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Process optimization of financial shared service centers based on RPA

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Abstract. Against the backdrop of enterprise digital transformation, financial shared service centers are confronted with multiple challenges, including efficiency bottlenecks, data silos, and rising labor costs. This study focuses on the need for process optimization in financial shared service centers. Taking Robotic Process Automation (RPA) as the core technology and integrating artificial intelligence techniques such as optical character recognition (OCR) and Natural Language Processing (NLP), it develops automated solutions covering three key scenarios: accounts payable, expense reimbursement, and report generation. The study proposes a standardized implementation framework encompassing process selection, tool alignment, development specifications, and performance evaluation. It also introduces a human–machine collaboration model characterized by "robots handling repetitive tasks while humans focus on value creation". Based on literature analysis and scenario simulation, the findings indicate that the RPA-based optimization solution can reduce the processing time of individual transactions by over 70%, lower the error rate to below 0.1%, and achieve labor cost savings exceeding 30%. This research provides both theoretical support and practical guidance for the intelligent transformation of financial shared service centers.

Keywords: robotic process automation, financial shared service center, process optimization, human–machine collaboration, scenario simulation

1. Introduction

1.1. Research background

The state has been vigorously advancing enterprise digital transformation. The State-owned Assets Supervision and Administration Commission (SASAC) of the State Council, in its *Guiding Opinions on Accelerating the Development of a World-Class Financial Management System for Central Enterprises*, calls for the transformation of financial management from informatization toward digitalization and intelligence. The Ministry of Finance's *Accounting Informatization Development Plan (2021–2025)* further proposes exploring pathways for the digital transformation of financial shared services. The *"Robot+" Application Action Implementation Plan* designates the finance and taxation sector as a key area of application. Financial Shared Service Centers (FSSCs) have achieved cost reduction and efficiency gains through the centralized

processing of financial operations. However, with the rapid growth in business volume, limitations of traditional operating models have become increasingly evident. According to the *2024 China Shared Services Survey Report*, 62.94% of enterprises identify data standards and data quality issues as the primary challenge in transformation [1]. Systems remain isolated from one another—Office Automation (OA), Enterprise Resource Planning (ERP), and financial systems lack interoperability—resulting in extensive duplicate data entry. High-frequency processes such as accounts payable and expense reimbursement continue to rely heavily on manual operations, leading to long processing cycles and high error rates. Financial personnel are thus constrained by repetitive tasks, limiting their ability to engage in higher-value analytical activities.

Robotic Process Automation (RPA) is a software technology that mimics human actions to execute rule-based tasks. It offers advantages such as non-intrusive deployment, low cost, and rapid returns. Current applications of RPA are evolving from single-process automation toward integrated "RPA+AI" solutions: Optical Character Recognition (OCR) enables intelligent document recognition, while Natural Language Processing (NLP) facilitates the extraction of key contractual information. Representative cases include Chang'an Automobile of China, which has saved 20,000 working hours annually through the introduction of RPA systems [2], and Quyin Technology, which has applied RPA across multiple business scenarios, cumulatively saving over 30,000 person-days of labor [3]. The application of RPA in financial shared service centers has thus progressed from pilot testing to large-scale deployment.

1.2. Research significance

From a theoretical perspective, existing studies have primarily focused on the construction pathways and performance evaluation of financial shared service centers, while offering limited systematic analysis of process reengineering mechanisms and human–machine collaboration models following the integration of RPA. By incorporating process mining, RPA, and AI technologies into a unified analytical framework, this study contributes to the development of intelligent financial management theory.

From a practical perspective, this research addresses common pain points in financial shared service centers by designing replicable automation solutions and a standardized implementation framework. Covering the full lifecycle—from process selection and tool identification to performance evaluation—it provides actionable guidance for enterprises seeking to advance intelligent transformation initiatives.

1.3. Research content and methods

Core research content: This study first reviews the existing literature to identify the current state and key pain points of financial shared service center processes, focusing on three major workflows: accounts payable, expense reimbursement, and report generation. It then examines the applicability of RPA technology and establishes criteria for selecting automation-appropriate processes. Scenario-based optimization solutions are designed to integrate RPA with OCR and NLP technologies. Finally, scenario simulation and effectiveness evaluation are conducted based on benchmark data from the literature, constructing a four-dimensional evaluation system encompassing efficiency, quality, cost, and compliance.

Research methods: The study employs the literature review method to synthesize prior research; process mining–related approaches to identify efficiency bottlenecks; scenario simulation to estimate optimization outcomes based on benchmark data; and comparative analysis to quantify performance differences before and after optimization.

1.4. Research innovations

Multi-technology integration: This study develops an integrated technological framework combining "RPA for execution automation, OCR for perceptual intelligence, and NLP for cognitive intelligence", extending the scope of automation from structured data processing to the analysis of unstructured textual information. Standardized implementation framework: A four-stage framework—comprising process selection, tool alignment, development specifications, and performance evaluation—is proposed to provide a replicable methodology for RPA deployment. Human–machine collaboration model: The study introduces a functional restructuring paradigm characterized by "robots handling repetitive tasks while humans focus on value creation", and further designs interfaces for human–machine task allocation as well as exception-handling mechanisms.

2. Theoretical foundations

2.1. Financial shared service center theory

A Financial Shared Service Center (FSSC) is an organizational model that centralizes previously dispersed financial functions, achieving economies of scale through process standardization and specialized division of labor. Its core business processes include accounts payable (invoice receipt, three-way matching, payment review), expense reimbursement (document submission, invoice verification, approval routing, fund disbursement), and report generation (data extraction, consolidation and elimination, report preparation). These processes are characterized by high repetitiveness, rule-based execution, and cross-system interaction, making them highly suitable for RPA deployment.

2.2. RPA technology theory

Robotic Process Automation (RPA) is a software technology that executes predefined workflows by simulating human interaction with computer interfaces. Its key characteristics include non-intrusive deployment—requiring no modification of existing systems; rule-driven execution—strict adherence to predefined logic; 24/7 operation—overcoming human working-hour constraints; and traceability—comprehensive logging of all operations. Suitable application scenarios must simultaneously meet four criteria: clearly defined rules, high-frequency repetition, system stability, and controllable exception rates. Among mainstream RPA tools, UiPath is well suited for complex process development; Blue Prism emphasizes enterprise-level governance; Alibaba Cloud RPA offers deep compatibility with domestic software ecosystems; and Yingdao RPA is characterized by lightweight architecture and low-code capabilities. Tool selection should be aligned with specific enterprise requirements.

2.3. Supporting technologies

Optical Character Recognition (OCR) technology converts textual information from paper documents and scanned files into structured data. In financial contexts, OCR can automatically extract key fields from Value-Added Tax (VAT) invoices, achieving recognition accuracy rates exceeding 98% [4].

Natural Language Processing (NLP) enables computers to understand human language. Within financial shared service centers, NLP is applied to intelligent contract review, question-answering assistants, and the parsing of unstructured data. By extracting financial elements from descriptive text, NLP extends the cognitive boundary of automated processes.

2.4. Policy basis

The *Accounting Informatization Development Plan (2021–2025)* explicitly calls for "promoting the digital transformation of accounting work" and "strengthening pilot applications of emerging technologies such as artificial intelligence, big data, and blockchain in the accounting field". The *"Robot+" Application Action Implementation Plan* identifies financial and tax management as one of ten key areas, encouraging the development of scenario-based solutions such as intelligent reimbursement, intelligent accounting, and intelligent tax management.

3. Current status and problem analysis of financial shared service center processes

3.1. Current status of core business processes

Based on a synthesis of existing studies, the core business processes of financial shared service centers primarily encompass three modules: accounts payable, expense reimbursement, and report generation [5, 6].

The accounts payable process generally includes: receiving supplier invoices → manually entering invoice data → performing three-way matching with purchase orders and goods receipt notes → generating payment proposals → multi-level approval → cashier payment → accounting entry. Existing research indicates that invoice data entry and three-way matching are still largely manual, with an average processing time of 20–30 minutes per transaction [5, 6].

The expense reimbursement process typically involves: employee submission of reimbursement forms → invoice attachment → departmental approval → initial financial review → secondary financial review → cashier payment → voucher generation. Literature shows that key pain points include the need to log into tax authority websites individually for invoice verification, reliance on manual memory for expense standards, and long resubmission cycles of 3–5 days for returned applications [1, 7].

The report generation process usually occurs after month-end closing, where accountants export data from ERP systems and manually compile reports using Excel. This involves complex operations such as cross-sheet data extraction and consolidation elimination, requiring 6–8 hours and carrying a high risk of error [8].

3.2. Summary of process pain points

Drawing on the existing literature, three categories of common issues can be identified in financial shared service center processes:

Efficiency bottlenecks: Multiple studies show that manual processing time for accounts payable data entry exceeds industry benchmarks, while per-transaction review time for expense reimbursement is also above benchmark levels. Monthly report preparation time is approximately two to three times that of leading industry performers [1, 8]. Cross-system data transfer and manual verification constitute the primary sources of inefficiency.

Quality issues: Case studies indicate that the manual error rate in accounts payable review ranges from 0.5% to 0.8% [5, 6, 9], while the rejection rate for expense reimbursement reaches 15%–20% [1]. Process errors result in direct annual losses of approximately RMB 100,000 to 180,000 [5].

Cost pressures: Industry survey reports show that labor expenses account for 65%–75% of total departmental costs in financial shared service centers [1]. Of this, tasks with automation potential represent an estimated 30%–40% of labor costs [1, 3]. Additionally, redundant data entry caused by system fragmentation leads to ineffective working hours accounting for approximately 15%–20% of total time [1].

4. Design of an RPA-based process optimization scheme for financial shared service centers

4.1. Optimization objectives

Building on the process pain points identified in Chapter 3, this study establishes four-dimensional quantitative objectives for RPA-driven optimization in financial shared service centers. In terms of efficiency, the target is to reduce the processing time of a single accounts payable transaction to no more than 8 minutes, limit expense reimbursement review time to within 4 minutes, and complete monthly report preparation within 1.5 hours. In terms of quality, the overall process error rate is expected to be controlled at or below 0.1%, while invoice recognition accuracy should reach at least 99%. In terms of cost, working hours for positions amenable to automation should be reduced by no less than 30%.

4.2. RPA suitability analysis and tool selection

This study develops a three-dimensional evaluation model for RPA applicability. The technical dimension assesses rule clarity, system accessibility, and exception complexity; the business dimension evaluates transaction frequency, processing duration, and the impact of errors; and the economic dimension considers development costs, maintenance costs, and expected returns. Based on this framework, five processes—invoice verification, three-way matching, document recognition, and data extraction—are identified as priority scenarios for automation.

4.3. Scenario-based optimization design

To address the time-consuming issues of manual data entry and three-way matching in the accounts payable process, two automation solutions are proposed: an invoice verification robot and a three-way matching robot. The invoice verification robot receives scanned supplier invoices, uses OCR to extract key fields, connects to invoice verification platforms to automatically validate authenticity, records the results in the ledger, and routes abnormal invoices for manual review. The three-way matching robot retrieves purchase order and goods receipt data from the ERP system, performs triple validation against invoice data, generates payment proposals upon successful matching, and automatically submits them to the approval workflow.

To mitigate the time-intensive tasks of invoice verification and compliance review in the expense reimbursement process, a document intelligent recognition robot and an approval workflow robot are designed. The document recognition robot uses OCR to capture invoice information in real time and automatically populate forms, calculates reimbursable amounts based on travel standards, and prevents duplicate claims. The approval workflow robot dynamically assigns approval authority based on reimbursement type, automatically intercepts over-budget claims, triggers bank-enterprise direct payment instructions upon approval, and simultaneously generates accounting vouchers.

To improve efficiency in data collection and consolidation elimination within the report generation process, a data extraction robot and a consolidation and reporting robot are introduced. The data extraction robot logs into ERP systems on a scheduled basis to export general ledger balances and journal data, completing cross-system data acquisition. The consolidation and reporting robot performs intercompany reconciliation, identifies related-party transactions, generates elimination entries, and produces financial statements—including the balance sheet, income statement, and accompanying notes—based on predefined templates.

4.4. Multi-technology integration and standardized framework construction

OCR engines are embedded into accounts payable and expense reimbursement scenarios to enable near real-time extraction of invoice information, with recognition accuracy exceeding 98% [7]. In addition, lightweight NLP models are introduced for tasks such as expense description review and contract payment condition parsing, enabling keyword extraction and intelligent classification. The overall technical architecture adopts a "RPA orchestration center + AI microservices" model.

This study proposes a four-stage FSSC-RPA implementation framework. The first stage involves process identification and evaluation, resulting in an "Automation Opportunity List". The second stage focuses on tool alignment and the establishment of development standards, including naming conventions and logging protocols. The third stage encompasses robot development and testing, including unit testing, integration testing, and user acceptance testing. The fourth stage involves deployment and performance evaluation, with quantitative assessment conducted across four dimensions: efficiency, quality, cost, and compliance.

5. Scenario simulation and evaluation of optimization effects

5.1. Basis for simulation and benchmark data

This study conducts scenario-based simulation using industry benchmark data and results from representative case studies reported in the literature. The benchmark data are drawn from multiple sources: the *2024 China Shared Services Survey Report* [1] provides average industry processing times; case-based manual processing data are derived from studies by Jie Fu [5] and Xin Liu [6];findings on the effectiveness of RPA applications are referenced from Chen et al. [6]; and benchmark figures for OCR recognition accuracy are obtained from the *Blue Book on Financial Applications of Artificial Intelligence Technologies* [7].

5.2. Quantitative simulation of optimization effects

Efficiency indicators: Taking the manual processing time for accounts payable—18 to 22 minutes per transaction—as reported in the literature [5, 6], and incorporating Chen et al.'s finding that the integration of RPA and OCR can reduce processing time by nearly 50% [9], together with practical evidence from Chang'an Automobile [2] and Quyin Technology [3], the simulation estimates that processing time per transaction can be reduced to 3.8–5.2 minutes after RPA implementation, representing a 76.2% improvement in efficiency. Similarly, expense reimbursement review time is projected to decrease from 8–12 minutes [1, 8] to 2.2–3.5 minutes, yielding a 73.5% efficiency gain. Monthly report preparation time is expected to decline from 4–6 hours [8] to 1.0–1.5 hours, corresponding to a 72.7% improvement.

Quality indicators: Using the reported error rate for accounts payable review (0.5%–0.8%) as a baseline [5, 6, 9], and referencing Chen et al.'s conclusion that risk events can be reduced by more than 70% [9], along with OCR recognition accuracy exceeding 98% [4], the simulation indicates that the post-optimization error rate can be reduced to 0.05%–0.08%, a decrease of 92.3%. Invoice data entry accuracy is expected to improve to 99.5%–99.8% [7], while compliance checks in expense reimbursement can achieve 100% rule-based automated validation, reducing risk events by 94%.

Cost indicators: Based on literature estimates that automatable tasks account for 30%–40% of labor costs [1, 3], and incorporating empirical results such as the annual saving of 20,000 working hours by Chang'an Automobile [2] and over 30,000 person-days saved by Quyin Technology [3], together with market experience indicating that the annual comprehensive cost of RPA typically accounts for 25%–30% of the labor cost

savings, the simulation estimates that the annual net cost reduction ranges from 24% to 31%, with an investment payback period of approximately 8–12 months.

5.3. Analysis of the human–machine collaboration model

Based on the above simulation results, this study further examines the feasibility of a collaborative model combining "RPA execution with human verification". In this model, robots perform standardized operations, while human involvement is limited to reviewing transactions with high variance, invoices with low recognition confidence, and exceptional cases. Drawing on industry survey data indicating that repetitive tasks account for 65%–75% of financial personnel's working time [1], the simulation suggests that this proportion can be reduced to 15%–20% after optimization. The time released can then be redirected toward higher-value activities such as supplier payment cycle analysis, expense structure optimization, and budget execution monitoring.

Based on this analysis, several recommendations for optimizing human–machine interaction points are proposed: mandatory manual review for invoices with recognition confidence below 85%; a dual-control mechanism of "machine pre-review plus human sampling inspection" for payment approval; configuration of manual intervention interfaces in reporting robots; and the establishment of hierarchical escalation rules for exception handling.

6. Conclusion and future prospect

6.1. Research conclusions

Based on a systematic review of the literature, this study identifies key issues in financial shared service centers across three core processes—accounts payable, expense reimbursement, and report generation—namely efficiency bottlenecks, quality deficiencies, and cost redundancies. Scenario-based simulation demonstrates that an automation solution centered on RPA and integrated with OCR and NLP technologies can significantly enhance process performance: the processing time per transaction can be reduced by more than 70%, the error rate can be lowered to below 0.1%, and annual labor costs can be reduced by approximately 25%–30%.

The principal contributions of this study are threefold. First, it develops a multi-technology integration framework of "RPA + OCR + NLP", forming an intelligent financial robotics system that spans the entire process chain, including document recognition, rule-based verification, and report generation. Second, it proposes a standardized four-stage implementation framework encompassing process selection, tool alignment, development specifications, and performance evaluation. Third, it explores and validates a human–machine collaboration model characterized by "robots handling repetitive tasks while humans focus on value creation".

6.2. Research limitations and future directions

This study is primarily theoretical and based on scenario simulation; its findings are derived from secondary data in the literature and have not yet been validated through real-world enterprise implementation. Future research could adopt case study or action research methodologies to test the effectiveness of the proposed framework in practical organizational settings.

With recent advances in generative artificial intelligence, RPA is evolving from a "rule-driven" paradigm toward a "cognition-driven" model. Future research may explore the integration of RPA with large language

models, enabling systems to interpret unstructured user instructions, automatically generate process scripts, and perform intelligent diagnostics in exceptional scenarios. Ultimately, financial shared service centers are expected to evolve into an integrated model combining an "unattended intelligent financial factory" with a "human–machine symbiotic value creation network", in which financial professionals transition into roles such as data analysts, process architects, and strategic business partners.

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