



SYSTEM INTEGRATION IN CUSTOMS FOR TAX COLLECTION EFFICIENCY: A BIBLIOMETRIC AND SCIENCE-MAPPING ANALYSIS

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Abstract:

This study examines the integration of systems for tax collection efficiency in customs administration, addressing critical gaps in understanding the intellectual structure and theoretical foundations of this rapidly evolving field. Despite the growing importance of digital transformation in tax administration globally, existing knowledge remains theoretically fragmented, lacking coherent frameworks that bridge technological innovation with administrative effectiveness. Furthermore, the theoretical gap is evident in the absence of integrated models explaining how system interoperability influences tax collection outcomes. Accordingly, a comprehensive bibliometric analysis of 706 Scopus publications (1981-2025) was conducted using OpenRefine for data harmonization and VOSviewer for visualization. The analysis uniquely identifies four distinct theoretical clusters that evolve in isolation: technological determinism in system design, institutional theory in administrative reform, economic efficiency models in revenue optimization, and governance theory in compliance management. At the same time, publications increased sharply after 2018, reflecting urgent needs for frameworks to guide pandemic-driven digitization. Additionally, the study's novelty lies in demonstrating the evolution of system integration research from purely technical implementations to complex socio-technical systems that require interdisciplinary foundations. Moreover, substantial research contributions emerged from the United States (US) (18.27%), China (16.43%), and the United Kingdom (UK) (6.09%). Keyword clustering reveals insufficient theoretical development at the intersection of computer science (11.8%) and social sciences (24.4%), particularly in human-technology interaction within tax administration contexts. This study uniquely establishes a conceptual map that reveals how research has been conducted within disciplinary silos, with limited cross-pollination between technological and

administrative theories. In addition, this fragmentation creates a significant gap that hinders the development of a comprehensive framework. Nonetheless, findings guide future research toward integrated theoretical models that better explain how digital transformation drives tax collection efficiency in customs administration.

Keywords:

System Integration, Customs Administration, Tax Collection Efficiency, Interoperability, Tri-STIF Framework

Introduction

Tax collection efficiency in customs administration is a critical aspect of national revenue systems, as it impacts economic stability and development. Customs administrations are responsible for collecting various taxes and duties on imported and exported goods, which constitute a significant portion of national income. Notably, efficient tax collection ensures that governments have the necessary funds to provide public services and invest in infrastructure, while also maintaining fair trade practices and protecting domestic industries. This introduction examines the importance of tax collection efficiency in customs administration, the challenges it faces, and the strategies employed to improve it.

Customs administrations worldwide face numerous challenges in achieving efficient tax collection. These challenges include complex regulatory environments, high administrative costs, and the need for coordination between various government agencies. For instance, the Malaysian Customs Department has been collecting less indirect tax revenue compared to the costs incurred, indicating inefficiencies in the system (Mansor et al., 2005). Similarly, in Russia, the complexity of customs procedures and the extensive documentation required increase business costs and create opportunities for tax evasion (Balandina et al., 2018). In essence, these inefficiencies highlight the need for reforms and modernization in customs administration to streamline processes and reduce administrative burdens.

One key strategy to improve tax collection efficiency in customs administration is the adoption of digital technologies. The digitization of tax and customs administration has demonstrated promising results, enhancing budget efficiency and reducing administrative costs. In Russia, the development of digital information exchange systems between tax and customs authorities has been identified as a crucial step towards improving customs payment administration (Zasko et al., 2021). Consistent with this, in Slovakia, the proposal to electronize the tax administration has been put forward to enhance tax collection efficiency and reduce labor costs (Dobrovic et al., 2016). Together, these examples demonstrate the potential of digital technologies to transform customs administration and enhance tax collection efficiency. Another notable aspect of improving tax collection efficiency is optimizing business processes and implementing best practices. The World Customs Organization (WCO) has been promoting the exchange of experiences and best practices among tax administrations to improve customs revenue collection (Macedo, 2011). In the Baltic countries, efforts to simplify administrative procedures, automate internal processes, and reduce manual work have aimed to increase the efficiency and effectiveness of customs administrations (Macedo, 2011). Additionally, the separation of fiscal and non-fiscal control functions, as well as the redistribution of responsibilities among controlling authorities, have been proposed as measures to improve customs administration in Russia (Balandina et al., 2018). Collectively, these strategies

highlight the importance of continuous improvement and adaptation to changing operational environments in achieving efficient tax collection in customs administration.

Identifying Critical Theoretical and Empirical Gaps

Despite the practical significance and growing body of literature, significant theoretical and empirical gaps remain. First, existing studies tend to focus on individual countries or specific technologies in isolation, lacking a holistic view of how system integration research has evolved globally across disciplines, regions, and time periods. Moreover, this fragmentation prevents scholars and policymakers from understanding the broader intellectual structure and identifying where knowledge production is concentrated versus underexplored.

Second, while numerous case studies document implementation experiences, there is a limited systematic analysis of collaborative networks and knowledge diffusion patterns, particularly the extent to which developed nations dominate discourse. At the same time, emerging economies remain peripheral contributors despite facing acute challenges in mobilizing revenue. Third, the relationship between major digital transformation milestones (e.g., the rise of e-government in the 2000s, the emergence of big data analytics after 2010, and pandemic-accelerated digitization after 2020) and shifts in research focus has not been empirically documented. This leaves unclear how scholarship responds to technological and policy disruptions. Fourth, prior reviews have not adequately theorized how technical and socio-economic perspectives integrate, or fail to integrate, in system design. While interdisciplinary research is underway, the field lacks middle-range theories that explain how organizational factors (e.g., customs agency capacity, inter-agency coordination) mediate between institutional contexts and individual compliance outcomes.

Finally, prior reviews have not employed rigorous bibliometric methodologies combining multiple analytical layers (temporal trends, disciplinary distribution, citation analysis, keyword co-occurrence, and international collaboration networks) to provide a comprehensive knowledge map. This study addresses these gaps by moving beyond descriptive publication counts to explicitly connect thematic, methodological, and geopolitical fragmentation patterns, thereby revealing systemic disconnections that prior bibliometric analyses have not adequately captured. Therefore, addressing these gaps is essential to guide future research into underexplored areas, foster equitable international collaboration, and ensure that scholarly inquiry aligns with the most pressing challenges in customs modernization.

In summary, the efficiency of tax collection within customs administration is crucial for the economic stability and growth of countries. The difficulties encountered by customs authorities, including complex regulations and high administrative costs, require the adoption of digital technologies and improvements to business processes. Thus, by studying successful practices and continually refining their operations, customs administrations can increase their efficiency and effectiveness in tax collection, thereby supporting national revenue and economic growth. Correspondingly, this study addresses the identified gaps through systematic bibliometric analysis, providing the first comprehensive intellectual map of this critical domain.

Literature Review

The research trend on system integration for tax collection efficiency in customs administration highlights the increasing role of digital technologies and innovative solutions in enhancing the efficiency and effectiveness of tax and customs operations. Studies have indicated that integrating digital technologies, such as Blockchain, Geographic Information Systems (GIS), Big Data, the Internet of Things (IoT), and neural networks, has significantly improved process automation, decision-making, and financial security in customs and tax processes (Odeyemi, O. et al., 2024). These technologies have optimized data collection and budgeting efficiency, although challenges related to technical resources, system interoperability, and data security persist. Nonetheless, implementing these technologies requires institutions to modernize their existing systems and adapt to technological advances to maximize their potential impact (Cardenas-López, 2023).

In Russia, the digitization of tax and customs administration has been a key focus, with efforts to enhance budget efficiency through improved customs payment collection systems. The development of digital information exchange systems between tax and customs authorities has been identified as a key area for modernization (Zasko et al., 2021). In addition, the integration of international standards from organizations such as the WCO and the World Trade Organization into national legislation has also been emphasized to improve the unified mechanisms for customs, tax administration, and currency control (Ryl'skaya et al., 2019). This approach aims to create a more efficient and effective system for managing state revenues by redistributing functions between customs and tax authorities to streamline operations (Ryl'skaya et al., 2019).

In Malaysia, the indirect tax administration system has faced challenges in efficiently collecting revenue, with the amount of uncollected indirect tax revenue on the rise (Dobrovic et al., 2016). The study suggests that improvements in tax administrative arrangements are necessary to enhance the system's efficiency and effectiveness (Mansor et al., 2005). Similarly, in Ecuador, the complexity of the tax system has been observed to impact the efficiency of customs administration, with simpler tax systems leading to better revenue collection and tax effort (Aguirre & Del Villar, 2022). Concurrently, the study highlights the importance of simplifying tax complexity and enhancing the quality and dissemination of national statistical data to improve customs administration efficiency (Aguirre & Del Villar, 2022).

The integration of digital solutions into customs administration has also been explored in the context of the National Tax and Customs Administration (NAV) in Hungary. The digitization efforts have led to increased efficiency in official audits, making it easier to compare data from tax authorities and taxpayers (Vozár & Bán, 2024). At the same time, the introduction of digital solutions has had a positive overall impact, with interactions between NAV and taxpayers shifting towards more efficient and smoother administration (Vozár & Bán, 2024). Essentially, the study highlights the potential of digital technologies to transform customs operations, improve compliance, and enhance sustainability practices (Shubailat et al., 2024).

The research trend on system integration to enhance tax collection efficiency in customs administration underscores the crucial role of digital technologies and innovative solutions in modernizing tax and customs processes. Notably, key strategies for improving efficiency and effectiveness include aligning with international standards, simplifying tax systems, and embracing digital solutions. Nevertheless, challenges such as the availability of technical

resources, system interoperability, and data security must be addressed to harness the benefits of these technologies fully. Thus, ongoing initiatives to modernize and integrate tax and customs systems are crucial for optimizing state revenue administration and improving customs efficiency.

Research Question

RQ1: What are the trends in System Integration for Tax Collection Efficiency in Customs Administration according to the year of publication?

RQ2: What are the popular subjects related to the study, and what percentage does each subject represent?

RQ3: What are the most cited articles?

RQ4: Where are the top 10 countries based on the number of publications?

RQ5: What are the popular keywords related to the study?

RQ6: What is the co-authorship by countries' collaboration?

Methodology

Bibliometrics comprises the collection, organization, and quantitative analysis of bibliographic records from scholarly publications (Verbeek et al., 2002; Alves et al., 2021; Assyakur & Rosa, 2022). Beyond descriptive indicators, such as outlet identification, publication years, and leading authors (Verbeek et al., 2002), it also employs advanced techniques, including document co-citation analysis. A rigorous literature review proceeds iteratively: refining keywords, systematically searching the literature, and conducting in-depth analysis to assemble a comprehensive corpus and yield reliable findings (Fahimnia et al., 2015). Following this rationale, the study emphasizes high-impact publications that offer substantive insight into the field's theoretical foundations. Moreover, to ensure data integrity, Scopus was utilized as the primary database (Di Stefano et al., 2010; Khiste & Paithankar, 2017; Al-Khoury et al., 2022). For quality control, only peer-reviewed journal articles were included, with books and lecture notes excluded (Gu et al., 2019). Using Elsevier's Scopus, records from 1981 through August 2025 were gathered for subsequent analysis.

The raw Scopus export (CSV) was cleaned and harmonized in OpenRefine through a five-step pipeline: (1) schema inspection to verify core fields (authors, title, year, journal, abstract, keywords, affiliations, Digital Object Identifier (DOI)); (2) text normalization (trimming whitespace, fixing Unicode/HTML, lowercasing keywords, canonicalizing DOIs); (3) deduplication using exact DOI matches and, where absent, an approximate key (normalized title + year + first author) with iterative Cluster and edit (fingerprint/gram-based and nearest-neighbor methods); (4) controlled-vocabulary mapping to consolidate synonyms in keywords (e.g., NSW/ASW → "single window"; "risk based" → "risk-based targeting") and standardization of author, journal, institution, and country names; and (5) quality checks logging Key Performance Indicator (KPI) metrics (missing DOIs, duplicate rates pre/post, unique keyword counts) prior to exporting an analysis-ready UTF-8 CSV (semicolon-delimited keyword fields). The OpenRefine operations JSON and a project archive accompany the cleaned dataset to ensure full reproducibility. The resulting file is directly compatible with Bibliometrix/Biblioshiny (R), VOSviewer, and CiteSpace.

Data Search Strategy

In conducting this bibliometric study, the Scopus database was selected as the primary source due to its extensive coverage of peer-reviewed journals, conference proceedings, and academic

publications across disciplines. Simultaneously, a structured data searching strategy was applied using the search string [TITLE-ABS-KEY ("system" AND "tax collection") AND (LIMIT-TO (LANGUAGE, "English"))]. This approach ensured that only documents containing both "system" and "tax collection" in their titles, abstracts, or keywords were retrieved, thereby capturing literature directly relevant to the intersection of technological or systemic approaches in improving tax collection practices. Additionally, restricting the language to English was an intentional decision to standardize analysis and facilitate consistent interpretation of results, as English remains the dominant language in scholarly communication. The database was accessed in August 2025, which provides a clear temporal reference point.

The search yielded a final dataset of 706 documents, representing a substantial body of work that highlights global research attention to the role of systems in tax collection efficiency. This dataset serves as the foundation for further bibliometric analysis, including trends in publication over time, leading authors, source journals, geographical distribution, and thematic clusters. Notably, by focusing on this specific query, the study ensures a comprehensive yet targeted mapping of knowledge that aligns closely with the research objective of understanding how system integration supports effective tax administration. The size of the dataset also suggests sufficient breadth to identify research patterns, collaborations, and future directions while maintaining analytical precision.

Table 1: The Search String

Scopus	TITLE-ABS-KEY ("system" AND "tax collection") AND (LIMIT-TO (LANGUAGE , "English"))
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Table 2: The Selection Criterion

Criterion	Inclusion	Exclusion
Language	English	Non-English
Publication Stage	Final	In Press

Data Analysis

VOSviewer, developed by Nees Jan van Eck and Ludo Waltman at Leiden University, Netherlands, is a widely recognized bibliometric software designed for visualizing and analyzing scientific literature (Clague et al., 1996; Veeramootoo et al., 2018). Known for its intuitive interface, the tool is particularly effective in generating network visualizations, clustering related items, and creating density maps. Furthermore, it supports the exploration of co-authorship, co-citation, and keyword co-occurrence networks, offering researchers a holistic view of research landscapes. With its continuous updates and adaptability, VOSviewer enables the computation of metrics, customization of visual outputs, and seamless compatibility with multiple bibliometric data sources, making it a highly valuable tool for academic inquiry.

A key strength of VOSviewer is its ability to translate complex bibliometric data into clear, meaningful visualizations, such as maps and charts. In particular, the software emphasizes network visualization by clustering related items, examining keyword co-occurrence patterns, and generating density representations. Its user-friendly design makes it accessible to both

beginners and advanced users, ensuring effective exploration of large datasets. For this study, datasets in PlainText format, including publication year, title, author, journal, citation, and keywords, were retrieved from the Scopus database covering 1981 to 2025, and analyzed using VOSviewer version 1.6.20. Thus, by employing clustering and mapping techniques, VOSviewer offers an alternative to the Multidimensional Scaling (MDS) method, situating items in low-dimensional spaces to accurately reflect their degree of relatedness (Veeramootoo et al., 2018). Unlike MDS, which often applies similarity measures such as the cosine and Jaccard indices, VOS adopts the Association Strength (AS_{ij}) approach, which is calculated as the ratio of the observed co-occurrence of items i and j to the expected co-occurrence under statistical independence (Paula et al., 2017). Essentially, this normalization technique makes VOSviewer particularly well-suited for co-occurrence analysis, while maintaining conceptual links to the MDS framework by Roberts (2010):

$$AS_{ij} = \frac{C_{ij}}{w_i w_j}.$$

Findings

What are the trends in System Integration for Tax Collection Efficiency in Customs Administration according to the year of publication?

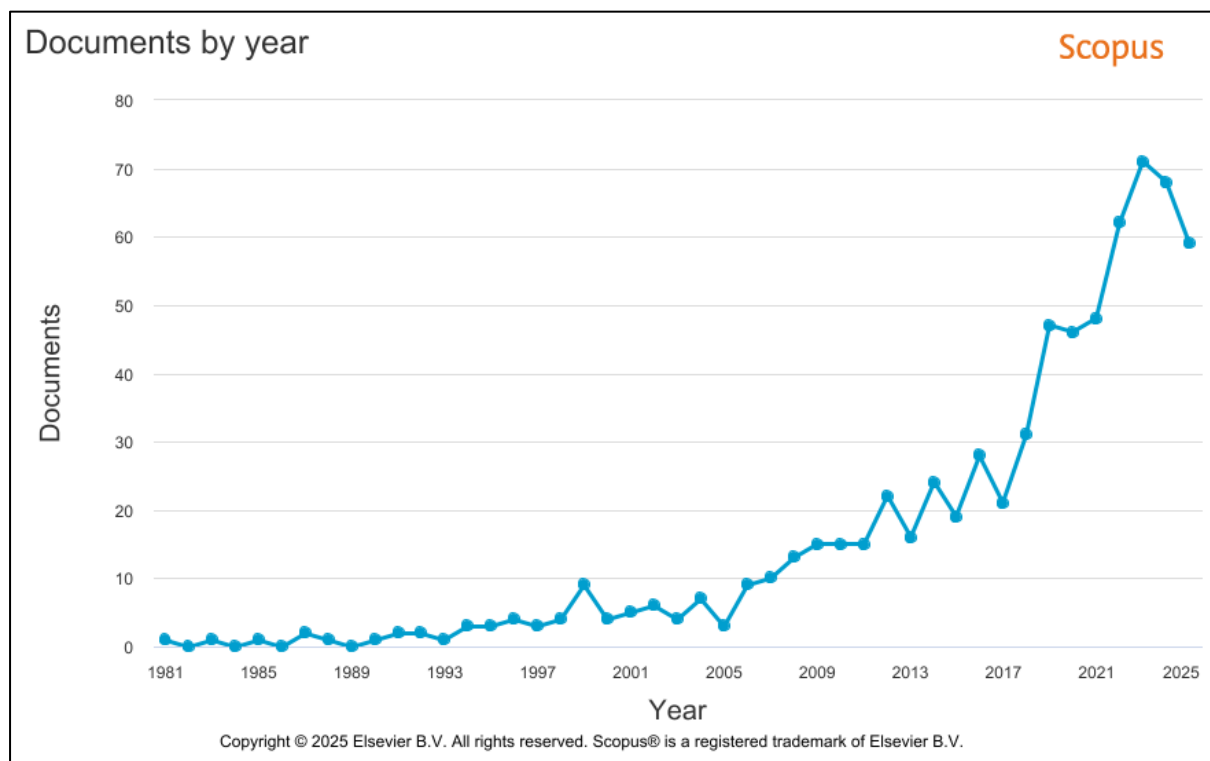


Figure 1: Trend of Research in System Integration for Tax Collection Efficiency in Customs Administration

The publication trend from 1981 to 2025 indicates a gradual yet steady increase in scholarly interest toward system integration and tax collection efficiency within customs administration. However, between 1981 and the early 2000s, the number of publications remained very low, rarely exceeding five per year, reflecting the limited adoption of digital systems in tax and customs operations during that period. Meanwhile, the modest increase starting in the mid-2000s coincides with the global expansion of e-government initiatives, the introduction of electronic tax systems, and international trade facilitation measures. From 2010 onwards, publications began to rise more consistently, particularly from 2015, when discussions around digital transformation, big data, and integrated systems in public administration became prominent. In other words, this progression highlights how technological advancements and policy reforms gradually brought system integration into the spotlight of academic and policy research.

The sharp increase from 2018 onward, peaking between 2023 and 2024 with more than 70 publications, can be attributed to global shifts in tax administration practices driven by rapid digitization, the COVID-19 pandemic, and the urgent need for governments to secure revenue through more efficient collection systems. The pandemic accelerated the adoption of digital platforms, compelling customs and tax agencies to integrate technology to maintain continuity, ensure compliance, and improve efficiency. Furthermore, international bodies such as the WCO and the Organization for Economic Co-operation and Development (OECD) have promoted modernization strategies, shaping both policy and academic research agendas. In comparison, the slight decline observed in 2025 (59 publications, though still high) may suggest either a stabilization of research interest after the pandemic-driven surge or delays in indexing for the current year. Overall, the trend reflects the increasing recognition of system integration as a critical enabler for effective tax collection in a digital economy.

What Are the Popular Subjects Related to The Study, And What Percentage for Each Subject?

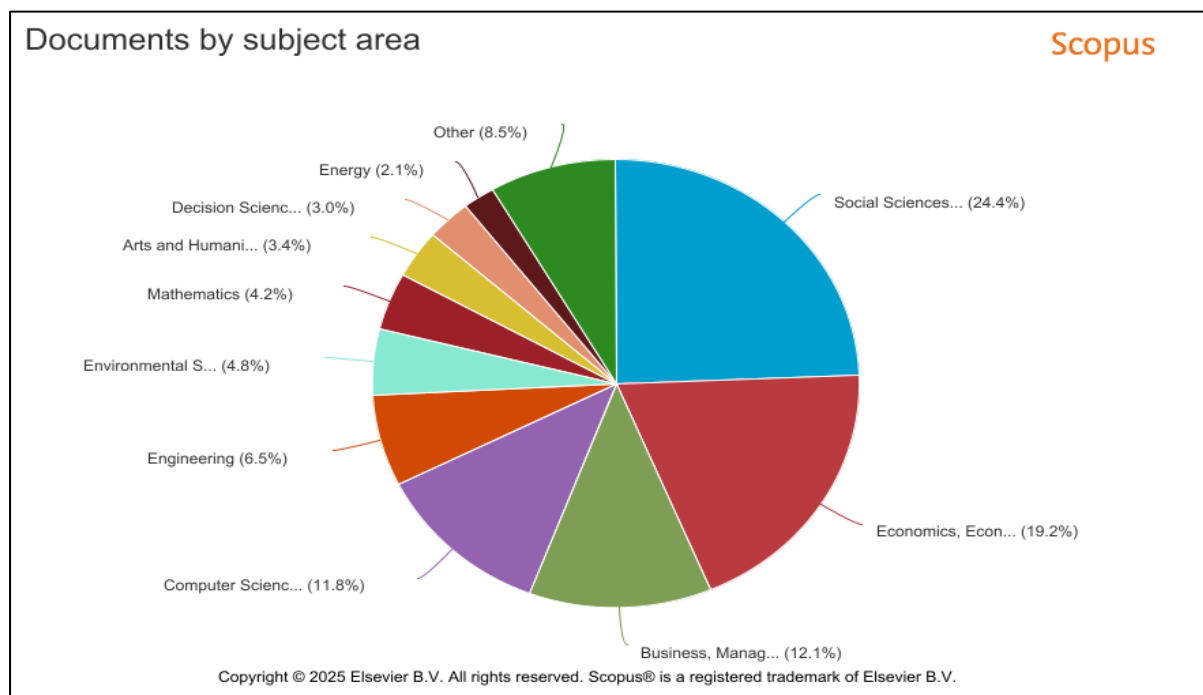


Figure 2: The Most Popular Subjects Related to The Study

Table 3: The Most Popular Subjects Related to The Study

Subject Area	No of Publications	Percentage
Social Sciences	306	24.4
Economics, Econometrics and Finance	241	19.2
Business, Management and Accounting	152	12.1
Computer Science	148	11.8
Engineering	82	6.5
Environmental Science	60	4.8
Mathematics	52	4.2
Arts and Humanities	43	3.4
Decision Sciences	37	3
Energy	26	2.1
Others	106	8.5

The distribution of subject areas reveals that Social Sciences (24.4%), Economics, Econometrics and Finance (19.2%), and Business, Management and Accounting (12.1%) dominate research on system integration for tax collection efficiency in customs administration. This is expected, as issues related to tax systems, governance, and administrative reforms are inherently linked to social, economic, and business perspectives. Specifically, these fields focus on the policy implications, compliance behavior, organizational practices, and institutional reforms required to enhance tax efficiency. In addition, the prominence of Economics and Finance reflects the critical role of tax systems in generating government revenue, while the Social Sciences encompass studies on governance, regulation, and public trust. Similarly, the contribution from Business and Management emphasizes organizational performance, strategic integration, and leadership in implementing digital tax systems.

Meanwhile, Computer Science (11.8%) and Engineering (6.5%) also make notable contributions, underscoring the technological foundation necessary for system integration and digital transformation. The involvement of Computer Science reflects studies in artificial intelligence (AI), blockchain, data analytics, and system architecture applied to customs administration. At the same time, Engineering highlights the design and technical implementation of integration platforms. Other subject areas, such as Environmental Science (4.8%) and Energy (2.1%), appear less dominant yet still relevant, likely due to research on green taxation, carbon trading, and energy-related customs policies. Moreover, the presence of Mathematics (4.2%) and Decision Sciences (3%) underscores the analytical and modeling approaches applied to optimize tax collection processes. Collectively, the spread across multiple disciplines reflects the interdisciplinary nature of tax system integration, requiring collaboration between social scientists, economists, and technologists to address both policy challenges and technological innovations effectively.

*What Are The Most Cited Articles?***Table 3: The Most Cited Articles**

Authors	Title	Year	Source Title	Cited by
Clague et al. (1996)	Property and Contract Rights in Autocracies and Democracies	1996	Journal of Economic Growth	352
Veeramootoo et al. (2018)	What determines success of an e-government service? Validation of an integrative model of e-filing continuance usage	2018	Government Information Quarterly	325
Roberts (2010)	The Logic of Discipline: Global Capitalism and the Architecture of Government	2010		199
Paula et al. (2017)	Deep learning anomaly detection as support fraud investigation in Brazilian exports and anti-money laundering	2017		130
Tang et al. (2017)	Tax collector or tax avoider? An investigation of intergovernmental agency conflicts	2017	Accounting Review	122
Aizenman and Morion (2004)	International reserve holdings with sovereign risk and costly tax collection	2004	Economic Journal	116
Agostini and Palmucci (2008)	The anticipated capitalisation effect of a new metro line on housing prices	2008	Fiscal Studies	114
Fjeldstad and Semboja (2001)	Why people pay taxes: The case of the development levy in Tanzania	2001	World Development	108
Fjeldstad (2001)	Taxation, coercion and donors: Local government tax	2001	Journal of Modern African Studies	97

	enforcement in Tanzania			
Ajaz and Ahmad (2010)	The effect of corruption and governance on tax revenues	2010	Pakistan Development Review	83

Where Are The Top 10 Countries Based On The Number Of Publications?

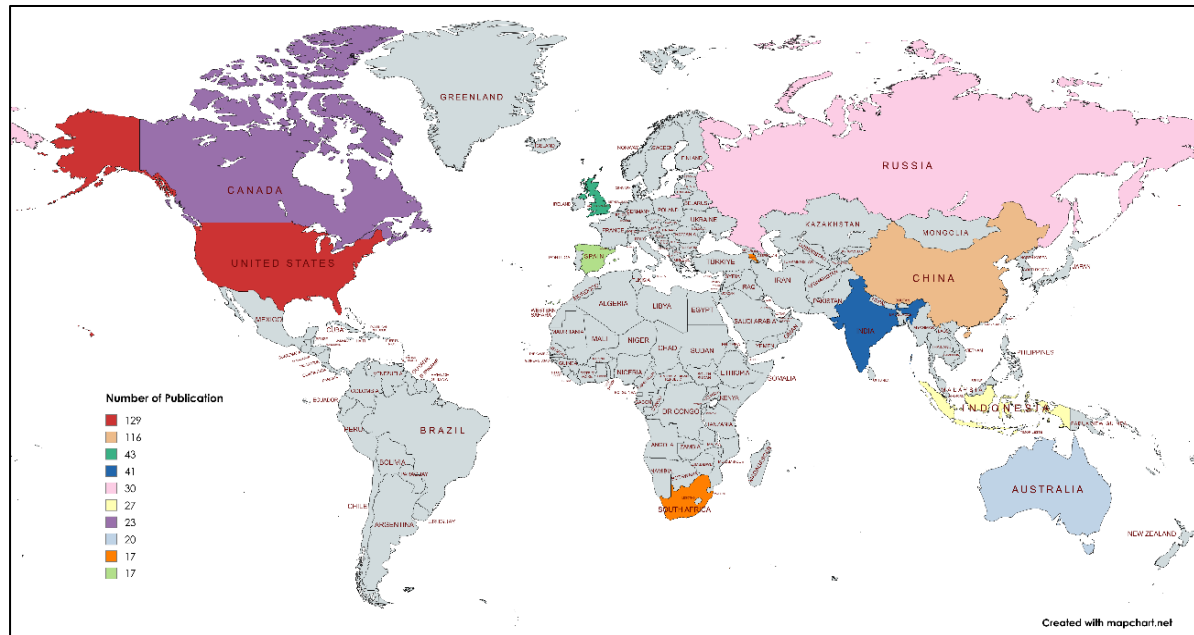


Figure 3: Top Countries Based on The Number of Publications

The analysis of publication output by country reveals that the United States (US) (18.27%) and China (16.43%) are the leading contributors to research on system integration and tax collection efficiency in customs administration. This dominance can be attributed to their robust academic infrastructure, substantial research funding, and global leadership in digital transformation and e-governance. Notably, the US has a long history of developing advanced tax and customs systems, supported by both government agencies and academic institutions that prioritize innovation in digital administration. Similarly, China's rapid modernization of its tax and customs systems, particularly through large-scale digital initiatives such as the Golden Tax Project and integration with international trade systems, has attracted significant scholarly attention, resulting in a high volume of publications.

The United Kingdom (UK) (6.09%) and India (5.95%) also rank highly, reflecting their active roles in both academic research and policy reforms in taxation and digital governance. The UK's prominence is tied to its leadership in public administration studies and its experience integrating technology into customs and trade systems. Conversely, India's growth stems from its push toward digital governance and tax modernization, especially since the introduction of the Goods and Services Tax (GST). Following this, contributions from the Russian Federation (4.25%), Indonesia (3.82%), and other emerging economies, such as South Africa and Spain, reflect an increasing regional interest in strengthening customs administrations to boost revenue collection and trade efficiency. Concurrently, these results demonstrate that while

developed countries lead in knowledge production, emerging economies are actively engaging in this research area to address revenue mobilization challenges and align with international standards, making the field both globally relevant and regionally diverse.

What Are The Popular Keywords Related To The Study?

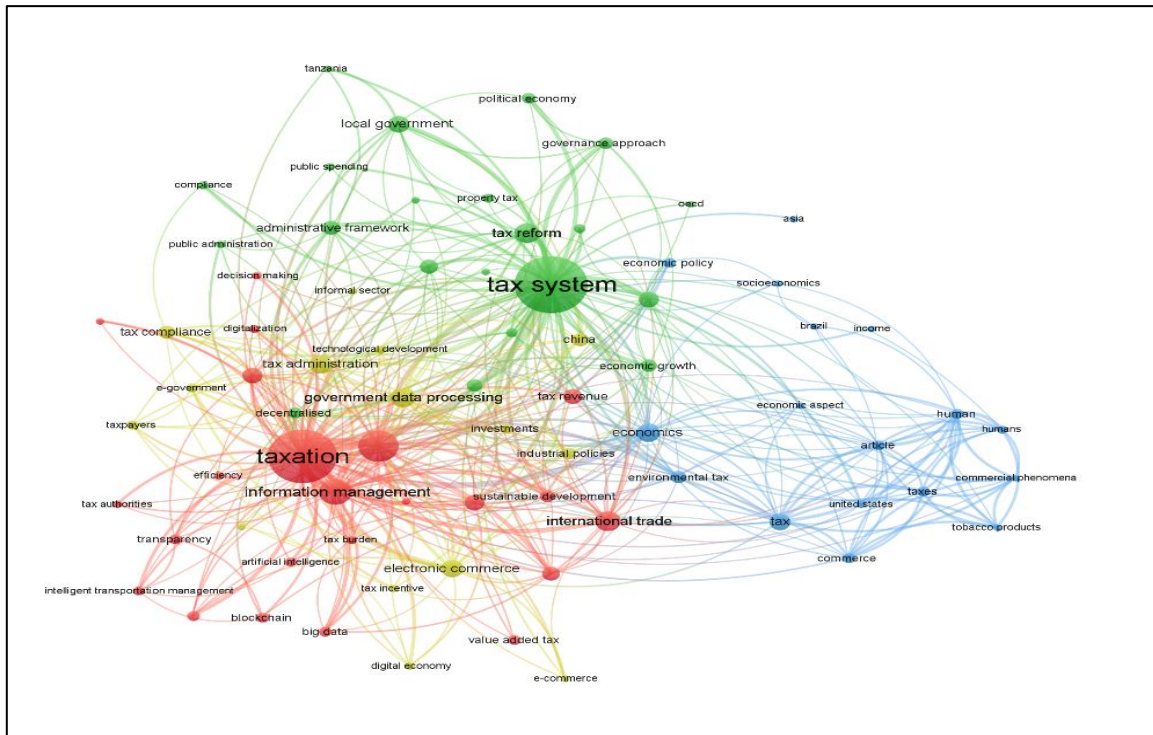


Figure 4: Network Visualization Map of Keywords' Co-Occurrence

Co-occurrence analysis of author keywords in VOSviewer is a bibliometric technique used to identify and visualize relationships among frequently used keywords within a dataset. It helps uncover thematic structures and research trends by analyzing how frequently specific keywords co-occur across publications. In this study, the co-occurrence map provides insight into the intellectual structure of research on system integration and tax collection efficiency, indicating which concepts are most frequently studied together and how they form clusters of related themes. Thus, by focusing on author keywords, the analysis highlights the research directions prioritized by scholars and the connections among taxation, governance, and digital systems.

In line with this, the settings applied to generate the visualization employed the full-counting method, where each co-occurrence of a keyword pair is counted equally, regardless of its frequency within a single document. Specifically, a minimum threshold of 10 occurrences was set, reducing the total pool from 2,193 keywords to 76, ensuring that only the most relevant and frequently used terms were included in the analysis. Furthermore, the minimum cluster size was set to 1, allowing for smaller yet meaningful themes to be retained, which ultimately resulted in four distinct clusters. Consequently, these methodological settings strike a balance between inclusivity and focus, ensuring that the analysis captures both dominant and emerging research themes without diluting the findings with overly fragmented or rare keywords.

The findings make significant contributions to the body of knowledge by revealing the thematic focus and intellectual landscape of this research domain. For example, the prominence of keywords such as “tax system” (172 occurrences), “taxation” (160), and “tax collection” (79) reflects the central research agenda on modernizing tax administration and improving efficiency. Meanwhile, clusters involving terms such as “information management,” “government data processing,” and “electronic commerce” indicate the growing role of digitalization and technology in shaping tax systems. At the same time, other areas, such as “tax reform,” “fiscal policy,” “tax compliance,” and “sustainable development,” demonstrate how system integration is studied within broader governance and economic contexts. In addition, the presence of country-specific terms, such as “China,” and thematic areas, such as “developing countries,” highlights the global diversity of research, addressing both advanced and emerging economies. Together, these patterns provide valuable insight into the evolving intersections of taxation, governance, and technology, guiding future studies and policymaking in the field.

What Is The Co-Authorship By Countries' Collaboration?

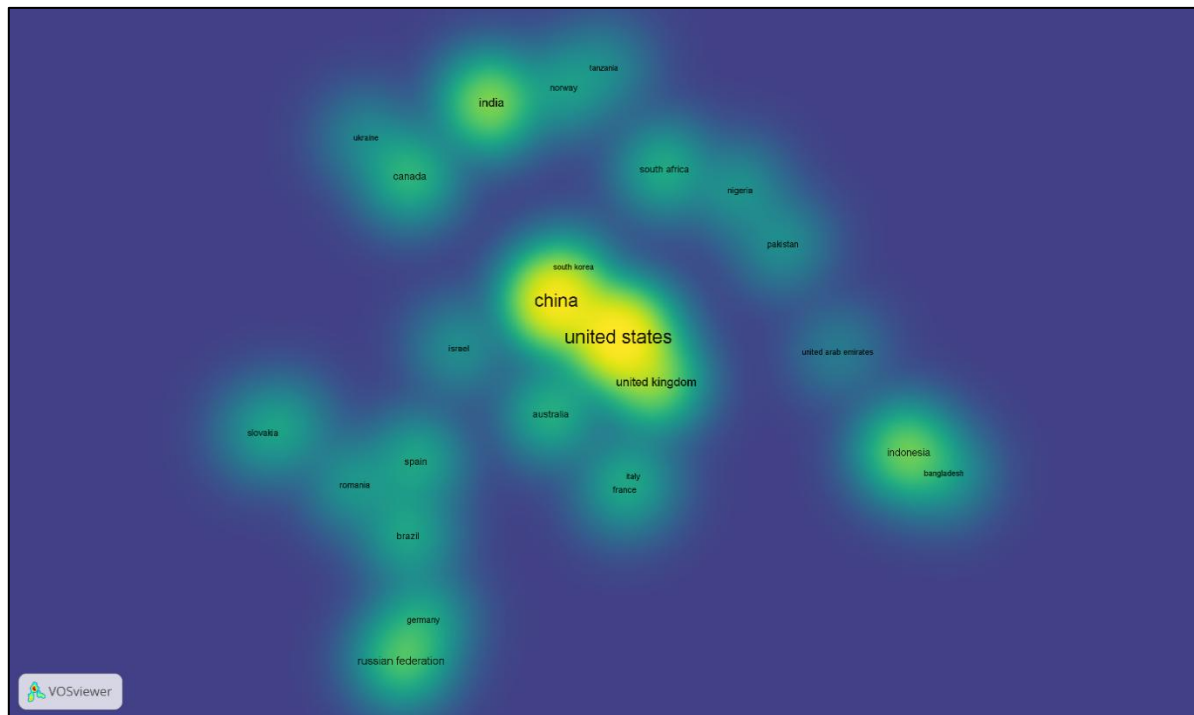


Figure 5: Co-authorship by Countries

Co-authorship by countries' collaboration in VOSviewer is a bibliometric technique that visualizes how researchers from different nations work together on academic publications. This analysis identifies the strength and frequency of international research partnerships by linking countries based on co-authored papers. In essence, the larger the number of documents and citations associated with a country, and the stronger its link strength, the more central it is in global research collaboration. Such mapping highlights knowledge networks, influential contributors, and the degree of internationalization in a given research field. In the context of tax collection efficiency and system integration, co-authorship analysis reveals which countries

are driving research and how cross-border collaborations foster knowledge exchange and innovation.

For this study, the co-authorship network was generated using the full-counting method, in which each collaborative paper is counted equally across countries regardless of the number of co-authors involved. A minimum threshold of 5 publications per country was applied, reducing the dataset from 91 countries to 36, thereby focusing only on those with substantial research activity. In contrast, the minimum cluster size was set to 1, which allowed even smaller yet significant collaborative groups to be included in the visualization. Based on these parameters, the analysis yielded seven clusters, each representing a group of countries with stronger internal research ties. This approach ensured a balanced visualization of both leading research nations and emerging contributors, highlighting the structure of global research on taxation and system integration.

The findings make notable contributions to understanding the global distribution of knowledge production in this field. Accordingly, the US (132 documents, 2,401 citations, TLS = 35) and China (116 documents, 860 citations, TLS = 22) stand out as leading contributors, in volume and in international collaboration. This reflects their central role in shaping research agendas. In comparison, the UK, Canada, Australia, and South Africa also demonstrate strong collaboration networks, as demonstrated by their relatively high total link strength values, underscoring their integration into global knowledge exchange. Meanwhile, emerging economies such as India, Indonesia, and Malaysia are contributing significantly to publication volume but display lower link strength. This suggests less extensive global collaboration and greater focus on national or regional studies. Overall, these results reveal that research on system integration and tax efficiency is increasingly internationalized. However, disparities in collaboration intensity persist, with developed countries acting as global hubs and developing nations gradually expanding their roles in cross-border partnerships.

Discussion

This study set out to map the intellectual landscape of research on system integration for tax collection efficiency in customs administration through six research questions. Correspondingly, the findings reveal vital patterns that both confirm and extend prior understanding while highlighting novel insights specific to this domain.

Publication Trends and the Digital Transformation Imperative (RQ1)

The sharp rise in publications from 2018 onward has surpassed 70 annually by 2023 and 2024. This trend reflects a global acceleration in research on digital governance. It aligns with the growing urgency around customs modernization, driven by WCO initiatives, trade facilitation agreements, and the COVID-19 pandemic. Unlike the gradual growth observed in general Information and Communication Technology (ICT) adoption, customs-related digital integration displays a punctuated trajectory. This supports models of crisis-driven institutional adoption, especially in revenue-critical sectors where disruptions impose immediate fiscal consequences. Building on this, scholars have noted how COVID-19 and international policy pressures have catalyzed system-level digitization in the tax administrations of developing countries. The modest uptick beginning in the mid-2000s coincides with the global expansion of e-government. Following this, the post-2015 surge reflects increased research interest in big data, system interoperability, and cross-agency digital transformation. Although a slight drop in publications is noted in 2025, it remains unclear whether this signals saturation or a

temporary indexing delay.

Interdisciplinary Convergence and Theoretical Fragmentation (RQ2)

The dominance of Social Sciences (24.4%), Economics (19.2%), and Business/Management (12.1%) confirms that tax collection efficiency is fundamentally a governance and policy challenge. In contrast, the substantial presence of Computer Science (11.8%) and Engineering (6.5%) reveals a critical theoretical gap. While interdisciplinary collaboration is occurring, prior literature reviews have not adequately theorized how technical and socio-economic perspectives integrate, or fail to integrate, in system design. At the same time, our contribution is demonstrating that scholarly discourse remains siloed: social scientists emphasize compliance behavior and institutional reform. Technologists focus on architecture and algorithms, but few studies bridge these perspectives to examine, for example, how technical design choices (e.g., interoperability standards) shape compliance outcomes or how governance structures enable or constrain technology adoption. This finding extends observations by e-governance scholars who noted similar disciplinary divides in digital government research. However, it adds the insight that in tax/customs domains, the cost of fragmentation is higher since system failures directly impact revenue collection and economic stability. In line with this, the presence of Environmental Science (4.8%) and Energy (2.1%) is theoretically intriguing, suggesting emergent linkages between customs administration and green taxation/carbon border adjustments, a frontier barely explored in prior bibliometric studies and deserving of dedicated research attention. Moreover, the contributions from Mathematics (4.2%) and Decision Sciences (3%) underscore the analytical and modeling approaches applied to optimize tax collection processes, yet these remain disconnected from implementation research in public administration.

Citation Patterns and Theoretical Foundations (RQ3)

The field's theoretical underpinnings remain rooted in macro-institutional and political economy perspectives, exemplified by foundational works such as Roberts' exploration of global capitalism and state architecture (Roberts, 2010). In parallel, recent research highlights a growing emphasis on technological integration within tax systems, particularly through AI and blockchain technologies. For example, AI and blockchain are increasingly theorized as transformative tools for tax compliance and fraud detection. Studies indicate that these technologies enhance transparency, automate auditing, and support real-time compliance monitoring (Akintobi et al., 2023; Adelekan et al., 2024; Olabanji et al., 2024). Additionally, this computational turn represents a shift from traditional behavioral models of taxpayer compliance to systemic design approaches that blend AI-driven risk assessment with secure digital infrastructure. Nevertheless, the implementation gap remains: studies emphasize the need to align technical innovations with regulatory readiness and institutional capacity (Wang, 2024; Mamman et al., 2025). On the other hand, while governance issues such as corruption, coercion, and state legitimacy were historically central to taxation discourse in developing contexts, contemporary literature increasingly analyzes these dynamics through a digital lens. For instance, digital technologies are viewed as tools for enforcement and mechanisms for building trust in state institutions and reducing opportunities for rent-seeking behavior (Belahouaoui & Attak, 2024). This dual emphasis on institutional theory and digital innovation underscores the need for meso-level integration: how organizational and technological capacities mediate between macro-level structures and micro-level compliance behavior. Nonetheless, few studies examine how specific system architectures (e.g., blockchain-based ledgers, AI-driven compliance scoring) interact with bureaucratic performance or taxpayer

trust. Therefore, bridging these levels remains a central theoretical and empirical challenge.

Geographic Asymmetries in Knowledge Production (RQ4)

Global knowledge production in customs and tax modernization exhibits striking geographic imbalances. Correspondingly, US (18.27%) and Chinese (16.43%) dominance in publication output reflects research capacity and geopolitical imperatives. Both nations treat customs modernization as strategically vital, the US for trade enforcement and sanctions, and China for Belt and Road integration. This aligns with studies suggesting that major economies prioritize customs reform as a lever of global competitiveness and enforcement capacity (Krutikov et al., 2021). This finding extends prior observations about Global North research hegemony by suggesting that emerging economies (India 5.95%, Indonesia 3.82%) are gaining traction, likely driven by domestic reform urgency (India's GST rollout, Indonesia's trade facilitation needs). In particular, the theoretical gap is that most high-impact publications emerge from contexts with advanced digital infrastructure and strong institutional capacity, potentially limiting the relevance of their findings to resource-constrained settings. Our analysis reveals this asymmetry more systematically than prior reviews, highlighting the need for context-sensitive theorization that accounts for varying levels of institutional maturity, technological readiness, and fiscal pressure. Furthermore, the concentration of citations in US/UK/China publications suggests knowledge flows remain unidirectional, with limited incorporation of Southern perspectives. This pattern perpetuates epistemological imbalances in understanding tax modernization challenges.

The UK's prominence (6.09%) is tied to its leadership in public administration studies and its experience in integrating technology into customs and trade systems. Contributions from the Russian Federation (4.25%), Spain, and South Africa reflect increasing regional interest in strengthening customs administration to boost revenue collection and trade efficiency. Nevertheless, these remain peripheral to mainstream discourse dominated by Anglo-American and Chinese scholarship.

Thematic Clusters and Research Frontiers (RQ5)

Keyword co-occurrence analysis reveals four distinct clusters that reflect underlying research paradigms: Cluster 1 (tax systems and reform) reflects an economic-administrative paradigm; Cluster 2 (digitalization and information management) reflects a digital-technological paradigm; Cluster 3 (compliance and governance) reflects a behavioral-compliance paradigm; and Cluster 4 (development and sustainability) reflects a sustainability-governance paradigm. This clustering validates the interdisciplinary nature of the field but also exposes theoretical siloes: terms such as "blockchain," "artificial intelligence," and "big data" cluster separately from "tax compliance" and "governance," suggesting technological and behavioral research streams progress in parallel rather than synthetically. Our theoretical contribution is to identify this disconnect as a key frontier: future research must theorize how specific technological affordances (e.g., blockchain's immutability, AI's pattern recognition) interact with behavioral and institutional dynamics to produce (or hinder) collection efficiency. Although prior bibliometric reviews have noted similar technology-governance gaps in the broader e-government literature, our analysis specifically highlights this problem in the high-stakes domain of revenue administration, where it has direct fiscal consequences.

The prominence of keywords such as "tax system" (172 occurrences), "taxation" (160), and "tax collection" (79) reflects the central research agenda around the modernization of tax administration and efficiency. Clusters involving terms such as "information management," "government data processing," and "electronic commerce" indicate the growing role of digitalization and technology in shaping tax systems. In comparison, other terms such as "tax reform," "fiscal policy," "tax compliance," and "sustainable development" illustrate how system integration is studied within broader governance and economic contexts. Specifically, the presence of "China" as a highly occurring keyword (reflecting case-study concentration) alongside generic terms such as "developing countries" reveals an epistemic imbalance, highlighting the dominance of specific contexts, particularly China and major economies, in shaping global understanding of tax modernization. This dominance may limit the generalizability of findings across institutional contexts, highlighting a gap in comparative theory. However, current frameworks do not adequately explain why certain integration approaches succeed in some situations while failing in others, particularly beyond basic cultural or economic factors. This presents a significant opportunity for future research to develop middle-range theories that account for institutional, technical, and socio-political contextual factors.

Collaboration Networks and Knowledge Diffusion (RQ6)

Building on RQ5's identification of thematic siloes, this analysis examines how limited international collaboration may reinforce these disciplinary and methodological fragmentations. Although co-authorship analysis reveals the US and China as central nodes (TLS = 35 and 22, respectively), it has relatively limited cross-collaboration between them, likely reflecting geopolitical tensions. The UK, Canada, and Australia form a tighter Anglo cluster, while India, Indonesia, and Malaysia exhibit lower link strength despite decent publication volumes, indicating regional rather than global collaboration patterns. This pattern illustrates a modular rather than scale-free collaboration structure, which limits knowledge spillovers across geopolitical clusters, as predicted by network theory and models of knowledge diffusion. This finding contributes to the theory by demonstrating that knowledge diffusion in tax/customs research follows geopolitical and linguistic lines more closely than in other technical domains (e.g., biomedical research, which has stronger global networks). Notably, the implication is that best practices in system integration may not transfer efficiently across regions, and international organizations (such as the WCO, IMF, and OECD) play crucial intermediary roles in knowledge brokering, roles that are undertheorized in the current literature.

The 'South-South collaboration gap' represents a critical development research agenda. The absence of South-South collaboration mechanisms means countries facing similar challenges (e.g., Indonesia, Nigeria, Mexico, Malaysia) rarely co-author, missing opportunities for peer learning among comparable contexts. Our bibliometric evidence makes this pattern visible and actionable for policy intervention. The relatively high total link strength values for the UK, Canada, Australia, and South Africa underscore their integration into global knowledge exchange. At the same time, emerging economies exhibit significant publication volume but lower collaborative intensity, suggesting opportunities to strengthen international research partnerships. Moreover, platforms such as the WCO are identified as critical intermediaries that could foster better knowledge integration and exchange among developing nations (Peteva, 2020). Despite this, these roles remain largely undertheorized in academic literature.

Synthesis: Toward Integrative Theories of Tax System Modernization

Collectively, these RQ1 to RQ6 reveal a field that is interdisciplinary, growing, yet still fragmented across methodological and geographic lines. Although the pandemic and trade reform generated urgency, long-term system integration depends on bridging three levels through the Tri-Level Socio-Technical Integration Framework (Tri-STIF) :

- Macro-level: Political regimes, legal frameworks
- Meso-level: Organizational capacity, inter-agency coordination
- Micro-level: Taxpayer behavior, user adoption

As our analysis reveals, the current literature remains fragmented across these levels. This study's primary theoretical contribution is to systematically document this fragmentation and identify where synthesis is most needed. For example, future research should develop middle-range theories that explain how inter-agency coordination mechanisms (organizational level) enable or constrain technology adoption (technical level) under varying institutional constraints (macro level), integrating across levels that are rarely examined in existing studies.

The findings also reveal that while digital transformation has accelerated research attention, implementation challenges persist. Although the pandemic catalyzed urgency, sustainable modernization requires addressing the organizational, institutional, and capacity constraints that our analysis indicates remain undertheorized. In addition, the geographic concentration of high-impact research in advanced economies, combined with limited South-South collaboration, suggests that knowledge production does not adequately reflect the diversity of implementation contexts where system integration is most urgently needed.

Limitations and Future Research

This study's limitations include reliance on a single database and English-language publications, which may omit relevant theoretical developments in other languages or databases. Thus, future research should expand database coverage and consider multilingual sources to capture a broader range of theoretical perspectives. Additionally, the bibliometric approach provides insights into publication patterns, though it cannot assess the quality or theoretical rigor of individual contributions. Therefore, future studies should combine bibliometric mapping with systematic theoretical reviews to provide deeper insights into the needs of theoretical development.

Conclusion

This bibliometric and science-mapping analysis demonstrates that research on system integration for tax collection efficiency in customs administration has expanded rapidly, particularly since 2018, but remains fragmented across thematic, methodological, and geopolitical dimensions. The purpose of this study was to analyze the research trend on system integration using bibliometric methods to address key research questions concerning publication patterns, subject-area distribution, highly cited works, geographical contributions, keyword co-occurrence, and international collaboration networks. The findings revealed that publication output increased significantly since 2010, with a sharp rise after 2018, reflecting the influence of digital transformation, e-governance, and pandemic-driven modernization. The social sciences, economics, and business were the most dominant subject areas, complemented by contributions from computer science and engineering, which underscore the interdisciplinary nature of this field. Collaboration patterns revealed the US and China as

leading contributors, supported by strong engagement from the UK, India, and other emerging economies. However, the analysis also reveals that research remains fragmented across four distinct paradigms: economic-administrative, digital-technological, behavioral-compliance, and sustainability-governance, which have evolved in parallel rather than in concert, while the dominance of high-capacity jurisdictions reinforces epistemic and geopolitical imbalances.

Our contribution is threefold. First, this study consolidates dispersed research by making the paradigmatic structure of the field explicit, showing how disciplinary and regional silos constrain theoretical integration and policy transfer. Second, it introduces the Tri-Level Socio-Technical Integration Framework (Tri-STIF), which explains why similar digital tools and integration initiatives produce divergent outcomes across contexts, and identifies research hotspots, gaps, and future opportunities, thereby supporting scholars and policymakers in developing more efficient tax collection systems. Third, it demonstrates how thematic, methodological, and geopolitical fragmentation limit knowledge diffusion, particularly through limited South-South collaboration and unequal participation in global research networks. For policymakers and customs administrations, the findings underscore that investing in technology alone is insufficient. Effective system integration for tax collection efficiency requires an institutional-technical fit, including coherent legal frameworks, robust governance arrangements, interoperable data standards, sustained ICT support, and user-centered design.

Certain limitations must be acknowledged. Reliance on a single database may omit relevant works indexed elsewhere, and excluding non-English sources limits the range of perspectives included. Future research should integrate multiple databases, consider multilingual studies, pursue theory-driven comparative studies, and prioritize South-South collaboration through capacity building, shared datasets, and inter-regional learning to overcome fragmentation. This bibliometric analysis highlights the importance of system integration as a crucial enabler of tax collection efficiency in customs administration, laying a coherent foundation for the next generation of research and reforms aimed at developing more resilient, equitable, and efficient customs tax systems.

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