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Article

The Practice and Challenges of Tax Technology Optimization in the Government Tax System

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Abstract: With the continuous advancement of information technology, modern tax administration is undergoing profound transformation while also facing increasingly complex challenges. Traditional tax management models struggle to cope with the growing volume of economic activities, diversified taxpayer behaviors, and higher demands for transparency and service quality. In this context, the integration of emerging digital technologies-such as big data analytics, artificial intelligence-driven decision support systems, blockchain-based data security frameworks, and scalable cloud computing architectures-has become essential for enhancing the efficiency, openness, accuracy, and intelligence of tax governance. This paper systematically analyzes key technological pathways for optimizing tax technology, focusing on how data integration, intelligent risk identification, process automation, and secure information sharing can be achieved through these tools. By comparing representative domestic and international practical cases, the study summarizes effective technological strategies and explores their applicability in different tax environments. Furthermore, it proposes a set of feasible solutions aimed at improving compliance monitoring, strengthening taxpayer services, reducing administrative costs, and building resilient digital infrastructures. The findings provide valuable theoretical and practical references for future tax information management and the construction of smart tax systems.

Keywords: optimization of tax technology; government taxation system; challenge; practice

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1. Introduction

Taxation is an important component of government financial management. In today's era of rapid economic development and continuous progress in information technology, tax management is facing increasingly severe challenges. To enhance efficiency and avoid tax loopholes, it is necessary to fully utilize advanced technologies such as big data and artificial intelligence to improve and perfect tax management, enabling the tax system to achieve automated control. However, technical tax optimization also faces many predicaments, such as data security, compatibility between technology and systems, and cross-departmental collaboration issues. This paper mainly discusses the core technologies, practical experiences and problems faced in the optimization of tax technology, and puts forward corresponding countermeasures, aiming to provide support for the optimization and development of the tax system.

2. The Core Technology of Tax Technology Optimization

Big data, artificial intelligence (AI), blockchain and cloud computing are the fundamental technologies for optimizing tax technology [1]. The coordinated development of these new technologies has promoted the optimization of the tax system and achieved the digital transformation of tax management. Big data technology mainly collects, organizes and analyzes a large amount of tax data. Based on this, it can provide reference basis for tax decision-making, help tax authorities grasp the dynamic

information of taxpayers, predict potential problems, and thereby optimize tax planning and adjustment strategies [2]. Technologies such as machine learning and deep learning in artificial intelligence can enhance the intelligence level and accuracy of tax inspections through automatic auditing, risk prediction, and tax fraud detection, reduce the pressure of manual auditing, and improve the precision and intelligence level of tax management. Applying blockchain technology to the tax management system can ensure the openness and immutability of tax data, enhance the credibility of tax management, and at the same time help prevent the occurrence of tax fraud. Cloud computing can provide flexible and scalable computing and storage capabilities, enhance the tax management system's ability to handle big data, promote cross-regional and cross-departmental information sharing and cooperation, and make the tax system more efficient and more responsive (As shown in Figure 1).

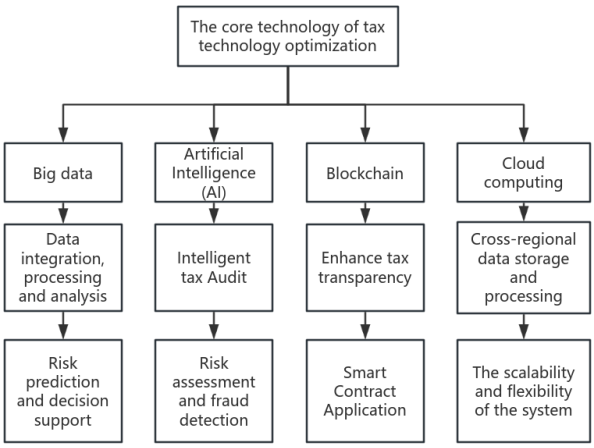

Figure 1. Core technology framework diagram.

3. Analysis of Practical Cases of Tax Technology Optimization in the Government Tax System

3.1. Domestic Tax Technology Optimization Practice

In recent years, with the rapid advancement of technologies such as artificial intelligence, big data and cloud computing, government tax departments have begun to apply these new technologies in tax administration [3]. With the help of these new technologies, government tax authorities can effectively enhance the efficiency of tax collection and administration, strengthen the early warning and prevention of tax risks, and at the same time optimize the service experience of taxpayers. The following will introduce successful cases of domestic tax technology upgrading and transformation, and present the key data changes before and after implementation through the form of data comparison [4].

The tax department of a certain province has introduced a tax collection and administration system based on artificial intelligence, which uses artificial intelligence technology to analyze and automatically process tax data. In the tax declaration and collection process, the system can independently identify taxpayers' tax behaviors and assess potential tax risks [5]. Meanwhile, through the application of machine learning, the system is continuously optimized and has the ability to conduct real-time tax inspections. When filling out tax returns, it will proactively identify problems, effectively reducing human intervention. Tax authority staff have improved their work efficiency and handled tax affairs more precisely through this system. Statistics show that the tax compliance rate has increased by 10%, the tax declaration time has been shortened by 46.67%, the accuracy

rate of tax risk early warning has improved by 21.43%, and the satisfaction rate of taxpayers has risen by 20% [6].

The tax authorities in a certain area have fully utilized cloud computing technology to comprehensively optimize tax services. Through cloud computing, not only has the capacity for storing and processing tax data been enhanced, but also the entire process of digital management of tax services has been achieved, significantly improving the elasticity and scalability of tax work. Taxpayers can submit tax returns, query and handle tax payment vouchers and other affairs online through the cloud platform, reducing the complexity of the traditional tax handling process and the time and energy required. The result is that the tax processing time for taxpayers has been shortened by 50%, the coverage of tax services has expanded by 133.33%, and at the same time, the confidentiality of tax data has also been enhanced (As shown in Table 1).

Table 1. Comparison of Changes Before and after Optimization of the Intelligent Tax System.

Indicator	Before implementation	After implementation	Improvement range (%)
Tax compliance rate	85%	95%	+10%
Tax declaration time (minutes per time)	15	8	-46.67%
Accuracy rate of tax risk early warning	70%	85%	+21.43%
Taxpayer satisfaction	75%	90%	+20%

From the above case analysis, it can be seen that the domestic tax system has achieved a certain degree of scientific and technological achievements. By applying advanced technologies such as artificial intelligence, big data and cloud computing, not only has the efficiency and accuracy of tax collection and administration been improved, but also the ability to prevent and control tax risks has been enhanced, and the experience of taxpayers in handling tax-related business has been effectively improved. These successful technological optimization models provide referential experience for the update of the regional tax system and also lay a solid foundation for its own technological innovation and development (As shown in Table 2).

Table 2. Comparison of Tax Service Efficiency Before and after the application of Cloud computing Platform.

Indicator	Before implementation	After implementation	Improvement range (%)
Taxpayer's tax processing time (minutes per time)	20	10	-50%
Coverage of tax service channels	3	7	+133.33%
The frequency of data security incidents	Five times a month	0 times per month	-100%
Taxpayer satisfaction	80%	95%	+18.75%

3.2. International Tax Technology Optimization Practice

With the deepening of globalization, many countries have increasingly recognized the necessity of promoting economic growth and achieving tax fairness by enhancing the effectiveness and transparency of taxation. Therefore, various countries have been strengthening tax administration, risk management and the construction of tax service networks by introducing new technological means such as artificial intelligence, big data and blockchain, and striving to improve the efficiency and level of tax administration. The

following are some advanced tax technologies adopted by countries around the world, and the impact of technological development on the performance of tax collection and administration is presented through data Table 3 and Table 4.

Table 3. Comparison of the US Tax Administration System Before and after Optimization.

Indicator	Before implementation	After implementation	Improvement range (%)
Tax compliance rate	80%	95%	+15%
Tax declaration time (minutes per time)	30	18	-40%
Accuracy rate of tax risk early warning	70%	90%	+20%
Taxpayer satisfaction	85%	92%	+8.24%

Table 4. Comparison of the Estonia Tax System Before and After Optimization.

Indicator	Before implementation	After implementation	Improvement range (%)
Tax compliance rate	70%	95%	+25%
Tax declaration processing time (minutes per time)	30	12	-60%
Tax data security	60%	95%	+58.33%
Taxpayer satisfaction	78%	92%	+18%

The United States adopts an intelligent tax management system in tax administration. This system combines big data and artificial intelligence technologies to automate tax declaration, tax verification and tax risk early warning operations. This system is capable of integrating a large amount of tax payment information, automatically identifying possible tax issues, and intelligently predicting the occurrence probability of tax risks based on a large amount of tax information. Through this system, the tax compliance rate has increased by 15% and the processing time for tax declaration has been reduced by 40%. The accuracy rate of tax risk early warning has significantly increased by 20%. These improvements have reduced the need for manual tax inspections, not only enhancing work efficiency but also strengthening risk control capabilities. Taxpayers' satisfaction has increased by 8.24%, indicating that the development of tax technology has not only enhanced the level of tax management but also significantly improved the quality of customer service.

Estonia has taken the lead in the digital transformation of taxation. By integrating blockchain technology and artificial intelligence, Estonia's electronic tax system can ensure the immutability of tax data and provide taxpayers with comprehensive and transparent tax management services. The application of blockchain technology has greatly enhanced the security of tax data and significantly reduced tax fraud and data leakage problems. The application of this system has increased the tax compliance rate by 25%. In addition, the processing time of tax returns has been significantly reduced to 12 minutes. Through these technological improvements, the tax system has not only enhanced efficiency but also strengthened the security of tax data. Taxpayers' satisfaction has also increased by 18%, indicating that the application of electronic taxation has enhanced the convenience of the tax handling process and further improved the working efficiency of the tax bureau and the transparency of information disclosure. These achievements reflect Estonia's success in tax technology innovation and provide valuable experience for tax digitalization in other countries.

4. The Challenges Faced by Tax Technology Optimization in the Government Tax System

4.1. The Difficulty of Integrating the Old System with New Technologies

One of the main challenges in optimizing tax technology is the integration of the old system with new technologies. The tax management of most government departments still relies on the outdated information technology architecture, and when attempting to introduce advanced information technology, they face extremely complex challenges. Old information systems are constructed through outdated technology stacks and programming languages, which makes them incompatible with emerging technologies such as artificial intelligence, big data, and cloud computing, increasing the difficulty of integration. Although replacing the old system requires huge labor and economic costs, it will also affect the efficiency of project advancement and even lead to instability of the entire system. Furthermore, traditional tax management systems, due to their static and fixed data storage methods, are unable to connect with big data and achieve real-time data processing, resulting in the ineffective integration and application of new technologies.

4.2. Risks of Information Leakage and Data Theft

With the development of tax informatization and intelligent construction, the threats of data leakage and information theft faced by tax authorities have gradually intensified. The tax system holds a vast amount of information with high data value, such as citizens' basic information (identity information, income, assets, tax history, etc.) and company profiles. If the security and integrity of this information are compromised, it will greatly affect the public's trust in the tax authorities. In addition, tax data is usually shared with other government departments, banks, etc., increasing the risk of information leakage. Especially when using channels such as the Internet and cloud computing, due to the lack of effective security guarantees, external risks such as hacker attacks and malicious software will increase.

4.3. The Data Standards of Different Departments Are Not Uniform

In the process of optimizing tax technology, the lack of unified data standards among various government departments is a significant problem. The tax system needs to exchange and share data with other government departments, banks, social welfare institutions, etc. However, there are differences in data standards, naming conventions and field definitions among various departments, resulting in conflicts and incompatibilities during the process of data exchange and integration. Different departments use their own standards and system architectures, making cross-departmental data sharing complex and inefficient. To adapt to different data standards, a large amount of data cleaning and transformation is usually required, which not only increases the workload but also easily leads to errors. Especially in the case of multiple systems involved, conflicts in data standards can lead to information delays or deviations. Although tax data is shared among various units, due to their different needs, the same data has different meanings and formats in different databases, which affects the accuracy and consistency of the data and thus the effectiveness of data analysis and decision support.

5. Optimization Strategies for Tax Technology Optimization in the Government Tax System

5.1. Implement a Phased Technological Upgrade Plan

By applying phased technologies to optimize the tax system, new technologies can be stably introduced into the original system. Such technical methods reduce the risk of technical conversion and improve the efficiency and scalability of the overall system. The phased plan divides the system upgrade process into multiple links, and comprehensive

detection and evaluation are carried out at each stage to ensure the use and efficiency of the technology. Focus on optimizing key business modules, such as the collection and storage methods of tax data and the tax declaration platform, to ensure the stability and efficiency of the basic system; Gradually introduce big data analysis and artificial intelligence technologies to assist in tax review, risk prediction and data interpretation, more accurately identify tax risks and enhance risk prevention and control capabilities. Each stage must undergo strict system testing to ensure that the new technology ADAPTS to the current system environment. This gradual transition approach can ensure that technological updates do not cause excessive fluctuations, thereby avoiding the risks brought about by one-off large-scale changes (As shown in Table 5).

Table 5. Comparison before and after the implementation of the phased technical upgrade plan.

Indicator	Before implementation	After the implementation of the first stage	After the implementation of the second stage	After the implementation of the third stage
Tax data processing speed (minutes)	30	20	15	5
Accuracy of tax audit	65%	75%	85%	95%
Tax risk identification rate	50%	60%	75%	90%
Taxpayer satisfaction	70%	80%	85%	95%

5.2. Strengthen Data Encryption and Access Control

To ensure the security of tax data, strengthening data encryption and access control is a crucial strategy. The tax system processes a large amount of sensitive information, such as taxpayers' financial data and personal identity information, etc. Data during storage and transmission should be fully protected. Strong encryption algorithms should be adopted to encrypt tax data. Even if the data is stolen, unauthorized personnel cannot obtain or interpret it. Common encryption methods such as symmetric encryption (such as the AES algorithm) and asymmetric encryption (such as the RSA algorithm) can provide reliable and powerful protection in various environments. Strict access control rules are also an important means to ensure data security. Through role-based Access Control (RBAC), different access permissions are set according to the job responsibilities of employees, and only authorized employees are allowed to access the relevant data. Adopt the principle of least privilege to restrict the permissions of each user when accessing and operating data, reducing internal risks. Technologies such as Multi-factor Authentication (MFA) can be used to verify the identities of visitors and ensure that their permissions are effectively confirmed.

5.3. Build a Unified Data Sharing Platform

In order to improve the efficiency and transparency of tax administration, building a unified data sharing platform is a key strategy for the optimization of the tax system. This will help eliminate barriers among various departments and systems, establish a centralized database, promote data circulation, improve tax calculation accuracy, and enhance decision support. Efficient information flow and strict data control standards are the keys to this process.

To achieve the integration and mutual exchange of data among departments in colleges and universities, the data sharing platform should follow unified data standards

and interface protocols to ensure the intercommunication and sharing among the tax subsystem, external institutions and the platform. Mathematically, data sharing can be represented by the data flow model as:

$$D_{shared} = \bigcup_{i=1}^{n} D_i \quad (1)$$

Among them, Dshared represents a unified and shared data set, Di is a data set from different systems or departments, and n is the number of data sources. This formula indicates that the unified sharing platform aggregates data from all different departments in order to provide more comprehensive tax information.

The data sharing platform should have efficient data processing capabilities and be able to support the real-time processing and analysis of large-scale data. This requires the platform to have an efficient data storage and processing architecture, capable of updating data and analysis results in real time as needed. Through the data model, it can be expressed as:

$$D_{processed} = f(D_{shared}, T) \quad (2)$$

Among them, Dprocessed represents the processed data, f is the data processing function, and T is the timestamp or time range of the real-time data. This formula shows that after data is processed and updated on the sharing platform, it can support rapid decision-making and analysis.

6. Conclusion

With the development of information technology, the technological update of the tax system is an important way to enhance the efficiency, transparency and service quality of the government's tax system. Through the application of high and new technologies such as artificial intelligence, big data and cloud computing, the tax processing process has achieved intelligence and automation, improved efficiency and enhancing the effectiveness of tax collection and administration, risk management and tax services. Although there are problems such as the integration of old systems, data security, and cross-departmental data sharing in the process of using technologies, to solve such problems, the government needs to formulate effective measures to achieve a high degree of integration of technology and policy, and ensure the stability and high-performance operation of the tax system.

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