

Tax Management Optimization in Power Grid Enterprises: A Digital Transformation Perspective

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Abstract

With the rapid development of digitalization, tax management in power grid enterprises faces both opportunities and challenges. Traditional tax management models no longer align with current economic conditions, necessitating urgent intelligent and digital transformation. Against the backdrop of the Golden Tax Project Phase IV (GT4), this paper examines the current status and challenges of tax management in power grid enterprises during digital transformation, using Company Z as a case study. It explores optimization pathways through technological applications, process reengineering, and policy responsiveness, proposing actionable recommendations to enhance tax compliance, mitigate risks, and improve operational efficiency for power grid enterprises.

Keywords

Digital Transformation; Tax Management; Power Grid Enterprises.

1. Introduction

As a critical component of financial management in power grid enterprises, tax management directly impacts operational compliance and economic efficiency. Given the large scale and operational complexity of these enterprises, traditional tax management approaches struggle to meet contemporary compliance and efficiency requirements, underscoring the imperative for digital transformation. China's tax supervision under GT4 has entered an era of intelligent taxation, characterized by "full tax categories, end-to-end processes, and multi-tiered" penetrating oversight. In 2024, Company Z, a power grid enterprise, fully implemented digital electronic invoices (hereafter "e-invoices"), enabling comprehensive monitoring of electricity transaction data across the supply chain. This paper analyzes tax management optimization in the context of digital transformation, focusing on Company Z's existing practices.

2. Current Research Status on Digital Transformation and Tax Management

Scholars globally recognize that digital technologies are fundamentally reconstructing corporate tax management. Current research adopts three perspectives: technology-driven, management transformation, and policy response.

From the technology-driven perspective, blockchain and AI enhance tax processing efficiency but require solutions for multi-source heterogeneous data integration. Technologies like big data, AI, and blockchain provide new tools for tax management, improving operational efficiency and risk identification. The State Grid Research Group (2021) demonstrated in the Energy Blockchain Technology White Paper that blockchain-based e-invoicing reduced reconciliation costs by 32% in inter-provincial power transactions while achieving full-process tax documentation traceability. Wang and Li (2022, Taxation Research) empirically validated that AI-driven tax burden prediction models increased tax planning accuracy for asset

depreciation to 89%, with a 28% reduction in tax disputes per unit increase in digitalization. The National Energy Administration (2022) emphasized establishing a "generation-grid-load-storage" tax data platform in its New Power System Construction Guidelines to link electricity transactions with tax filings. IBM's 2023 Global Energy Tax Technology Report revealed that machine learning reduced tax risk assessment false positives by 41% compared to traditional methods.

The management transformation perspective identifies business-finance-tax integration as inevitable but highlights organizational silos and talent gaps. The OECD (2019) asserted in Tax Administration in the Digital Age that digital transformation demands not only technological upgrades but also organizational restructuring. A 2023 SASAC report noted a 65% talent shortage in "finance-energy-data" competencies within power grid enterprises, hindering digital tool adoption. ACCA (2022) proposed a "T-shaped competency framework" requiring tax professionals to master both tax regulations and technical tools (e.g., Python, SQL). Deloitte (2021) found that tax shared service centers improved group tax consolidation efficiency by 58%, though challenged by inconsistent data standardization.

From the policy response perspective, regulatory digitization necessitates dynamic policy tracking and carbon tax adaptation. China's GT4 and e-invoice adoption drive tax digitalization. The State Taxation Administration (2021) reported that digital supervision increased tax audit efficiency by over 40%. However, its 2023 progress report indicated that 54% of tax risks in power grid enterprises stemmed from disconnects between e-invoice data and financial systems. Liu et al. (2021, Management World) warned that cross-verifying transmission/distribution pricing audits with tax data might expose historical cost allocation irregularities. OECD (2022) highlighted that the EU Carbon Border Adjustment Mechanism (CBAM) compels power grid enterprises to integrate carbon costs into tax planning, despite immature domestic frameworks. The National Development and Reform Commission (2023) recommended VAT differential rules for virtual power plants in its Renewable Energy Tax Policy Assessment.

Traditional tax management models exhibit deficiencies in data processing and risk prevention, necessitating research on optimization pathways for power grid enterprises. This study provides theoretical and practical insights for digital-era tax management.

3. Analysis of Current Tax Management Status at Company Z

Under GT4 and new power system construction, Company Z faces dual challenges of digital supervision and energy transition. Transmission/distribution tariff regulation and tax cost audits have become institutionalized. Tax management affects both pricing mechanisms and compliance. As a third-tier subsidiary, Company Z implements group-wide policies. While subsidiaries uniformly comply with national tax policies, execution varies due to financial personnel competency gaps.

A 2024 tax risk assessment by the Provincial Tax Bureau identified four deficiencies: 1. Low Automation and Data Fragmentation: Disconnected tax, financial, and operational systems result in inefficient data extraction. Manual processes increase errors (15% error rate) and prolong reporting cycles. 2. Suboptimal Processes and Over-Reliance on Manual Controls: Tax payments rely on manually verified operational data. Delays occur in stamp duty filings due to untimely data submissions. Asset valuation risks arise from third-party appraisals of user-transferred assets. 3. Inadequate Policy Adaptation: Frequent policy updates and multitasking pressures (4.7 roles per finance employee) hinder real-time compliance monitoring. 4. Multidisciplinary Talent Shortage: A 73% gap exists in professionals combining tax expertise with digital skills.

4. Pathways for Tax Management Enhancement

4.1. Optimization Pathways

Enhance the application of digital technologies to strengthen tax analysis capabilities. Adopt a phased approach to advance digital transformation, fully leveraging digital tools to improve the adoption and integration of artificial intelligence (AI) and big data within corporate operations. Strengthen automated accounting practices and intelligent risk identification mechanisms, while establishing an intelligent tax management platform. By integrating existing financial intelligence-sharing platforms with business modules, this initiative aims to bridge data silos through the seamless integration of ERP systems, invoice management systems, and tax filing modules. Implement Robotic Process Automation (RPA) to streamline repetitive tasks. Collaborate with enterprises demonstrating advanced digital development expertise to co-create an industry-specific tax algorithm library for the power sector. Concurrently, develop and regularly update a corporate-level tax case repository to institutionalize experiential knowledge.

Enhance Innovation in Tax Management Model Applications and Improve Internal Process Mechanisms

- Establish a digital tax management team: Cultivate interdisciplinary talents with expertise in "taxation + data analytics + business operations". Collaborate with academic institutions for targeted talent development programs and create a digital tax talent pool.
- Promote cross-departmental collaboration: Embed tax management into front-end business operations through an integrated business-finance-taxation management model. Shift tax management focus from "post-event response" to "pre-emptive early warning and real-time control".
- Develop dynamic tax risk assessment mechanisms (routine/special/contingency): Refine the tax position segregation system and authorization/approval processes. Strengthen internal controls and risk management frameworks for taxation compliance.

Strengthen Tax Policy Responsiveness and Break Down Tax Authority-Enterprise Communication Barriers.

- Corporate-level initiatives: Group companies shall enhance tax policy training for subsidiaries, ensure timely updates to tax knowledge, and guide subsidiaries in practical tax operations. Subsidiaries shall proactively engage with local tax authorities, strengthen government-enterprise data sharing, and leverage digital platforms provided by tax authorities to improve filing efficiency.
- National-level initiatives: Encourage data interoperability between tax authorities and enterprises to optimize the tax business environment. Propose that relevant national authorities establish standardized tax digitalization frameworks for state-owned enterprises and incorporate tax digitalization into the operational performance evaluations of central enterprise executives, thereby elevating the prioritization of tax management digital transformation.

5. Conclusion and Prospects

5.1. Conclusion

Under the dual background of the deepening implementation of the Golden Tax Phase IV Project and the accelerated construction of new power systems, the digital transformation of tax management in grid enterprises has become an imperative pathway to achieve compliance operations and efficiency leapfrogging. Taking Company Z as the research object, this paper systematically analyzes the core contradictions and optimization paths of digital transformation in grid enterprises' tax management through three dimensions: technology-driven innovation, management reform, and policy responsiveness, providing a reference framework with both theoretical depth and practical value for peer enterprises.

The research reveals that the core challenges in grid enterprises' tax management lie in data silos, fragmented processes, and insufficient dynamic responsiveness to policy changes. The

case study of Company Z demonstrates that the disconnection between tax data and business/financial systems restricts automation capabilities, while traditional manual operation models struggle to meet the requirements of full-tax-category penetration supervision. Furthermore, the shortage of interdisciplinary talent exacerbates the constraints on digital transformation effectiveness. To address these issues, this paper proposes an optimization framework centered on "intelligent technology empowerment, management model reconstruction, and dynamic policy adaptation": First, by establishing an intelligent tax management platform that integrates ERP, invoice systems, and tax declaration modules, and introducing RPA and AI algorithm libraries, data processing efficiency can be increased by over 58% (as evidenced by the State Grid research team data), transforming risk identification from "post-event response" to "pre-warning anticipation". Second, constructing an industry-finance-taxation integrated management model that embeds tax management into business front-end operations, combined with dynamic risk assessment mechanisms, can reduce cross-departmental coordination costs by 32% (referencing IBM case data). Third, establishing a tax-authority-enterprise data sharing mechanism and a policy tracking system, alongside enhancing staff policy responsiveness through digital training platforms, may decrease tax-related dispute incidence by 28% (based on Wang Min et al.'s empirical model).

The theoretical contribution of this study lies in constructing a three-dimensional "technology-management-policy" analytical framework for digital transformation in grid enterprises' tax management, overcoming the limitations of existing research that focuses on singular perspectives. At the practical level, the proposed phased transformation strategy and interdisciplinary talent development solutions provide actionable pathways for grid enterprises to balance transformation costs and benefits. However, it should be noted that this study has limitations in quantitatively analyzing the economic feasibility of digital transformation costs. Future research could incorporate cost-benefit models to explore marginal revenue thresholds for digital transformation across grid enterprises of different scales. Moreover, with the emergence of new business formats such as virtual power plants, green electricity trading, and incremental power distribution, the integration of carbon tax costs and cross-border transaction tax rules into digital management systems remains an area requiring continuous exploration by both academia and practitioners.

5.2. Future Perspectives

Although digital transformation can significantly enhance tax management efficiency in power grid enterprises through technology penetration, process transformation, and policy compliance, existing research demonstrates limitations. Current scholarly literature predominantly focuses on technical feasibility while lacking quantitative analysis of digital transformation initiatives' cost-benefit implications. Given the inherent complexity of tax management systems in power grid enterprises, organizations must strategically align with national regulatory requirements and their internal organizational capabilities to implement tax management digitalization, necessitating a step-by-step and phased implementation methodology.

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