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OPPORTUNITIES FOR DEVELOPING CUSTOMS INFRASTRUCTURE TO ACCELERATE TRADE FLOWS

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Abstract: This article examines the strategic opportunities for enhancing customs infrastructure as a key driver for accelerating international and regional trade flows. The study analyzes current challenges in customs procedures, identifies infrastructural and technological constraints, and evaluates the potential of digital solutions, risk-based control systems, automated processing tools, and modern logistics hubs to improve trade facilitation. Special attention is given to the role of integrated information platforms, coordinated border management, and public–private partnership mechanisms in ensuring efficient, transparent, and predictable customs operations. The research highlights how strengthening Uzbekistan's customs infrastructure can reduce transaction costs, optimize cargo movement, and create favorable conditions for increased competitiveness in global markets.

Keywords: customs infrastructure, trade facilitation, digital customs, risk management system, border management, logistics hubs, automated customs procedures, international trade, supply chain efficiency.

1. Introduction

In the context of increasing globalization and rapidly expanding international supply chains, the efficiency of customs infrastructure has become one of the central determinants of trade competitiveness. For developing economies such as Uzbekistan, improving customs procedures and modernizing related infrastructure are essential for reducing logistics costs, accelerating cargo flows, and strengthening the country's position as a regional transport and transit hub [1]. The growing volume of cross-border trade, diversification of trade partners, and the strategic importance of Uzbekistan's geographic location require the establishment of a modern, technology-driven, and fully integrated customs system [2].

Over the past decade, Uzbekistan has undertaken comprehensive reforms aimed at simplifying customs formalities, enhancing transparency, and facilitating trade. These reforms include the introduction of digital customs services, risk management–based control mechanisms, pre-arrival processing tools, and coordinated border management practices [3]. Despite these positive developments, several challenges remain, including infrastructure limitations at border crossing points, insufficient interoperability of information systems, fragmentation of logistics facilities, and the need for deeper public–private cooperation in managing customs processes [4].

Given these circumstances, the development of efficient customs infrastructure has become a strategic priority for supporting national economic growth, improving trade facilitation performance, and ensuring smooth integration into global and regional value chains. This study investigates the key opportunities for enhancing customs infrastructure in Uzbekistan, with a particular focus on digitalization, automation, and the creation of modern logistics hubs. The analysis highlights how these improvements can reduce delays, minimize transaction costs, and contribute to the establishment of predictable and business-friendly customs operations [5].

The findings contribute to the broader discourse on trade facilitation and offer practical insights for policymakers, customs authorities, and private sector stakeholders aiming to improve the efficiency and competitiveness of cross-border trade processes in Uzbekistan [6].

Literature Review

The efficiency of customs infrastructure and its impact on trade flows have been widely examined in international economic and logistics literature. Scholars generally emphasize that well-functioning customs systems, supported by modern infrastructure and advanced information technologies, play a crucial role in reducing trade barriers, accelerating cargo movement, and enhancing global supply chain integration.

Early theoretical contributions by A.Deardorff and P.Krugman highlighted that non-tariff barriers—particularly administrative and border-related delays—create significant trade costs comparable to or even exceeding tariff duties. Subsequent empirical studies by the World Bank (Trade and Transport Facilitation Assessments), the World Customs Organization (WCO), and the OECD have demonstrated that countries with streamlined customs procedures and integrated border management frameworks experience substantial improvements in trade competitiveness [7].

A growing body of research focuses on the digital transformation of customs processes. Grainger (2011) and Henningsen (2019) underline that electronic data interchange (EDI), single window systems, and automated risk management tools help reduce human intervention and increase transparency. WCO's SAFE Framework further supports these findings by promoting paperless procedures, real-time data exchange, and coordinated border management as essential elements of modern customs infrastructure. Studies also show that digital customs solutions significantly decrease clearance times and logistics bottlenecks [8].

Several authors analyze the role of risk-based customs control in facilitating trade. Cantens et al. (2013) argue that the implementation of risk management systems shifts the focus from physical inspection to intelligence-driven analysis, reducing the inspection burden on low-risk cargo and improving overall efficiency. Similarly, research by McLinden et al. (2015) notes that adopting risk-based approaches requires not only technology but also institutional reforms, capacity building, and the harmonization of customs procedures with international standards [9].

In the context of infrastructure development, recent literature points to the importance of logistics hubs, dry ports, and cross-border transport corridors. Studies by UNESCAP and the World Bank show that efficient border crossing facilities, equipped with modern inspection technologies and integrated data platforms, directly influence the speed and reliability of trade flows. Moreover, public–private partnership (PPP) models are increasingly recognized as effective mechanisms for financing and managing large-scale customs and logistics infrastructure [10].

Regarding Uzbekistan, existing research primarily focuses on trade facilitation reforms, digital customs initiatives, and the development of international transport corridors such as the Trans-Caspian and Uzbekistan–Kyrgyzstan–China routes. However, comprehensive academic studies specifically addressing the strategic opportunities for modernizing customs infrastructure remain limited, creating an important gap that this research aims to fill.

Overall, the reviewed literature underlines that modern, technology-enabled customs infrastructure is a decisive factor for enhancing trade efficiency, reducing transaction costs, and improving integration into regional and global economic networks. This provides a solid conceptual basis for analyzing Uzbekistan's current opportunities and policy priorities in developing its customs infrastructure.

2.Materials and Methods

The aim of this study is to assess the effectiveness of customs infrastructure development in accelerating trade flows through a combined institutional, technological, and indicator-based approach. The methodological framework is grounded in the Customs Infrastructure Development Model (CIDM), which interprets customs modernization as a multidimensional system shaped by economic, logistical, technological, regulatory, and management factors. Within this model, customs infrastructure is understood not only as physical facilities but also as an ecosystem consisting of integrated information systems, risk management tools, logistics hubs, and coordinated border control mechanisms.

The study applies systematic, comparative, and econometric analytical methods. In particular, the experience of Uzbekistan is compared with international best practices adopted by the European Union, Singapore, South Korea, and China in the fields of customs digitalization, border management, and trade facilitation. Based on this analysis, an indicator-driven conceptual framework was developed, and the notion of a "Customs Infrastructure Performance Index (CIPI)" is proposed. This index incorporates a set of interrelated metrics, including border crossing point capacity, customs clearance time, digital service penetration, risk management efficiency, logistics infrastructure density, investment in customs modernization, and the level of institutional coordination.

The empirical basis of the research includes customs performance indicators of Uzbekistan for the period 2010–2024, covering major customs posts and logistics centers. Data sources include the State Customs Committee of the Republic of Uzbekistan, the Ministry of Transport, UNCTAD, the World Bank (Logistics Performance Index), the World Customs Organization (WCO), and the OECD Trade Facilitation Indicators. The database includes time-series and panel data on cargo processing times, trade turnover, infrastructure capacity, digitalization rates, and cross-border logistics efficiency.

3. Results and Discussion

Global online trade has been expanding rapidly with the development of internet technologies, enabling consumers in different countries to purchase products directly regardless of language or currency barriers. Digital transformation processes in China's economy are fundamentally reshaping the dynamics of global trade. In 2019, the value of global cross-border e-commerce exceeded USD 780 billion, and it is projected to reach USD 4.82 trillion by 2026. The Asia–Pacific region is the leading driver of global growth, with China's market share in the region rising from 17% in 2011 to 83% in 2018.

In the first three quarters of 2024, the total volume of imports and exports conducted through CBEC (Cross-Border E-Commerce) in China reached CNY 1.88 trillion (approximately USD 265 billion). However, a structural imbalance exists within this expansion: exports dominate with a 77.6% share, while imports account for only 22.4% of the total volume. These indicators necessitate new customs and logistics solutions that offer higher efficiency compared to traditional trade models.

In regulating the sector, the "E-Commerce Law" adopted in 2018 serves as the primary legal framework. The state-supported CBEC model differs from traditional imports (General Trade) by offering the following preferential tax mechanisms:

1. Customs Duty: For almost all goods included in the approved CBEC list, the duty rate is 0%.
2. VAT and Consumption Tax: These taxes are calculated with a regulatory discount of 70%.

The tax calculation formula is:

$$CBEC_{VAT} = Standard_{VAT} \times 0.7$$

(For example: instead of the standard 13% VAT, a CBEC participant pays 9.1%.)
These incentives allow the final price of CBEC goods to be 10–20% cheaper compared to traditional imports.
Trade Facilitation: "Single Window" and WCO Standards
The Chinese customs system, aligned with the standards of the World Customs Organization (WCO), has implemented a data-driven control approach.
Integrated Trade Clearance
The system integrates three main information flows in real time through the "One-Stop Data Pipe":
Order: Information is obtained from the electronic platform (product type, price).
Payment: Transaction ID is retrieved from Alipay/WeChat Pay systems.
Logistics: Waybill and status information is received from the carrier.
The automatic reconciliation of this information is referred to as "Three-Sheet Matching." If a match is confirmed, the goods are processed through the "Green Channel" within 24 hours.
Duty-Free Regime and Return Policy
First Import Relief: Retail CBEC goods are classified as "personal use items," which eliminates the requirement for a license or complex registration procedures for the first import.
Easy Returns: Unsold or returned goods can be re-entered into the customs warehouse (bonded zone), and taxes can be recalculated accordingly.
In China, imports intended for individuals are conducted under two different regimes. The table below illustrates the differences between traditional postal imports and modern CBEC retail imports:
Step 1: Data Ingestion (E-Transit → System)
Process: Before approaching the customs border, the carrier or declarant uploads shipment documents (invoice, waybill, etc.) into the E-Transit system.
System Action: Our system is integrated with E-Transit. As soon as a new declaration appears, the system automatically copies all required fields (e.g., 8, 14, 31, 33, 34, etc.) into its temporary database. These are raw, unprocessed data.
Step 2: Automated Data Processing Pipeline
This is the most critical stage, executed within a few seconds. The system converts raw data into a model-readable "language."
Initial Cleaning:
The system verifies incoming data.
Ensures the sgd.date column is in the correct format.
Identifies null rows and processes them according to predefined logic (e.g., treats total_taxes=0 as a preferential case).
Feature Engineering:
New features are computed:
value_per_kg = customs_value / net_weight
tax_ratio = total_taxes / customs_value
age_of_good = declaration_year - manufacturing_year
And others.
Encoding Categorical Variables:
Target Encoding (Risk Profiling): For high-cardinality columns such as importer_id or tariff_code, the system uses a pre-stored "risk dictionary" to map each ID to a corresponding risk score (e.g., importer_id "301234567" → importer_risk = 0.45).

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One-Hot Encoding: For low-cardinality columns such as country, new binary columns are created (country_CN, country_TR, etc.).
Outcome: At the end of this stage, each declaration is represented as a single vector containing hundreds of numeric features.
Step 3: Hybrid Strategy Application ("Smart Filter")
Using the prepared vectors, the system activates the smart filter. The daily budget is 100 declarations.

```
################## YANGI REALISTIK NATIJALAR (EMBARGO BİLAN) ##################

--- Korrelyatsiya Matritsasi ---
[[ 21   0]
 [  1 416]]

--- Classification Report (To'liq) ---
              precision    recall  f1-score   support

  Normal (0)       0.95      1.00      0.98        21
Firibgar (1)       1.00      1.00      1.00       417

    accuracy                           1.00       438
   macro avg       0.98      1.00      0.99       438
weighted avg       1.00      1.00      1.00       438

----------------------------------------
✅ ACCURACY (Aniqlik): 0.9977
🎯 PRECISION (Firibgar 1): 1.0000
🛡 RECALL (Firibgar 1): 0.9976
🚀 AUC-ROC qiymati: 0.9998
```

Exploitation (90 declarations):
All 3,000 prepared declaration vectors are fed into the XGBoost model.
XGBoost assigns a risk score between 0 and 1 to each declaration.
The system ranks all 3,000 declarations by risk score and selects the top 90 as "HIGH-RISK."
Exploration (10 declarations):
From the remaining 2,910 "low-risk" declarations, the system randomly selects 10. This serves as the system's "intelligence-gathering" process.
Step 4: Result Formation and Employee Assignment
Unified List: The 90 XGBoost-selected and 10 randomly selected declarations are combined into a final inspection list of 100 declarations.
Interface: The list is sent to the officer's workstation (MED post interface) along with:
Declaration number
Risk score (e.g., 95%)
Selection reason ("High Risk (XGBoost)" or "Random Selection (Exploration)")
Step 5: Feedback and System Self-Learning
This is the final, continuous process that ensures the system remains "alive" and increasingly intelligent.
Officer Decision: The officer reviews the 100 declarations and assigns a final label to each (fraudulent = 1, legitimate = 0) in the system.
Database Enrichment: These 100 new, fully verified labels are immediately added to the historical dataset.
Periodic Model Retraining:
At predefined intervals (e.g., nightly or weekly), an automatic script runs.

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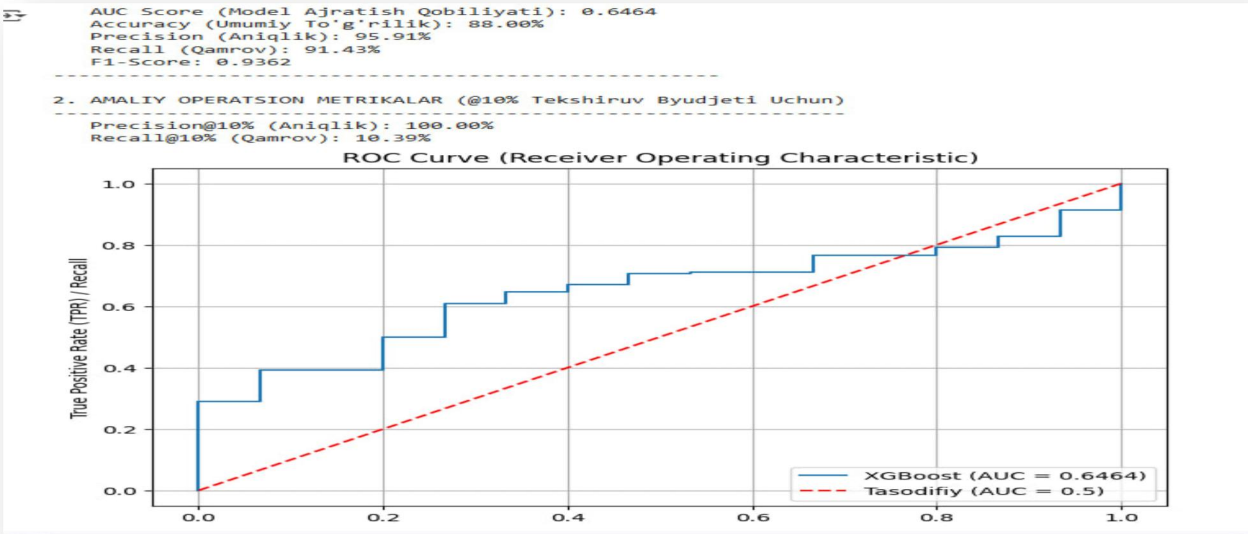
The script processes the updated and enriched historical dataset, repeating all feature engineering steps from Step 2 (including updating the "risk dictionaries").
The XGBoost model is then retrained from scratch using the most recent data.
From the next day, the system operates using the new, more intelligent model.
This cycle continues indefinitely. In this way, the model evolves from a one-time predictor into a self-improving intelligent partner, continuously adapting to changes in the customs environment.



4. Conclusion

The study demonstrates that the development and modernization of customs infrastructure are critical drivers for accelerating trade flows and enhancing the efficiency of cross-border transactions [15]. Digitalization, automated risk-based control, and integrated logistics platforms significantly reduce clearance times, lower transaction costs, and improve transparency in customs operations. The implementation of data-driven approaches, such as the "Three-Sheet Matching," the Green Channel, and hybrid intelligent filtering with XGBoost, provides measurable improvements in the speed and accuracy of declaration processing.

Comparative analysis with international best practices, including those in the European Union, South Korea, Singapore, and China, indicates that a combination of technological, institutional, and regulatory reforms is necessary to maximize trade facilitation benefits. In the context of Uzbekistan, adopting similar digital and automated customs mechanisms, coupled with continuous system self-learning and employee feedback integration, can create a flexible and adaptive customs environment.

Ultimately, strengthening customs infrastructure not only accelerates trade flows but also supports national economic competitiveness, enhances integration into global supply chains, and ensures sustainable growth in cross-border commerce. Continuous investment in digital solutions, logistics hubs, and capacity building remains essential to fully realize these benefits.

REFERENCES:

[1] Sirochev, M.B. (2024). Facilitation of Trade and Modernization of Customs Procedures. International Multidisciplinary Journal for Research & Development, 11(06). Explores the role of advanced technologies and harmonized regulations in modernizing customs processes.

ISSN 2751-9708

[2] Seidemetova, E.O. (2025). Efficiency and Prospects of Digitalization in the Customs Activity of the Republic of Uzbekistan. Innovative Development in Educational Activities. Examines digital customs, risk management, and ICT effectiveness in Uzbek customs practice.
[3] Ortega, A.F.U. (2025). Smart Customs: Relationship with International Trade Facilitation. Diginomics. Analyses how smart customs technologies relate to trade facilitation and process automation.
[4] United Nations Economic Commission for Europe. (2024). Digitalization initiatives for customs and trade operations in Central Asia. Reports on integrated customs and "single window" systems and smart customs development in the region.
[5] SciUp (2022). Directions of Digital Transformation of the Customs Service. Discusses the shift from paper-based to digital and electronic customs systems and innovation trends.
[6] Kazakhstan-Central Asia trade facilitation report (2025). Study on Trade Procedure Simplification and Customs Digitalization, GIZ & IFC. Highlights regional e-customs infrastructure, unified window systems, and ICT integration.
[7] Schneider, F., & Enste, D. (n.d.). Hiding in the Shadows: The Growth of the Underground Economy. International Monetary Fund. Provides context on informal economy effects on customs and trade policy. (classic reference supporting analysis of trade facilitation impacts)
[8] Wang, H., & Sua, L. (2025). Exploring Trade Openness and Logistics Efficiency in the G20 Economies: A Bootstrap ARDL Analysis of Growth Dynamics. ArXiv. Investigates linkages between logistics infrastructure, customs performance, and trade growth.
[9] Park, S., Kim, S., & Cha, M. (2022). Knowledge Sharing via Domain Adaptation in Customs Fraud Detection. ArXiv. Discusses data-driven risk management and international customs information sharing.
[10] Le, T.V., & Fan, R. (2023). Digital Twins for Logistics and Supply Chain Systems: Literature Review and Research Potential. ArXiv. Offers insights into advanced digital systems that can support customs and logistics infrastructure.
[11] Liang, Y., Guo, L., Li, J., Zhang, S., & Fei, X. (2021). The impact of trade facilitation on cross-border e-commerce transactions: Analysis based on marine and land cross-border logistical practices between China and countries along the "Belt and Road". Water, 13(24), 3567.
[12] Bukhari, S.A.A., & Zaidi, S.S.Z. (2025). An analysis of the challenges faced by customs for trade facilitation in Pakistan. Contemporary Journal of Social Science Review, 3(3), 1539–1556.
[13] Intent Research Scientific Journal. (2024). Digitization of Uzbekistan's Single Window and its integration with customs operations. Intent Research Scientific Journal, 3(11).
[14] Mukhiddinova, D. (2024). Administrative legal aspects of customs administration in Uzbekistan. Society and Innovations Journal.
[15] Cui, J. (2025). The impact of artificial intelligence technology on cross-border trade in Southeast Asia: A meta-analytic approach