks (Gružauskas & Ragavan, 2020).

2. Research Methods

This research uses a qualitative method based on interpretivism, focusing on understanding the meaning and experience of individuals in context. This involves describing and analysing phenomena from the perspective of those involved. In this study, data collection techniques were employed through the use of secondary data sources, such as documents, reports and other written materials relevant to the implementation of Robotic Process Automation (RPA). Secondary data was collected in order to analyse the impact of RPA implementation on the effectiveness and efficiency of goods delivery. Five indicators were used to measure the effectiveness and efficiency of processing goods before and after RPA implementation. This study has two main variables: RPA effectiveness and RPA efficiency, which form the basis for the indicators used to collect data and are presented in Table 1 below :

Table 1 Variable Operational Table

Variabel	Indikator	Definisi Operasional
RPA Effectiveness	Number of HR to Process Goods	Number of human resources who perform the task of sorting goods
	Shipment Data Irregularity	Number of errors that occur due to human error before implementation and after RPA
	Shipment Data Production	Number of deliveries that have been produced before and after RPA implementation
Efisiensi RPA	Task Completion Time	Time taken to complete task before and after RPA implementation
	HR Costs Process Goods	Cost required to pay for human resources required to process goods

Variable Operational Table

The stages of qualitative research generally follow a set process (Creswell & Creswell, 2022). The stages are as follows:

1. Formulating research questions: The first step is to formulate relevant research questions that align with the objectives of the study. These questions will guide the data collection and analysis process.
2. Designing the study: Once the research questions have been established, the researcher needs to design an appropriate study design. Qualitative research designs can include case studies, ethnography, phenomenology or grounded theory, depending on the research objectives.
3. Collecting data: This stage involves collecting data directly through techniques such as interviews, observations or the collection of documents. Researchers may also apply triangulation techniques, involving the use of multiple sources of data to gain a more thorough understanding.
4. Analysing data: Once the data has been collected, the researcher will analyse it systematically. Qualitative data analysis involves organising, coding and thematising the data in order to identify any emerging patterns, themes or concept

3. Result and Discussion

In this study, the author collected secondary data, which served as the basis for determining the effectiveness and efficiency of RPA implementation at PT Pos Indonesia (Persero). Secondary data is data collected by researchers from various existing sources (therefore referred to as 'second-party data') (Harahap & Tirtayasa, 2020). This data can be obtained from various sources, such as books, reports, and journals (Oktavia, 2021). According to Wulandari and Taufik (2020), secondary data generally consists of evidence, records, or historical reports compiled in published and unpublished archives (documentary data) (Novellini and Sukma, 2021). Data collection in qualitative research is holistic, in-depth, and contextual. Data is obtained through techniques such as in-depth interviews, participatory observation, document studies, and field notes. In this study, the researcher observed operational activities at PT Pos

Indonesia (Persero) to collect data on the number of human resources involved in the shipping process and the time required to process shipments, comparing data from 2023 and 2024.

Meanwhile, production data, discrepancies, and human resource costs used at PT Pos Indonesia (Persero) were obtained by the author through an internal website that facilitates data collection. Production data and discrepancies were collected over a six-month period from January to June in 2023 and 2024 to determine the effectiveness of RPA use at PT Pos Indonesia (Persero). The data is presented in tabular form. Data presentation was conducted after data collection, involving filtering, grouping, and focusing on relevant information while eliminating irrelevant data. The aim was to organize the data in such a way that conclusions could be drawn and final results verified. In qualitative research, researchers reduce data through various forms of transformation, such as selecting data, grouping it into common patterns, and using other techniques. In this study, data reduction involved grouping and sorting data relevant to the final research results, thereby eliminating unnecessary data. The secondary data obtained and grouped are presented below:

Secondary Data

In this study, the authors collected secondary data by conducting observations to gather information on the number of human resources required, HR costs and processing times for shipments, both before and after the implementation of RPA. Production and irregularity data were collected from internal sites and are presented in Table 2 below.

Table 2 National Production & Irregularity Table

Month	Production 2023	Production 2024	Bulan	2023	2024
January	11.784.965	12.552.693	Januar y	40	67
February	10.611.713	11.268.120	Februa ry	38	47
March	13.302.195	14.022.076	March	47	52
April	11.007.147	11.054.349	April	37	46
May	11.410.173	12.146.486	May	32	41
June	10.736.162	12.396.102	June	16	47
TOTAL	**68.852.355**	**73.439.826**	**TOTAL**	**210**	**300**

National Production & Irregularity Table

Meanwhile, the field observation stage was carried out to collect data on the number of human resources required, the length of time taken for the delivery process and the cost of human resources when using and not using RPA. The data is available in Table 3.

Table 3 Observation Data

Data	2023	2024
Number of HR on duty	70 people	24 people
Length of time for processing goods	8.4 seconds/item	1.2 seconds/item
Human resource costs per month	Rp 466.667.000	Rp 191.667.000
Human resource costs per year	Rp 5.600.000.000	Rp 2.300.000.000

Data Reduction

In reducing the production data for the period from January to June in 2023, the data was adjusted for the office using RPA. However, in 2023, human labour was still used to process goods. For the reduction of the production data for 2024, the office used RPA as a tool to help with processing goods. The data is available in Table 4.

Table 4 Production Data Reduction

Production		
Month	**Production 2023**	**Production 2024**
January	1.387.610	1.056.166
February	1.157.120	869.956
March	1.419.148	1.070.833
April	1.203.650	862.351
May	678.040	910.594
June	1.136.795	1.008.998
TOTAL	**6.982.363**	**5.778.898**

Production Data Reduction

The reduction in irregularity data for the period January to June in both 2023 and 2024 has been adjusted to include misdirected shipments and under-delivery differences. This data is presented in Table 5.

Table 5 Irregularity Data Reduction

Month	**2023**	**2024**
January	33	56
February	34	37
March	38	38
April	31	32
May	21	36
June	7	34
TOTAL	**164**	**233**

Irregularity Data Reduction

Despite reductions and adjustments made by offices implementing Robotic Process Automation (RPA), production data showed significant fluctuations in 2023. The goods processing process still relies on human labour, which may cause instability in production. Production got off to a strong start in January, with 1.3 million items produced. However, there was a 15% decline in February to 1.1 million items. There was a recovery in March with a 27% increase to 1.4 million items, setting a record high for this period.

This positive trend did not continue into April, when production fell by 14% to 1.2 million items. This was followed by a drastic decline in May, with only 600,000 items produced — 50% of April's total. June showed improvement with an increase in production, although it did not reach the level seen in March. These fluctuations suggest that reliance on human labour poses a risk, and that the adoption of RPA has not yet been fully integrated into physical production processes. Further analysis is needed to identify the

causes of the decline in productivity, particularly in May, as well as strategies for stabilising production going forward. In 2024, Robotic Process Automation (RPA) was fully implemented in goods processing, resulting in a more stable production pattern, albeit with lower volumes than in 2023. From January to June 2024, production ranged from 800,000 to 1 million items per month — far below the 1.4 million items produced in March 2023.

Between January and June 2023, there were a total of 164 cases of reduced and adjusted irregularity data, including misrouted and short shipments. March had the highest error rate, while June had the lowest irregularity rate. In 2024, the total number of irregularity cases remained at 164, but the distribution pattern differed. January had the highest number of errors, while April had the lowest. Interestingly, despite the total number of cases being the same, 2024 saw an increase in irregularities compared to 2023 when viewed from the monthly distribution

DISCUSSION

Shipping goods through PT Pos Indonesia's services is a critical process involving a series of steps to ensure that packages arrive safely and on time. One of the most important steps is the processing of shipped goods. This includes determining the destination based on the postal code, selecting the route, and adjusting the transportation method according to the product chosen by the sender. This stage is prone to errors, particularly mistakes in selecting the shipping route and discrepancies in the quantity of goods, which often occur due to human error or inconsistent data. To address this issue, PT Pos Indonesia (Persero) has implemented Robotic Process Automation (RPA) to assist staff in the shipping process. RPA is designed to minimize errors by automating data verification, route selection, and shipping calculations, thereby improving operational accuracy and efficiency.

The purpose of this study is to analyze the extent to which the implementation of RPA has proven to be effective and efficient in reducing delivery errors. Data has been filtered to ensure that it only includes offices that have adopted RPA. The analysis shows that, although RPA has the potential to reduce human-caused errors, error patterns are still fluctuating. Some offices have seen a decrease in discrepancies, while others have not shown significant improvement. These findings suggest that the success of RPA depends on a variety of factors.

It is not only the technology itself that is most important, but also the readiness of infrastructure, staff training, and optimal system integration. Therefore, PT Pos Indonesia (Persero) needs to conduct a comprehensive evaluation of RPA implementation, including reviewing workflows and increasing human resource capacity, to ensure that automation truly minimizes errors and improves the reliability of delivery services.

Robotic Process Automation (RPA) Effectiveness

The effectiveness of a system is based on its ability to achieve predetermined objectives, as measured through theoretical studies. In the context of implementing Robotic Process Automation (RPA) at PT POs Indonesia (Persero), the two main objectives of applying RPA are to minimize human error in the goods delivery process and to reduce operational burdens by efficiently utilizing human resources in the goods processing department. The data presented in Figures 1 and 2 serve as the basis for analyzing the extent to which RPA has succeeded in achieving these objectives.

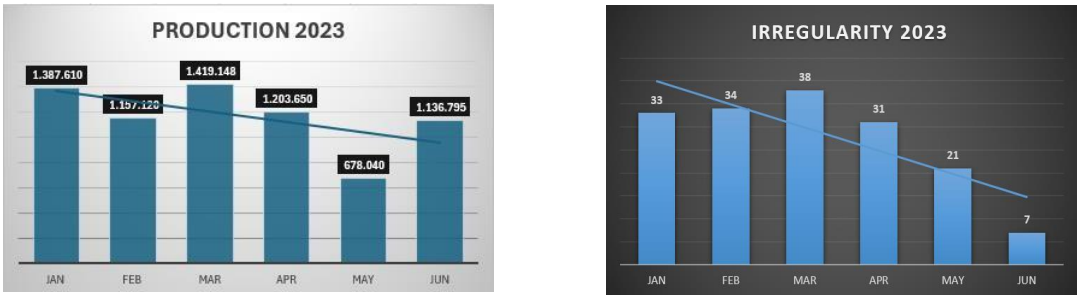

Figure 1: 2023 Data Diagram

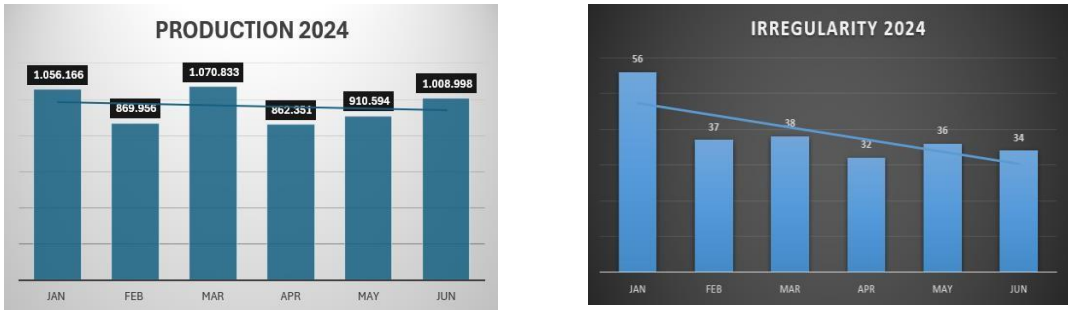

Figure 2 : 2024 Data Diagram

An interesting paradox emerges from the data presented on the implementation of Robotic Process Automation (RPA) at PT Pos Indonesia (Persero). In 2023, the goods processing department had a production volume of 6,982,363 units and 70 employees, with 164 cases of non-compliance. However, in 2024, despite a decrease in production volume to 5,778,808 units and a reduction in the number of employees to 24, the number of discrepancies increased to 233..

Robotic Process Automation (RPA) fficiency

The implementation of Robotic Process Automation (RPA) at PT Pos Indonesia (Persero) aims to improve operational efficiency, which is theoretically defined as achieving optimal results with minimal use of resources. In this context, RPA is expected not only to reduce the number of human resources but also to accelerate operational processes, reduce costs, and increase productivity. Based on the data presented, two key indicators show the level of efficiency after RPA implementation: processing time per item and human resource expenditure.

First, in terms of processing speed, there was a significant improvement after the implementation of RPA. While processing one item previously took 8.4 seconds, this figure dropped dramatically to just 1.2 seconds. This significant difference shows that RPA has successfully accelerated the workflow, enabling faster processes and better responses to service requests. Second, PT Pos Indonesia (Persero) has also managed to significantly reduce monthly operational costs. While labor costs reached Rp466,667,000 per month in 2023, this figure dropped to Rp191,667,000 in 2024. This resulted in monthly cost savings of Rp275,000,000, reflecting that the high level of cost efficiency achieved after RPA implementation was deemed successful. The cost reduction was not only due to a decrease in the number of employees but also to automation by robots, thereby minimizing human resource costs.

These two indicators also show that the implementation of RPA has contributed to a significant increase in efficiency for PT Pos Indonesia (Persero) in terms of delivery speed and cost savings. However, although RPA has proven to be efficient in this context, other factors such as output quality and its impact on long-term organizational performance also need to be considered. Efficiency is not only measured by speed and cost reduction; efficiency is also measured by consistent service quality and the ability to adapt to future changes. Although RPA has shown positive results, regular evaluations are necessary to ensure that its implementation aligns with the company's strategic objectives.

This study reveals that the dual impact of Robotic Process Automation (RPA) implementation at PT Pos Indonesia (Persero) has produced different results in terms of effectiveness and efficiency. In terms of effectiveness, RPA has successfully reduced reliance on human resources, as evidenced by the decrease in the number of employees in the goods processing department from 70 in 2023 to 24 in 2024. However, this technology has not been optimized to minimize operational errors, as indicated by an increase in discrepancies from 164 cases in 2023 to 233 cases in 2024, despite a decrease in production volume from 6,982,363 to 5,778,808 units. These findings highlight the need for improvements in system design and data input quality to maximize RPA effectiveness. In terms of efficiency, RPA has shown very positive results. Processing time per item has improved significantly, from 8.4 seconds to 1.2 seconds, dramatically increasing service speed. From a financial perspective, the company has reduced monthly operational costs by Rp275 million (from Rp466.6 million to Rp191.6 million), demonstrating RPA's ability to optimize resource utilization. These results indicate that RPA is a highly effective solution for improving process speed and cost efficiency.

Overall, this study proves that the implementation of RPA at PT Pos Indonesia (Persero) has provided strategic value for the company's digital transformation, especially in terms of operational efficiency. However, to maximize its benefits, the company also needs to refine the system, with a focus on improving accuracy and output quality. A holistic approach that combines the advantages of RPA with process improvements will be the key to the success of the company's digital transformation in the future.

4. Conclusions

The implementation of Robotic Process Automation (RPA) at PT POS Indonesia (Persero) has produced complex, multidimensional results, especially with regard to the effectiveness of delivery handling. RPA has reduced dependence on human resources, with the number of employees decreasing from 70 to 24. However, improving accuracy remains challenging, with the number of discrepancies increasing despite a decrease in production volume. This suggests there may be issues with workflow design, data input validation and system adaptation. Operational efficiency has improved significantly. Processing time per shipment item has decreased from 8.4 to 1.2 seconds, resulting in labour cost savings of Rp275 million per month. This efficiency is driven by RPA's ability to operate continuously and consistently. Additionally, cost reductions encompass recruitment, training, and physical facility usage. However, to ensure long-term sustainability and impact, PT Pos Indonesia (Persero) must develop a more comprehensive performance evaluation system that incorporates customer satisfaction, company reputation, innovation and readiness for digital transformation. Taking this holistic approach is expected to enable RPA to drive more strategic and sustainable digital transformation within PT Pos Indonesia (Persero).

The implementation of RPA in Indonesia's state-owned LSP has produced mixed results. While it has successfully improved efficiency, reducing costs by 59% and accelerating processes by 85%, its effectiveness in reducing errors has actually decreased, with irregularities increasing by 42%. To address this issue, companies must take four strategic steps. Firstly, a comprehensive evaluation of RPA workflows must be conducted to identify the root causes of increased errors. Secondly, they must establish a real-time monitoring system with automatic escalation mechanisms. Thirdly, they must enhance human resource capacity by providing comprehensive technical and change management training. Fourthly, they should consider integrating AI/ML to develop hyperautomation. These steps are designed to optimise RPA while preparing for a more comprehensive digital transformation. This structured approach enables companies to maximise the benefits of automation while minimising its negative impacts, thereby building a strong foundation for future digital evolution.

Further research into automation in the logistics industry requires the development of a comprehensive evaluation framework that covers three main areas: operational performance (e.g. efficiency and productivity); strategic impact (e.g. customer experience and business innovation); and technical aspects (e.g. system integration and data security). This holistic approach is essential for accurately measuring the value of a company's digital investment. At the technical level, the focus of research should be on optimising the integration of RPA with supporting technologies such as AI, NLP and the IoT. Experimenting with various implementation scenarios is necessary to determine the most suitable model for PT Pos Indonesia (Persero)'s operational characteristics, while ensuring system security in an increasingly complex work environment. Human resource transformation also requires a specialised approach, including developing competency-based digital training models and redesigning adaptive organisational structures. Comparative studies of best practices in global logistics companies will provide valuable insights to accelerate digital transformation. In the long term, it is crucial to conduct predictive research on the evolution of hyperautomation technology and its potential impact on future logistics business models. Systemic analysis is required to understand the interaction dynamics between technology, business processes and human factors within an ever-evolving digital ecosystem.

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