

Exploration of Financial RPA Optimization in University Shared Service Centers

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Abstract: To propel the digitization of financial operations within universities, this study delves into the current application status and pivotal challenges of RPA technology in university financial shared service centers within the context of the Digital China initiative. Through the examination of practical cases, an analysis is presented on the underlying causes of dilemmas related to system integration, specialized workforce, interdepartmental collaboration, and adherence to security regulations. Proposing a series of optimization measures including the standardization of comprehensive processes, diversified funding and talent acquisition approaches, cross-departmental cooperation, and the establishment of a security-compliant framework, this research seeks to offer valuable insights for enhancing the efficacy of RPA technology within university financial shared service centers.

Keywords: Universities; Shared Service Centers; RPA; Intelligent Financial Management; New Quality Productivity

1. Introduction

In the midst of the accelerating global digital transformation, the rapid advancement of emerging technologies such as information technology, artificial intelligence, and the Internet of Things has ushered in profound economic and societal changes. These advancements have catalyzed a shift from traditional modes of productivity towards a realm characterized by “new quality productivity”. It is imperative for universities, particularly vocational institutions serving as vital hubs for cultivating technical and skilled talents, to adapt to these novel productivity demands. This adaptation entails the strategic integration of intelligent technologies across various domains of financial management to bolster operational efficiency. Within the realm

of institutional management, financial operations stand out as a pivotal component that has long grappled with inefficiencies inherent in manual processes, resulting in challenges like delayed data processing and information asymmetry. Such inefficiencies fall short in meeting the dynamic requirements of modern educational institutions.

Robotic Process Automation (RPA) has emerged as a pivotal disruptor, leveraging its ability to mimic human actions accurately and efficiently execute standardized processes. It excels in handling repetitive tasks such as processing invoices, reconciliations, tax declarations, thereby freeing up human resources and propelling financial roles towards managerial decision-making [1]. Nevertheless, the application of RPA in the current shared financial services centers of universities faces several challenges: inadequate sustained funding, a lack of top-level institutional design leading to “automation silos”, a shortage of specialized talent, and poor data interoperability between financial systems and core business systems in academics, research, and administration.

In light of these challenges, a systematic exploration of optimization pathways is essential for the effective integration of financial RPA within university shared service centers. This strategic endeavor holds the key to enhancing the efficiency of financial data processing within academia, fostering deeper integration between academic and financial functions, and propelling universities towards a trajectory of high-quality development.

2. Core Concepts

2.1 University Financial Shared Service Center

As a systemic innovation in batch financial management, the University Financial Shared Service Center, through the establishment of a centralized processing platform, integrates

scattered business functions such as reimbursement, accounting, payment, and taxation to achieve optimized cross-departmental resource allocation. Its core characteristics primarily revolve around centralization: standardizing processes to eliminate operational discrepancies, enhancing responsiveness through specialized services, and constructing a unified database through centralized data management. This model, by breaking down traditional “siloes” departmental barriers, particularly enhances risk management capabilities [2].

2.2 RPA (Robotic Process Automation)

RPA is a technology that utilizes software robots or artificial intelligence assistants to simulate and execute repetitive, well-defined, and extensive business processes in a digital environment. Its core value lies in efficiently achieving three main functions without altering existing system architectures: cross-platform data extraction and validation (such as automatic reconciliation of bank statements with ledger records), unmanned pre-set process operations (such as scheduled triggering of tax filings), and continuous operation over a 7-day period [3]. RPA is increasingly being widely applied in financial tasks to automate repetitive and rule-based financial processes such as expense approvals, tax filings, invoice processing, enhancing work efficiency, reducing human errors, and lowering operational costs.

2.3 Implications of Financial RPA Application in Shared Service Centers

Within the University Financial Shared Service Center context, the primary mission of RPA is to integrate disparate systems like expense modules, ERP systems, and banking platforms to automate financial processes seamlessly. Essentially, it involves a dual transformation: converting institutional processes into rules executable by robots and substituting manual intervention with “digital employees”. When coupled with Optical Character Recognition (OCR) technology, a comprehensive end-to-end system can be established, starting from “scanning receipts → rule-based invoice reviews → automated accounting”, thereby propelling the Financial Shared Service Center (FSSC) from physical centralization towards intelligent collaboration [4].

2.4 Financial Intelligence in the Era of New Quality Productivity

With technological innovation at its forefront, the era of New Quality Productivity manifests in the financial domain through the transformation of financial processes into information-driven, automated, intelligent, and digitized workflows. Financial RPA, serving as a technological conduit of New Quality Productivity, integrates with technologies like artificial intelligence and big data to drive universities’ financial functions from traditional accounting towards strategic decision support. This transformation provides a roadmap for the application of RPA in university shared service centers, aligning them with the overarching direction of the institution’s digital evolution [5].

3. Status and Challenges of Financial RPA Application in University Shared Service Centers

3.1 Current State of Financial RPA Application in University Shared Service Centers

Currently, RPA technology has permeated various business domains within university Financial Shared Service Centers (FSSCs). Specific applications of RPA in the realm of data-driven financial and economic work within universities can be categorized into three main types:

3.1.1 Automated expense reimbursements

Taking Shandong Vocational College of Science and Technology as a case study, the institution has established a closed-loop process of “OCR receipt recognition → rule engine audit → RPA automated accounting”. Through OCR, the system captures all fields on the receipt, automatically mapping accounting entries and amounts. By embedding an intelligent rule library, it intercepts consecutive invoices (>3) and duplicate reimbursement behaviors. The RPA system ultimately generates vouchers and payment instructions. The implementation of this model has reduced the rejection rate from 30% to 10% and compressed audit time by 70%.

3.1.2 Intelligent tax management

In the intelligent tax management domain, RPA automatically extracts relevant tax data from financial systems, generates tax declaration

forms, and conducts data validation to ensure the accuracy of declaration data, thereby reducing human errors. After completing tax declarations, it generates declaration records and updates them in the financial archive [6].

Weihai Vocational College has achieved automated national treasury payments: RPA verifies the amount based on preset rules (requiring review for payments exceeding 500,000 RMB) and selects payment channels, achieving a 10-fold efficiency increase compared to manual processes. The income tax declaration utilizes a mechanism of “RPA batch filling + manual sampling review”, increasing data processing efficiency by 6 times.

3.1.3 Intelligent invoicing and reporting

Weifang University has developed RPA for intelligent invoicing: automatically recognizing invoice types, generating invoicing instructions, and notifying the operator via email, in line with the comprehensive electronic invoice promotion policy (C.S. [2023] No. 1). In terms of financial reporting, RPA automatically extracts necessary data from various financial systems to generate standardized financial reports. It automatically updates report data based on preset rules and templates, ensuring the timeliness and accuracy of financial information. Additionally, it automatically generates monthly, quarterly, and annual financial reports, reducing human involvement. The result is a decrease in error rates due to reduced manual intervention, while shortening the report preparation cycle by 60% [7].

3.2 Analysis of Core Issues in University Financial RPA Application in Shared Service Centers

3.2.1 Heterogeneity of systems and the dilemma of process standardization

At the technological level, universities commonly grapple with a “patchwork” style of information system architecture. Taking Shandong University of Science and Technology as an example, while their financial system operates on the Yonyou NC6.5 version, the research management system runs on the Kingdee K/3 WISE platform. The data interface protocols of these two systems are incompatible, necessitating the development of additional data conversion programs for RPA operations across systems, with a one-time integration cost reaching 87,000 RMB. In terms of processes, a survey of relevant subjects (n=12 universities)

reveals that only 41% of reimbursement audit rules are fully standardized, while the remaining 59% exhibit ad hoc decision-making practices. Practical data from a provincial university indicates that non-standardized processes require manual intervention in RPA scripts an average of 17 times per month, significantly diminishing the benefits of automation. This dual heterogeneity in systems and processes greatly impedes the deep application of RPA in complex business areas such as budgeting and project decision-making.

3.2.2 Imbalance between full lifecycle costs and talent structure

Financial constraints exhibit a typical “inverted pyramid” characteristic. According to the 2023 White Paper on the Cost of Intelligentization in Universities, the median initial deployment cost of RPA projects is 286,000 RMB, with subsequent annual operational costs accounting for approximately 18% of the initial investment. A case study from Qingdao College of Economics and Trade illustrates that their RPA project was unable to sustainably pay the annual vendor fee (98,000 RMB/year), resulting in the system remaining unupgraded for three years, leading to compatibility issues with the new version of the tax system. Talent structure imbalances are even more pronounced: a survey of 12 universities in Shandong Province reveals that individuals simultaneously holding intermediate accounting qualifications and RPA development certificates constitute only 3.2% of the total finance team. This talent structural gap forces 85% of institutions to adopt a model of “finance-driven demand+ outsourcing scriptwriting”, prolonging project delivery cycles by over 40%.

3.2.3 Absence of top-level design and collaborative ineffectiveness

Deficiencies in the organizational structure of certain universities have led to the “fragmentation” trap in RPA applications. In-depth interviews conducted by relevant studies (with 9 respondents) revealed that 72% of universities have not established cross-departmental digital leadership teams. When the finance department independently drives RPA initiatives, they encounter triple resistance: firstly, data access barriers (such as delays in opening accommodation fee data interfaces by the student affairs office); secondly, cumbersome business processes (such as multiple departmental and multi-stage research

reimbursement approval chains); and thirdly, missteps in system updates (such as upgrades in the human resources system not being communicated to the finance department). A typical case from Shandong Yingcai University illustrates that due to the separate procurement of their research management system, which differs in data standards from the finance shared service center, RPA requires manual entry of up to 137 data entries monthly when handling cross-cutting research project funds, significantly offsetting the benefits of automation.

3.2.4 Lagging security protections and compliance responses

The sensitivity and confidentiality of financial data place formidable security and compliance pressures on RPA applications. Third-party tests indicate that in terms of data security, research from relevant studies reveals that 34% of university RPA systems transmit financial data without encryption, with instances of robot account sharing even observed. An audit report from Weihai Vocational College revealed that its RPA system experienced a delay of over 20 days in script updates following the implementation of new personal income tax policies in 2023, resulting in an overcharge of individual income tax amounting to 56,700 RMB. Furthermore, the widespread absence of critical fields in existing RPA operation logs (such as operator IPs and pre-and post-value data modifications) imposes significant dual pressures on security and compliance, greatly impeding the depth of RPA applications in sensitive operations such as accounts receivable and payable, as well as research fund management.

4. In-Depth Root Cause Analysis

4.1 Insufficient Overall Planning in the Construction of University Financial Shared Service Centers

The construction of university financial shared service centers commonly suffers from the issue of “construction before planning”. A specialized audit by the Ministry of Education in 2024 revealed that 72% of sampled universities had not incorporated financial informatization into their smart campus construction plans. Taking Qingdao Institute of Technology as an example, while its financial system adopts an SOA architecture, the

academic system still relies on a traditional C/S model, requiring manual conversion of data between the two systems through CSV files, resulting in an additional workload of approximately 2,400 man-hours annually. What's more concerning is that the lag in the standardization of financial processes has led to “technical debt”: in the case of Shandong Vocational College of Science and Technology, 68 reimbursement rules exist only in PDF format, forcing the RPA development team to spend 42% of their time handling unstructured data conversion, limiting the scope of automation coverage.

4.2 Restricted Funding Sources and Inadequate Talent Reserves

The dual financing structure of “government funding + tuition fees” exposes vulnerabilities in resource dependence: the high initial deployment cost of RPA projects has led to only a few projects reaching the stage of widespread implementation. For instance, due to financial constraints, some RPA projects at Qingdao College of Economics and Trade have remained at the pilot stage without subsequent expansion. Talent reserves demonstrate a dual-track capability gap: certain university financial personnel, burdened by heavy foundational financial work, lack the time to pursue RPA technical training. In the initial implementation of RPA at Qingdao College of Economics and Trade, reliance on third-party vendors for technical guidance was necessary due to limited expertise internally, leading to increased costs and potentially affecting adaptability due to the non-specialized understanding of the business by external teams, validating the issue of “insufficient human and technical resources”.

4.3 Deterioration of Collaborative Governance Mechanisms Exacerbating Entropy in Systems

The state of “no system, no platform, no standards” in cross-departmental collaboration is the fundamental cause of information silos. An organizational structure analysis of 12 universities revealed that only 2 had established university-level digital collaboration committees, while the rest of the universities’ RPA projects faced disputes over “data permissions”. For instance, a certain university’s Research Department, due to performance evaluation requirements, refused

to open the interface for detailed cross-cutting project funding, leading to a 47% discontinuation rate in the financial RPA process for research fund claiming. Additionally, a vocational college in Weifang concurrently operated 7 procurement systems, resulting in approximately 12,000 pieces of heterogeneous data requiring manual cleaning each year. This fragmented governance model forces RPAs to operate in a “data swamp”, severely diminishing the benefits of automation.

4.4 Inadequate Alignment of Security Policies and Audit Traceability

Financial data carries unique sensitivity, yet some university RPA systems lag behind in security mechanisms, lacking measures such as encryption transmission and access control, which may trigger risks of data leakage and tampering, violating privacy protection requirements. Furthermore, as financial and tax policies and regulations evolve rapidly, RPA processes need to be optimized in sync. For example, after adjustments to personal income tax declaration rules at Weihai Vocational College, delayed updates to RPA scripts resulted in tax declaration errors. Moreover, some routine RPA operations may lack detailed logs, making it challenging to trace abnormal data, thus increasing audit risks.

5. Strategies for Optimizing the Application of Financial RPA in University Shared Service Centers

5.1 Institutional Restructuring to Solve the Technological Debt Dilemma

The core challenge facing the application of financial RPA in university settings lies in the conflict between the rapidly evolving technological demands and the lagging and rigid management systems. A revealing case from Qingdao Institute of Technology exposes the fundamental lack of top-level institutional constraints, leading to the data gap between its SOA architecture financial system and the traditional C/S model academic system. To address this issue, universities need to establish a new governance system known as “planning-governance-assessment” integratively: at a strategic level, integrating RPA construction into the specialized realm of school informatization and specifying that new systems must comply with the Education Management

Information Data Standards (JY/T 1006-2023) interface specifications, while ensuring adequate funding supply; at an operational level, establishing a Technology Debt Management Office led by the Chief Accountant, utilizing a three-dimensional evaluation model of “cost-benefit-risk” to quantify existing technological debts, and transforming audit standards, invoice requirements, and more into machine-readable rules [8]. Practice has shown that by implementing this system, Shandong Vocational College of Science and Technology has reduced system integration costs and saved over 3,000 man-hours annually.

5.2 Innovating Sustainable Resource and Talent Supply Mechanisms

The essence of resource constraints lies in the contradiction between traditional “wait-and-see” fundraising methods and the high sustainability capital investment demand of digital transformation. In this realm, the exploration at Shandong Vocational College of Science and Technology has been relatively successful: the institution has constructed an ecologically sustainable funding model through “government-enterprise-school” collaboration. On one hand, they have applied for provincial-level special education informatization subsidies (constituting 40%), and on the other, collaborated with Kingdee Software to establish an “Intelligent Financial Joint Laboratory”, introducing simulated projects from enterprise financial shared centers into teaching, resulting in an annual revenue of 850,000 RMB. Of greater significance is the innovative talent development model, realized through the implementation of the “Dual-qualified Teacher Three Certifications” initiative (Accountant + RPA Developer + Python Programming Certification), tripling the autonomous development capabilities of the financial team and enhancing the research abilities of teachers, leading to a win-win situation. Research data from related studies indicate that universities adopting this model witness a significant increase in the survival rate of RPA projects, thus fully validating the importance of an internally sustainable resource mechanism.

5.3 Process Innovation for Interdepartmental Collaboration

The apparent departmental barriers are not merely technical challenges but rather a

manifestation of organizational structure and governance failures. In-depth research at a provincial university unveiled the root cause behind the inability to automatically synchronize research funding data – a conflict in KPI assessment indicators between the Research Department and the Finance Department. Resolving this dilemma necessitates organizational transformation: first, the establishment of a university-level Digital Finance Committee, led by the Deputy Vice President in charge, to create a cross-departmental assessment system encompassing multiple key metrics; second, the implementation of a “process owner” system, assigning cross-departmental leaders to each core process (such as tuition management and research reimbursement); and finally, constructing a central data hub based on the Data Fabric architecture, facilitating seamless integration among various data systems through intelligent routing technology [9].

5.4 Strengthening Risk Control Capabilities in the Era of Intelligence

Traditional security control systems struggle to cope with the new risks posed by RPA technology. Insights from Weihai Vocational College highlight the severe risks of time delays and human errors in manual script update practices during changes in personal income tax policies. The risk control system for financial RPAs must undergo three essential transformations: transitioning from passive defense to proactive monitoring by deploying audit robots with User and Entity Behavior Analytics (UEBA) capabilities; shifting from static protection to dynamic response by establishing a compliance knowledge graph with 200 checkpoints, triggering script validations automatically; and moving from retrospective accountability to full-process traceability by utilizing blockchain technology to secure critical operations [10]. Acceptance data from a provincial education department indicates that this system has shortened policy response time from 38 days to 3 days, achieving a 100% completeness rate in audit issue tracing, providing reliable security safeguards for financial automation.

6. Conclusion

The empirical analysis conducted in this study has unveiled the core contradictions and

optimization pathways for the application of financial RPA in universities under the impetus of new quality productivity and digital transformation. By establishing a three-dimensional adaptation model encompassing “technology-institution-human resources”, a novel theoretical perspective has been provided for the digital transformation in the field of education. With the advancement of multimodal large-scale model technologies, the updated intelligent financial systems will transition from rule-driven to data-driven, propelling university financial departments towards becoming strategic decision-making centers.

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