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Implementation and Management of a Cross-Border Tax System Oriented Towards Global Tax Administration Informatization

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Abstract: Against the backdrop of accelerated development of the digital economy and globalization, traditional tax administration faces multiple challenges such as complex cross-border transactions, tax base erosion, and information barriers. The informatization construction of cross-border tax systems has become an important direction for improving management efficiency and governance capabilities. This article systematically reviews the theoretical basis of global tax management informatization, proposes an implementation path centered on system architecture optimization, information sharing mechanism, and data quality governance, and analyzes collaborative management and compliance risk prevention mechanisms. By analyzing typical cases such as the EU VIES, OECD CRS, and the Estonian e-tax platform, this study summarizes their systematic design and international collaboration experience, and provides relevant paths and practical references for building an efficient, secure, and sustainable global tax governance system.

Keywords: cross border tax system; informatization of tax collection and management; data sharing

1. Introduction

At present, the development of globalization and digital economy is giving rise to the continuous emergence of cross-border trade activities. Traditional tax collection and management models are difficult to solve problems such as tax base erosion, information loss, and increased compliance difficulties. To adapt to this trend, multinational tax systems are vigorously developing their information technology capabilities as an important focus of their international tax management work. To address current challenges in tax fairness and enforcement, countries are creating new models for tax information exchange, formulating unified identity recognition rules, and improving system architecture through multilateral cooperation mechanisms such as CRS and BEPS. This study focuses on the development logic of global tax administration informatization, starting from the specific implementation and operation processes of cross-border tax departments, and combining typical practical cases to construct a scientific, fair, and cooperative international tax governance system, providing theoretical references and practical experience.

2. Theoretical Basis of Global Tax Management Informatization

The rapid development of the digital economy and the normalization of cross-border transactions are posing severe challenges to the previous tax collection and management model based on regional principles. Base erosion, profit shifting (BEPS), and cross-border tax evasion are becoming increasingly severe, prompting tax management systems in various countries to transition from isolated national models to coordinated international frameworks. At the same time, the utilization of information technology has become a key way to improve the level of cross-border tax management. The Common Reporting Standard (CRS) and Automatic Exchange of Information (AEOI) led by the OECD have laid the

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technical foundation for international tax information sharing, improving taxpayers' international identification and financial information transparency. In addition, the combination of big data, blockchain, AI and other technologies has opened up new governance methods for the construction of the global tax management system. The informatization of tax management not only improves the efficiency of tax administration, but also promotes rule-based global tax governance, becoming a fundamental guarantee for modern countries to achieve tax fairness and international cooperation [1].

3. Core Implementation Path of Cross-Border Tax System

3.1. Building System Architecture and Centralized Distributed Deployment Path

Establishing a cross-border tax system requires simultaneous consideration of data processing speed, cross-border collaboration capabilities, and local laws and regulations, making the design of the system architecture an important foundation. Centralized architecture can achieve advantages such as unified standards and specifications, convenient centralized management, and security control, making it more suitable for countries with higher levels of regional integration, such as the EU VIES model; Distributed architecture places greater emphasis on system node autonomy and flexible deployment, making it suitable for multi-country cooperation scenarios with distinct national sovereignties and uneven technological foundations. The current hybrid architecture has become widely recognized in the industry, which constructs a "unified entrance, hierarchical processing, and flexible deployment" for cross-border tax information through centralized data centers and distributed service nodes. The use of elastic cloud computing deployment and consistent APIs enables strong scalability and interactivity, providing effective support for the interconnection architecture of tax systems across different countries [2]. A well-designed and arranged system architecture is a prerequisite for the efficient operation and collaborative governance of cross-border tax management systems (Figure 1).

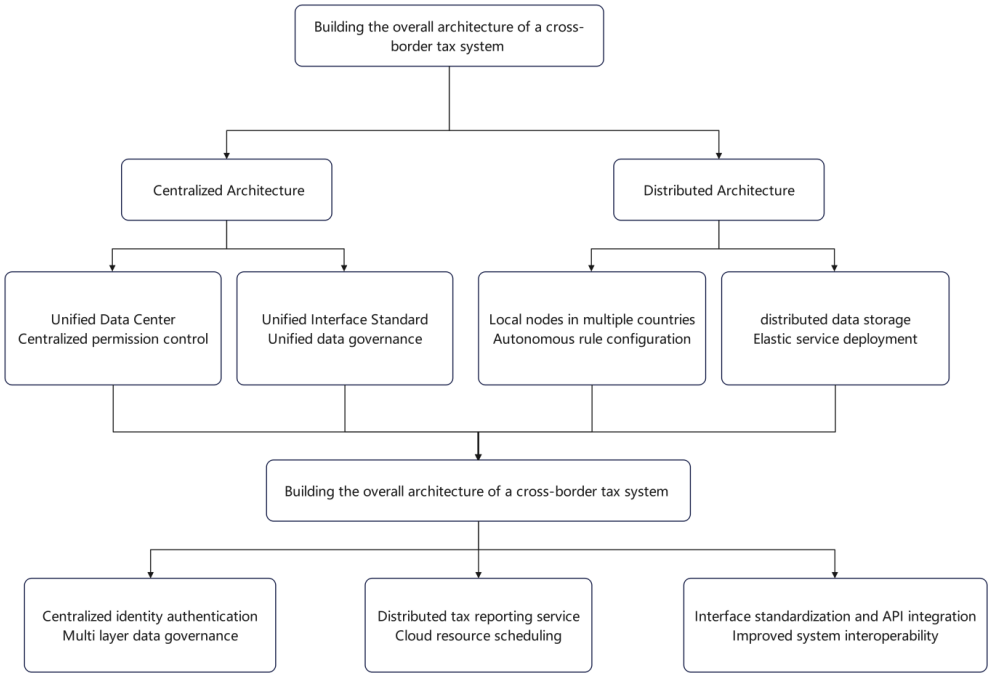

Figure 1. Comparison Framework of Cross border Tax System Architecture Types.

3.2. Promote Information Sharing and Improve the Construction of Identity Recognition System

A core aspect of achieving cross-border tax informatization is the establishment of secure and standardized mechanisms for taxpayer identification and data sharing among

multiple countries. The information sharing mechanism enhances the flow of tax collection and management data for financial institutions, enterprises, and natural persons by establishing standardized interface protocols (such as CRS XML Schema and FATCA) and cross-border data exchange platforms. In terms of identity recognition, many countries are gradually developing standardized taxpayer identification numbers (TINs), and using KYC authentication, electronic ID cards, blockchain-based verifiable identity (DID), and other technologies to enhance uniqueness and security. An efficient information sharing system can accelerate the process of disclosing cross-border tax collection and management information, and also provide technical support for risk identification and accountability. Table 1 compares several typical identity recognition and data exchange mechanisms:

Table 1. Comparison of Information Sharing and Identity Recognition Mechanisms.

Mechanism type	Application scenarios	Technological base	Characteristics and advantages
CRS Information Exchange	Cross border tax declaration of financial accounts	XML Schema + API	Automatic exchange, unified standards, wide coverage
TIN mapping recognition	Unique identifier for multinational taxpayers	National level registration system	Strong uniqueness, easy to track
KYC real name verification	Financial institution account opening and compliance inspection	User authentication interface	High real-time performance and standardized identity verification
Blockchain identity authentication	Identification of high-risk transactions or anonymous scenarios	DID + Smart Contract	Decentralized, tamper proof, and strong privacy protection

3.3. Strengthen Data Governance and Enhance Consistency Assurance Capabilities

In the cross-border tax system, the integration and consistency maintenance of heterogeneous data from multiple sources are key to ensuring the stable operation of the system. To achieve more efficient data governance, it is necessary to start from three aspects: standard setting, quality control, and process management, by unifying field definitions, data formats, and transmission protocols, and building a data management system that covers the entire process of collection, storage, cleaning, comparison, and use. By introducing metadata management, master data modeling, and data lineage tracing mechanisms, data accuracy and traceability can be effectively improved. On this basis, a cross-border data verification and consistency check mechanism should be established to ensure consistent and reliable information flow during the interaction process [3]. Data governance can also enhance the automation level of the system and provide robust data support for risk monitoring, collaborative tax management, and compliance supervision (Table 2).

Table 2. Comparison of Key Mechanisms for Data Governance and Consistency Assurance.

Data governance measures	Function description	The role in cross-border tax systems
Field standardization	Unified data field naming, format, and units	Realize the integration of tax data and system interoperability among multiple countries

Metadata management	Manage data meaning, sources, structure, and update rules	Improve data interpretability and support data sharing governance
Master data modeling	Building a unified model of core objects such as taxpayers and enterprises	Ensure consistent identity data and support multi system data integration
Data Bloodline Tracking	Track the entire process of data generation, transmission, and processing	Strengthen data traceability, support auditing and compliance supervision
Consistency verification mechanism	Automatically identify and correct cross system data differences	Improve data accuracy, reduce management risks and misjudgments

4. Operational management and risk prevention mechanisms for cross-border tax systems

4.1. Management and operation model and collaborative mechanism

The efficient operation of cross-border tax systems relies on clear management structures and multilateral collaborative mechanisms. At the management level, the system should be divided into a central coordinating agency and national execution nodes, with clear division of data responsibilities, permission control, and system interface specifications. In terms of collaborative mechanisms, it is necessary to establish a multi-level interactive framework of "technology docking + institutional coordination + data mutual trust", and achieve rule docking and information synchronization through regional tax alliances or cross-border regulatory platforms. To evaluate the efficiency of multilateral collaboration, appropriate performance metrics or key indicators should be introduced:

$$E_c = \frac{T_s \cdot D_c}{C_i + C_d} \tag{1}$$

Among them, E_c represents collaborative efficiency, T_s represents data synchronization frequency, D_c represents institutional compatibility between countries, C_i and C_d represent interface complexity and data differentiation cost, respectively. This model indicates that improving institutional alignment and reducing data system heterogeneity are key paths to enhancing the collaborative capabilities of cross-border tax systems.

4.2. Strengthen Risk Control and Information Governance

For the various risks of cross-border tax systems, such as tax avoidance, information abuse, and data fabrication, it is necessary to develop multi-dimensional and multi-level risk control and information management mechanisms. The first aspect involves using big data and artificial intelligence algorithms to build a risk control model, identifying abnormal transactions, cross-border tax avoidance patterns, and false declaration behaviors. The second construction includes a data permission management mechanism that covers the entire process of data collection, transmission, storage, and usage, enabling on-demand authorization, hierarchical calling, and auditable behavior of data. It is essential to strengthen institutional coordination and combine technical methods to form a closed loop of 'technical identification, rule judgment, accountability, and response'. Introduce data integrity testing, access log tracking, and multi-source data comparison measures to prevent data leakage and abuse. Risk control and information management mechanisms contribute to the highly reliable and regulated operation of cross-border tax systems [4].

4.3. Improve Legal System and Data Standards

The operation of cross-border tax systems must be carried out under clear legal systems and a unified data regulatory framework to ensure the compliance of information

exchange and the legality of data use. At present, the EU GDPR, OECD's Automatic Exchange of Tax Information Standard, and domestic local data regulations together constitute a complex cross-border compliance environment. Create a dual mechanism of 'international rule coordination + domestic legal adaptation' to achieve the harmonization of legal procedures related to data collection, storage, transmission, and sharing. It is also necessary to establish unified data formats, data fields, and interface specifications to enable synchronous technology integration and policy implementation. The dual goals of protecting data rights and improving tax governance efficiency are achieved through cross-border data sharing agreements, the establishment of usage accountability frameworks, and information review systems. Improving legal systems and data standards is the institutional cornerstone for building an open, agile, and secure global tax governance system [5].

5. Analysis of Typical Practical Cases

5.1. EU VIES and Tax Information Sharing System Case

The EU VIES (VAT Information Exchange System) is a cross-border tax information sharing platform organized by the European Union, aimed at strengthening the level of cooperation in value-added tax management among member states. The main function of VIES is to provide real-time query and verification of value-added tax numbers in cross-border B2B trade activities, assisting tax authorities in detecting fraud and tax evasion in a timely manner. VIES relies on unified interface standards and interconnected national tax databases to achieve automatic collection, comparison, and alerting of transaction information. Its functions mainly involve mutual recognition of taxpayer identities, real-time synchronization of declaration data, and correlated monitoring of abnormal situations. This system aims to improve cross-border tax transparency and promote the integrated implementation of EU VAT policies [6]. The successful experience of VIES is reflected in the highly unified institutional arrangements, technological cooperation, and highly integrated multilateral mutual trust mechanisms, providing a mature reference paradigm for other regional tax cooperation platforms (Table 3).

Table 3. Comparison of Key Elements and Functional Mechanisms of the EU VIES System.

Key elements	Implementation mechanism	Major function	Governance value
Mutual recognition of taxpayer identity	Unified VAT Registration Number System of Member State Tax Bureaus	Real time verification of cross-border transaction enterprise identity	Reduce the risk of false registration and identity forgery
Real time data synchronization	Networked database + unified declaration interface standard	Automatically update transaction declaration data	Improve data consistency and sharing efficiency
Abnormal information comparison	Cross border information verification + abnormal transaction recognition rule engine	Identify suspected tax evasion, false invoices, and other behaviors	Improve risk control response speed and tax inspection accuracy
Multilateral Information Cooperation Mechanism	EU Tax Information Committee Coordination and Standards Promotion	Multi country coordinated policy response and technological deployment	Strengthening the execution of tax policies and regional governance capabilities

5.2. Systematic Implementation Practice in OECD Tax Transparency Initiative

The cross-border tax transparency program led by the OECD, especially the Common Reporting Standard (CRS), has formed the technological infrastructure and legal environment for the automatic exchange of global tax information. The CRS stipulates that financial institutions in each country should regularly collect account information of non-residents and transfer it to the corresponding country for automatic data transmission through their respective tax authorities. This mechanism uses a unified data structure (XML Schema), standard declaration interface, and international legal agreements (such as the Multilateral Convention on Mutual Administrative Assistance in Tax Matters), forming a widely applicable, unified data format, and standardized global tax information sharing network [7]. Currently, over 100 countries and administrative regions have joined CRS, including the vast majority of offshore financial centers. The success of CRS cannot be separated from multilateral political consensus, legally binding frameworks, and efficient information system platforms. It has become a globally influential paradigm for tax information exchange systems, providing technical and institutional templates for building a global digital tax governance infrastructure (Table 4).

Table 4. Comparison of Key Mechanisms and Implementation Characteristics of OECD-CRS System.

Key mechanisms	Technological base	Implementation content and process	Global influence and effectiveness
Information collection mechanism	Financial institution KYC system + local declaration platform	Collect non-resident account information	High data quality, accurate taxpayer identification
Data exchange standards	CRS XML Schema + Encryption Transmission Protocol	Automatically generate structured data for cross-border exchange	Unified standards to enhance international data compatibility
Multilateral legal framework	Multilateral Convention on Mutual Administrative Assistance in Taxation (MAC)	Set exchange obligations and data usage boundaries	Enhance legal binding force and strengthen enforcement rigidity
Platform implementation and coordination	Tax authorities of various countries + OECD coordination mechanism	Establish a local CRS information system and annual declaration process	Covering over 100 countries, gradually forming a global information sharing network

5.3. Full Process Tax Automation Model of Estonian E-Tax Platform

As a global benchmark for digital government construction, Estonia's e-Tax system has achieved automated processing of the entire tax declaration, payment, tracking, data statistics, and other processes. Taxpayers can enter the system using their electronic ID card (e-ID) to view pre-filled tax forms, real-time declaration pages, and payment interfaces. The system can also be connected to other platforms such as banks, employers, social security institutions, etc. to achieve automatic aggregation and verification of personal and corporate tax information. The system relies on the national-level X-Road data exchange system to ensure the circulation and secure sharing of data between departments. In addition, the platform also combines anomaly detection technology in artificial intelligence to achieve the inspection of abnormal behaviors and declaration deviations. Thanks to its efficient and transparent system design, over 98% of tax declarations can be completed within a few minutes, greatly saving time and compliance costs for both taxpayers and tax administrators, providing a replicable and scalable "digital national tax" model for global tax automation reform (Table 5).

Table 5. Comparison Table of Functional Structure and Governance Advantages of Estonian e-Tax Platform.

Core module	Technical support	Function description	Governance advantages
User identity authentication	Electronic ID card (e-ID), digital signature	Online real name authentication, authorization declaration, and behavior recording	Unique identity, secure compliance, and prevention of false declarations
Automatic data filling	Multi -platform data integration + pre filling algorithm	Automatically generate declaration forms for personal income tax, corporate tax, etc.	Improve tax reporting efficiency and reduce human error
Tax declaration and payment	Real time declaration system + bank API integration	One-click submission, automatic tax payment, status tracking	Simplify processes and reduce operational costs for both parties involved in collection and payment
System interconnection and interoperability	National X-Road Data Exchange Platform	Data exchange with banking, social security, business registration and other systems	Establish a unified database to improve data consistency and integrity
Risk identification mechanism	AI algorithm + behavior pattern analysis	Abnormal declaration identification, automatic warning and auxiliary audit	Improve risk control efficiency and achieve precise governance

6. Conclusion

With the advancement of digitalization in the world economy and the normalization of cross-border transactions, the single tax collection and management system has been greatly impacted, and information technology construction has become a core means to enhance cross-border tax governance capabilities. This article analyzes the internal development laws of cross-border tax system informatization construction from four aspects: theoretical basis, system implementation path, operation management mechanism, and typical practical cases. The empirical results show that the establishment of unified data standards, mature technological structures, multilateral collaboration methods, and comprehensive regulatory systems is key to achieving efficient tax management and risk prevention. In the future, we should strengthen the integration and application of new technologies such as artificial intelligence (AI) and blockchain in the global tax system to promote the coordinated evolution of international tax standards and provide solid support for building an open, fair, and transparent international tax order.

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