The Eurasia Proceedings of
Educational & Social Sciences (EPESS)
ISSN: 2587-1730

The Eurasia Proceedings of Educational and Social Sciences (EPESS), 2025

Volume 46, Pages 116-124

IConETE 2025: International Conference on Education in Technology and Engineering

Expanding the Boundaries of RPA with Intelligent Automation in Investment Banking Operational Processes

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Abstract: Investment banking operational processes consist of data-intensive, repetitive tasks such as lien transactions and service agreements. The manual execution of these processes carries significant risks in terms of efficiency, cost, and accuracy. While basic Robotic Process Automation (RPA) applications offer rule-based solutions for reporting, they fall short in processing unstructured data, such as contracts. This technological gap makes Intelligent Automation solutions inevitable. This study demonstrates, through a case study, how the limitations of basic RPA in Aktif Investment Bank's Lien Transactions and Retail Service Agreements (RSA) processes are overcome with intelligent automation. In the Lien Transactions process, the competency of Optical Character Recognition (OCR) technology for understanding data in unstructured PDF documents is examined, while in the Retail Service Agreements process, OCR-based Intelligent Document Processing (IDP) technology has been integrated into existing RPA bots.As a result of the Retail Service Agreements process, document analysis times, previously conducted entirely manually, were reduced by 50% (achieving a gain of approximately 10.5 FTE), and the operational error rate was found to be near zero. This article reveals the concrete efficiency gains of intelligent automation in complex fields like investment banking and how it transforms the operational scope of RPA.

Keywords: Intelligent automation, Robotic process automation, Intelligent document processing

Introduction

The banking sector frequently finds itself needing to restructure its operational processes, driven by differentiating customer expectations and the increasing momentum of digitalization. Particularly in document-intensive and regulation-focused fields such as investment banking, manually performed, repetitive operational tasks have become a significant time drain for employees, leading to decreased productivity. This decline in efficiency is also directly correlated with a rise in error rates. This situation impacts not only global financial institutions but also local banks, transforming the need to increase efficiency, reduce costs, and minimize errors into a critical requirement.

Robotic Process Automation (RPA) was rapidly adopted in the banking sector, offering significant gains in automating repetitive, structured-data-based tasks. However, as the benefits of basic RPA are largely confined to rule-based and predictable processes, it falls short in situations requiring more flexible interpretation, such as processing documents containing unstructured data. This gap necessitates the intervention of Intelligent Automation technologies.

Technologies like Optical Character Recognition (OCR) and Intelligent Document Processing (IDP) enable documents to be read and semantically understood for their specific use within a process. They transform basic RPA applications into learning-capable systems, paving the way for end-to-end automation. In this context, it is widely accepted that Intelligent Automation represents the next stage of digital transformation and the adoption of cognitive capabilities in banking (Cooper et al., 2020).

This case study examines how the foundational RPA infrastructure at Aktif Investment Bank was expanded using Intelligent Automation technology and investigates the tangible gains achieved. The study focuses on the Lien Transactions and Retail Service Agreements (RSA) processes, both of which traditionally carry a high manual workload. This paper aims to provide a guide for Intelligent Automation strategies in operational processes by analyzing the efficiency of OCR technology and the impact of Intelligent Document Processing (IDP) on cost (FTE) and error rate metrics within these specific use cases. The findings demonstrate the contribution of Intelligent Automation to operational processes from a technical perspective, particularly in document-intensive sectors like investment banking, and present an applicable framework for similar implementations.

The remainder of this paper is structured as follows: Section 2 presents a literature review of the core technologies (RPA, OCR, and IDP) that form the foundation of this study. Section 3 details the methodology applied at Aktif Investment Bank and the underlying architectures of the targeted processes. In Section 4, the findings of the case study are presented, including process-specific gains in cost (FTE) and error reduction. Finally, Section 5 discusses the results and offers recommendations for future work.

Literature Review

Robotic Process Automation (RPA) and Its Operational Limitations

RPA is defined as a technology that automates repetitive and rules-based processes via software bots (Rajkhowa & Joshi, 2020; van der Aalst et al., 2018). For this reason, the majority of RPA projects in the banking sector have focused on the routine tasks of Operations teams. However, unstructured data—such as contracts and scanned documents used in investment banking processes—severely restricts automation efforts due to the cognitive deficiencies of basic RPA. The literature defines this as a "cognitive barrier" (Feio & Santos, 2022; Lacity & Willcocks2018). Because RPA is fundamentally rule-based, it cannot perform tasks requiring human judgment, thereby limiting operational advancement.

Intelligent Automation Architecture: OCR/IDP

In banking processes, the primary objective is to overcome the unstructured data barrier by transforming RPA into Intelligent Automation (IA) by equipping it with AI capabilities (Cooper et al., 2020). In this architecture, Optical Character Recognition (OCR) functions as a data capture and transformation layer, providing the data to feed the AI. Meanwhile, Intelligent Document Processing (IDP) technology, with its machine learning capabilities, serves as the module that integrates the AI's cognitive power into the process by simulating human judgment. IDP utilizes machine learning algorithms to classify the document and interpret it according to its context (Fernandez-Varela et al., 2023; Chitic et al., 2021). For processes requiring document flexibility, such as Retail Service Agreements (RSA), IDP (Intelligent Document Processing) has become a necessity (Feio & Santos, 2022; Rajkhowa & Joshi, 2020).

Gap in the Literature and Positioning of the Study

The existing academic literature focuses on the theoretical architecture of AI concerning the integration of Intelligent Automation with basic RPA. However, no case study has been found that demonstrates quantitative results—such as concrete FTE (Full-Time Equivalent) gains and error rate reductions—from AI-driven integration in a specific domain like investment banking operational processes. This study aims to fill this gap by presenting an applicable framework specific to the local investment banking practices at Aktif Investment Bank.

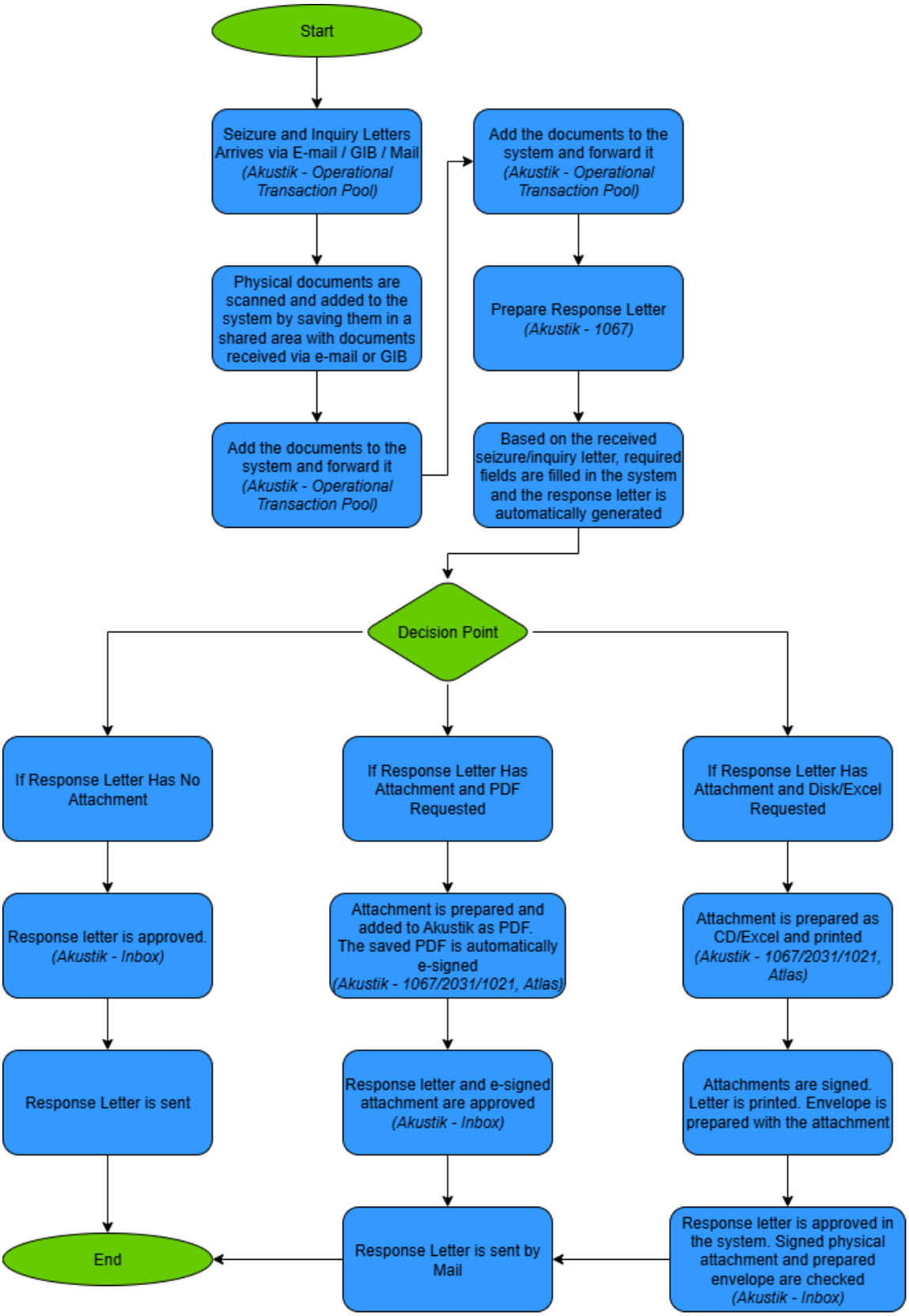

Figure 1. Case 1 The lien transactions process flow diagram

Methodology

Research Method, Scope, and Implementation Environment

This study was conducted using the case study method (Yin, 2018) to provide an in-depth analysis of RPA processes involving unstructured documents (Lien Transactions and Retail Service Agreements) and to empirically prove their quantitative outcomes. The bank under investigation is Aktif Investment Bank, which operates in the Turkish investment banking sector and possesses a robust RPA infrastructure. The focus of the study represents the teams that constitute a major part of the bank's RPA automation portfolio (representing up to 90% of the process density in Operations Teams). The development was carried out using a standard studio interface (operating with drag-and-drop activities) in close collaboration between Aktif Investment Bank's RPA process developers and the operations team. At Aktif Investment Bank, RPA robots are classified by color names for ease of management (e.g., 'Mavi.Can', 'Kırmızı.Can'), and there are currently 11 robots in operation.

Process Flow of the Case Studies

Case 1: The Lien Transactions Process (The Need for OCR)

This process was selected as a critical operational case at Aktif Investment Bank, characterized by its high volume, repetitive nature, and the need to capture scanned data. To overcome the unstructured data barrier, Optical Character Recognition (OCR) technology was integrated into the process as the first stage of transformation within the Intelligent Automation Architecture, serving to capture the scanned data (see Figure 1).

- **Data Capture Layer:** The RPA bot captures the document and sends it to the OCR engine. OCR analyzes the scanned document image and converts the text, including the notification number, date, and account information, into a machine-readable scanned document layer. The role of OCR is to provide the raw, readable data that will feed the AI/IDP.

- **RPA Interaction:** This data, once extracted with OCR, this scanned data is used as input for the RPA bot to begin its rule-based work. The bot uses this scanned data to interact with core banking applications (e.g., Acoustic Application - Screen 1067) and generate the corresponding response letter.

Case 2: The Retail Service Agreements (RSA) Process (The Need for IDP/AI)

The Retail Service Agreements (RSA) process was selected because, unlike the Lien process in Case 1, it requires a high degree of cognitive judgment and operational flexibility for automation. This process serves as the core case demonstrating why Intelligent Automation (IA) must go beyond simple OCR (Figure 2).

- **Cognitive Load of the Manual Process and the Insufficiency of OCR:**

The RSA process begins by listing customer documents from the monitoring screens of Aktif Investment Bank's internal applications, such as Akustik. While raw data capture (OCR) from a scanned document was sufficient in the Lien process (Case 1), the key points of the RSA workflow, as seen in its flowchart, are the cognitive steps where AI must intervene (Suri & Sharma, 2020):

1. Performing single/combined matching of the RSA document code.
2. Verifying the customer's signature and text based on the matched RSA type (single or combined).
3. Confirming the accuracy of the barcode match within the RSA.

These steps are tasks of high semantic complexity, requiring bank employees not only to perform data entry but also to conduct classification, matching, and visual verification. A basic OCR framework cannot simulate human judgment in these instances. This intense cognitive load causes the process to slow down, extends operational timelines, and leads to an increased error rate.

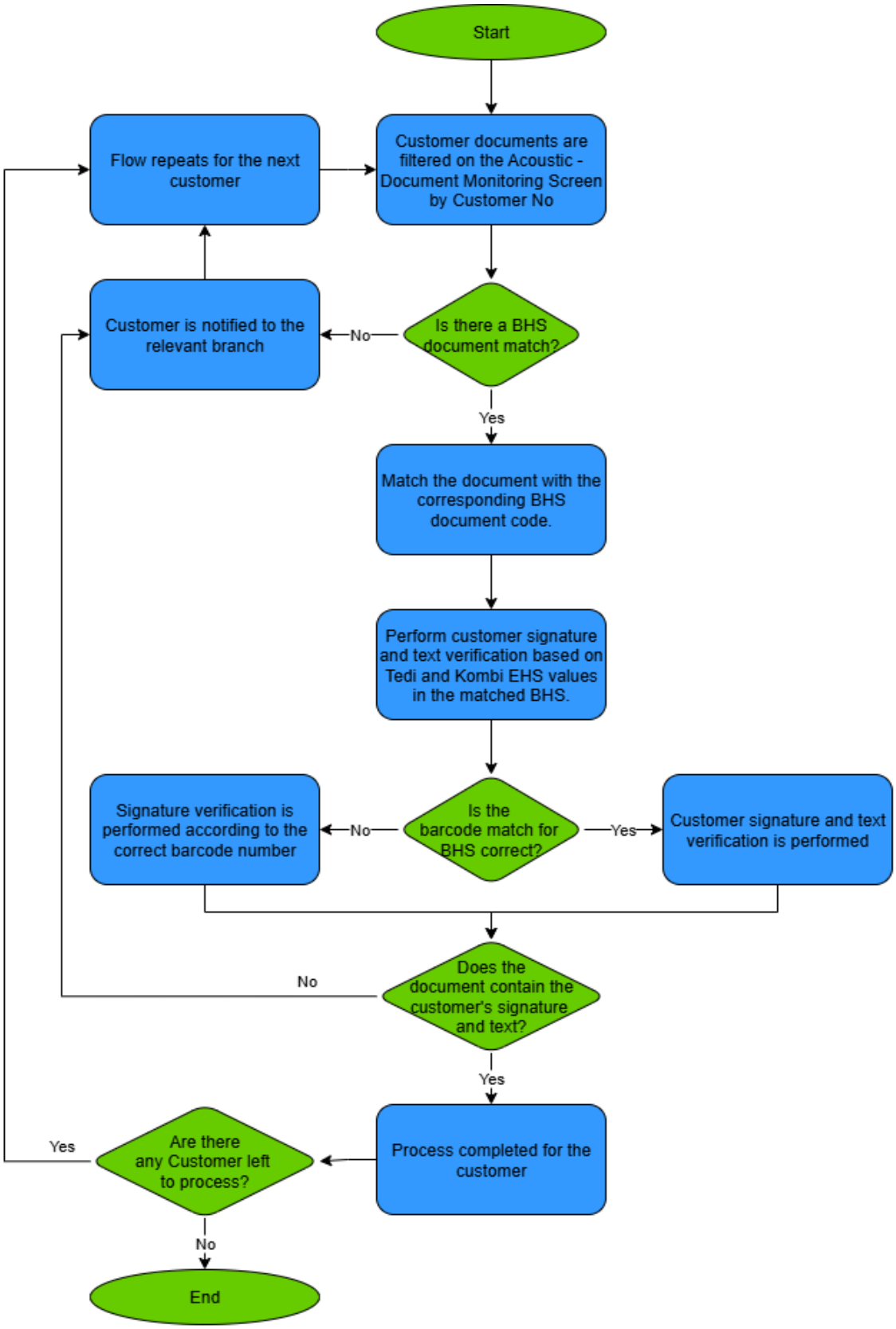

Figure 2. Case 2 The Retail Service Agreements (RSA) process

Intelligent Document Processing (IDP) Framework and AI Integration

Table 1. Intelligent Document Processing (IDP) structure

Stage	Technical Name	Description (Role of AI)	Application in the Case Study
1. Definition	Taxonomy Creation	The automation team and process owners define the data fields to be extracted from the documents (e.g., date, name, signature presence).	The required fields for both cases (Lien and RSA) were determined in this stage.
2. Digitization	OCR (Data Capture)	The OCR engine analyzes the scanned document (PDF, image) and converts the raw text and its position into a digital layer.	This stage is sufficient for Case 1 (Lien).
3. Classification	Document Classification (ML)	AI/ML algorithms analyze the document's content and layout to automatically determine its type (e.g., "Combined Agreement," "Single Agreement") based on the predefined taxonomy.	This is a critical step for Case 2 (RSA).
4. Extraction	Data Extraction (AI/NLP)	AI/ML models, based on the document type, find and extract the data defined in Stage 1 (Definition) from within the text in a template-independent (semantic) manner.	This advanced extraction is mandatory for Case 2 (RSA) (e.g., "signature check").
5. Validation	Cognitive Decision (Confidence Score)	The IDP framework assigns a Confidence Score to each extracted data field. This score indicates how confident the AI model is in the accuracy of that data.	The RPA bot makes a decision based on this score (e.g., if Confidence < 90%, it routes to human validation).

Quantitative Gain Measurement Methodology

The primary objective of this case study is to quantitatively measure the impact of Intelligent Automation integration on operational processes. While the gains in Case 1 (Lien Transactions) were qualitatively assessed for operational quality and error reduction, Case 2 (Retail Service Agreements-RSA) was selected to concretely measure efficiency and FTE gains. To this end, two fundamental quantitative metrics were defined and measured for the RSA process: Efficiency (FTE Gain) and Operational Risk (Error Rate).

Efficiency Measurement: Comparative Time Analysis and the FTE Formula

The Comparative Time Analysis method was used to substantiate the efficiency increase. This method compares the per-unit completion times of the pre-automation ("As-Is") and post-automation ("To-Be") processes:

- **Manual Time per Unit:** Following analyses and process measurements with the operations team, the average time spent by an employee to complete a single RSA control was identified as **167 seconds**.
- **Robot Time per Unit:** After the Intelligent Automation (IDP) integration, the average time spent by the robot to complete the same process (end-to-end, without human validation) was measured at **60 seconds**.

Based on this data, the Full-Time Equivalent (FTE) gain was calculated using the following formula (Romão et al., 2019):

$$\text{FTE Gain} = \frac{((\text{Manual Time per Unit} - \text{Robot Time per Unit}) \times \text{Monthly Transaction Volume})}{\text{Total Monthly Working Time (Minutes)}}$$

Operational Risk Measurement: Qualitative Methodology

The second fundamental gain of Intelligent Automation, the reduction of error rates and risk, was confirmed qualitatively.

- **Manual Error Rate:** The baseline error rate in the pre-automation process, originating from human data entry or incorrect contract matching, was used as the reference point.

- **Qualitative Assessment:** Post-automation, the Confidence Score mechanism introduced by the IDP module, along with the associated exception handling, ensured that potentially erroneous transactions were routed for human review. Following an analysis of this new process, the requesting operational unit (the process owner) confirmed that the margin of error in completed transactions had **"approached near zero."**

Findings

This section presents the tangible outputs of the Intelligent Automation application detailed in the Methodology, revealing the quantitative gains provided to the Bank under review.

Case 1: Lien Transactions Process Implementation Results

Case 1 (Lien Transactions) overcame the unstructured data barrier with a simple OCR plug-in. In this process, the following qualitative gains in operational quality and risk management were achieved, based on feedback from the process-owning operations team:

- Ensured that sent attachments had passed through approver control.
- Erroneous and incomplete submissions were prevented.
- E-signature usage increased. The process of printing outputs and acquiring wet signatures was reduced, and efficiency increased.

Case 2: Retail Service Agreements (RSA) Process IDP Integration and Gains

The Case 2 (Retail Service Agreements - RSA) process became the main case where the most concrete quantitative and qualitative results of the AI-based IDP integration were obtained. The analysis, conducted on **186,599** customer transactions over a 3-month period, is presented in the table titled "RSA Process 3-Month Period Comparative Efficiency Analysis (Based on 10.5 FTE Gain)".

Table 2: RSA process 3-month period comparative efficiency analysis (Based on 10.5 FTE gain)

Metric	Manual Process (Human	Intelligent Automation (Robot)
Analysis Period	3 Months	3 Months
Transaction Volume	186.599	186.599
Control Time per Unit (Seconds)	167 sec	60 sec.
Total Control Time (Hours)	8.658 hours	3.110 hours
Required Workdays (Human: 8 hrs/day, Robot: 24 hrs/day)	1.082 days	130 days
Total Hours Saved	5.548 hours	

Discussion

Evaluating the Findings

The findings from this case study support the thesis presented in the Introduction: "A direct correlation exists between time-based efficiency decline and an increase in error rates."

The methodological difference between Case 1 (Lien) and Case 2 (RSA) demonstrates the technological transformation specified in the Literature Review (Section 2):

- **Case 1 (Lien)** showed that simple OCR can solve the "data capture" problem, but that this is not cognitive automation.
- **Case 2 (RSA)**, however, proved that the steps requiring cognitive judgment in the RSA workflow ("signature check," "code matching") could not be overcome with basic OCR. The **10.5 FTE gain** achieved in this process demonstrates that AI-based IDP integration imparts cognitive decision-making capabilities, bypassing the rule-based limitations of RPA (Rajkhowa & Joshi, 2020).

One of the study's significant findings is the error rate. The fact that the error margin in the RSA process "approached near zero" indicates that expanding RPA's boundaries with Intelligent Automation is not just a choice for efficiency in highly-regulated sectors like investment banking, but also a necessity for operational risk management and regulatory compliance (Groomer & Murthy, 2021; Dias et al., 2021; Asatiani & Penttinen, 2021).

Conclusion and Contributions

This study has demonstrated, through a case study, how an investment bank with a foundational RPA infrastructure (Aktif Investment Bank) applied Intelligent Automation (IDP/AI) to overcome unstructured data and cognitive judgment barriers. The study's primary contribution to the literature and practice is that it goes beyond the theoretical benefits of Intelligent Automation to present **concrete, quantitative (10.5 FTE) and qualitative (near-zero error rate) gains** achieved in processes specific to the Turkish investment banking sector (Lien and RSA). Intelligent Automation has restructured not only operational efficiency but also risk and error management. This case offers an applicable framework and a technical model for local financial institutions facing similar operational challenges.

Limitations and Future Work

The limitations of this study include that the results are based on a single corporate case study and the solution's dependency on the RPA platform's native IDP modules and pre-trained AI models. Future work should focus on structures capable of more advanced cognitive decisions, such as using the structured data obtained from IDP with Generative AI models to summarize legal documents or perform real-time risk analysis (Zhang & Niu, 2023).

Scientific Ethics Declaration

* The authors declare that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the authors.

Conflict of Interest

* The authors declare that they have no conflicts of interest.

Funding

* This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Acknowledgements or Notes

* This article was presented as an oral presentation at the International Conference on Education in Technology and Engineering (www.iconete.net) held in Antalya/Türkiye on November 12-15, 2025.

* We gratefully acknowledge the support and contribution of the Aktif Bank R&D Center throughout the research and analysis process.

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To cite this article:

Unver, E. N., Demir, M.T. & Bas, U. (2025). Expanding the boundaries of RPA with ıntelligent automation in ınvestment banking operational processes. *The Eurasia Proceedings of Educational and Social Sciences (EPESS), 46,* 116-124.