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ENHANCING CUSTOMS RISK MANAGEMENT: UTILIZING BLOCKCHAIN TO MITIGATE ILLEGAL TRADE AND PROMOTE FAIR COMMERCE

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ABSTRACT

Administrasi bea cukai, khususnya di Indonesia, sedang menghadapi tantangan terkait aktivitas perdagangan ilegal dan ketidaksesuaian data impor-ekspor. Untuk mengatasi masalah ini, artikel ini menyelidiki penerapan teknologi *blockchain* dalam meningkatkan manajemen risiko bea cukai, dengan fokus pada potensinya untuk meningkatkan keterlacakan, keamanan, dan transparansi dalam perdagangan lintas batas. Studi ini mengeksplorasi bagaimana *blockchain*, dengan sistem buku besar yang terdesentralisasi dan tidak dapat diubah, dapat mengurangi penipuan dan perubahan yang tidak sah dengan menyediakan catatan transaksi yang tidak dapat diubah. Selain itu, otomatisasi pemeriksaan kepatuhan melalui kontrak pintar dapat menyederhanakan proses bea cukai dan meningkatkan efisiensi. Melalui tinjauan komprehensif terhadap literatur yang ada, studi kasus, dan wawancara ahli, artikel ini menggambarkan manfaat praktis *blockchain* dalam administrasi bea cukai. Temuan menunjukkan bahwa *blockchain* dapat secara signifikan meningkatkan integritas data, transparansi, dan kepercayaan keseluruhan di antara para pemangku kepentingan dalam ekosistem perdagangan global. Namun, studi ini juga mengakui tantangan signifikan yang terkait dengan penerapan *blockchain*, termasuk biaya tinggi, masalah skalabilitas, dan kebutuhan akan kesepakatan lintas batas yang kuat untuk memastikan berbagi data yang lancar dan kepatuhan terhadap peraturan. Artikel ini menyimpulkan dengan merekomendasikan proyek percontohan antara Indonesia dan Malaysia untuk menguji kelayakan *blockchain* dalam manajemen risiko bea cukai. Keberhasilan proyek semacam itu akan bergantung pada pengembangan kerangka peraturan yang mendukung, kolaborasi pemangku kepentingan yang efektif, dan strategi untuk mengelola biaya implementasi. Proyek percontohan ini dapat memberikan wawasan berharga untuk adopsi yang lebih luas dari teknologi blockchain dalam manajemen risiko bea cukai, yang berpotensi menjadi preseden bagi negara-negara lain di kawasan.

Customs administrations, particularly in Indonesia, are grappling with challenges related to illegal trade activities and discrepancies in import-export data. To address these issues, this paper investigates the application of blockchain technology in enhancing customs risk management, focusing on its potential to improve traceability, security, and transparency in cross-border trade. This study explores how blockchain, with its decentralized and immutable ledger system, can reduce fraud and unauthorized alterations by providing a tamper-proof record of transactions. Additionally, the automation of compliance checks through smart contracts can streamline customs processes and improve efficiency. Through a comprehensive review of existing literature, case studies, and expert interviews, the paper illustrates the practical benefits of blockchain in customs administration. The findings suggest that blockchain can significantly enhance data integrity, transparency, and overall trust among stakeholders in the global trade ecosystem. However, the study also acknowledges the significant challenges associated with implementing blockchain, including high costs, scalability concerns, and the need for robust cross-border agreements to ensure seamless data sharing and regulatory compliance. The paper concludes by recommending a pilot project between Indonesia and Malaysia to test the feasibility of blockchain in customs risk management. The success of such a project will depend on the development of supportive regulatory frameworks, effective stakeholder collaboration, and strategies to manage implementation costs. This pilot could provide valuable insights for broader adoption of blockchain technology in customs risk management, potentially setting a precedent for other countries in the region.

1. INTRODUCTION

1.1. Background

The escalating volumes of international trade and the proliferation of regional trade agreements, coupled with governments' continued reliance on revenue collected at the borders, impose substantial demands on customs administrations. These administrations are tasked with streamlining cross-border trade while addressing issues of noncompliance. Customs authorities face an increasingly complex landscape of illegal cross-border activities and are expected to deploy effective strategies to counteract these growing threats (Nagy & LeDrew, 2022).

Indonesia Customs, which is responsible for regulating the movement of goods both entering and leaving the country and for overseeing items with properties or characteristics, is also encountering challenges. Recently, there has been a case related to possible illegal activity. Damayanti (2024) highlighted a potential illegal textile import from China, estimated to reach USD 1.4 billion. This discrepancy stems from inconsistencies in the import data reported by Indonesia and China. Specifically, China documented a higher volume of exports to Indonesia than Indonesia recorded as imports from China. This issue has become a significant concern for Indonesia Customs.

The data presented in Figure 1 illustrates that import values in Indonesia exhibited considerable fluctuations, with a notable decline from 2018 to 2020 coinciding with the Covid-19 pandemic (Statistics Indonesia, 2024). Nevertheless, export values saw a resurgence following the pandemic. Of particular interest is the observation that during the period of declining import values from 2018 to 2020, the number of enforcement actions related to illegal imports increased (Figure 1). Especially, there were 18,204 enforcement actions in 2018, 21,062 in 2019, and 21,964 in 2020 (Annur, 2021).

On the export side, tracing goods will be important for Indonesia Customs, especially for companies using customs fiscal facilities such as Bonded Zone (also known as KB) and duty drawback (also known as KITE), to ensure that exports are properly executed. In the Indonesian Customs Policy, KB is a zone where companies can import raw materials and components without paying customs duties, provided the finished products are exported. Similarly, KITE is is a facility that allows manufacturers to import raw materials duty-free, as long as the final products are intended for export.

A case from 2015 to 2021 involved allegations of misuse of a KB, where goods intended for processing were exported without undergoing the required processing, raising concerns about potential state losses (Arfin, 2023). Statistically, Indonesian Customs (2023) data shows that exported goods that receive KB or KITE facilities contributes 41.5% of the total national exports in 2022, highlighting the significance of the importance goods tracing (Figure 2).

The two cases mentioned above illustrate issues in both import and export activities, which can be addressed by using relevant data to trace goods, while also ensuring the security and confidentiality of the information. The integrity of customs data offers a robust solution to the good tracing and security and confidentiality issues inherent in traditional customs processes. A blockchain technology, as a decentralized ledger, allows network participants to maintain an unalterable and shared record that is updated in real-time. This ensures that everyone involved can access and track accurate, up-to-date data regarding cross-border trade activities and the distribution of shipments (Okazaki, 2018). Meanwhile, with blockchain, records transactions are in a transparent and immutable manner, meaning that once data is recorded, it cannot be altered or deleted. This reduces the risk of data tampering and unauthorized access, which are significant concerns in customs operations. The decentralized nature of blockchain also means there is no single point of failure, making the system more resilient against cyber-attacks. Even if one node is compromised, the overall integrity of the data remains intact, providing a more secure environment for sensitive trade information (Mendling et al., 2018; Treiblmaier, 2018).

Studies have demonstrated blockchain's effectiveness in enhancing the security and confidentiality of trade data. For instance, Kshetri (2018) emphasizes blockchain's potential to reduce fraud and improve security in supply chain management by providing a tamper-proof record of transactions. Wang et al. (2019) discuss how blockchain can secure and streamline customs procedures, reducing the risk of data breaches and ensuring confidentiality. These studies underscore blockchain's transformative impact on customs processes, offering a secure, transparent, and efficient solution to

global trade challenges.

The World Customs Organization (WCO), in collaboration with the WTO, has recognized the potential of blockchain and distributed ledger technology (DLT) to support trade facilitation and customs administration. Although still at an experimental stage for many customs authorities, blockchain has been fully implemented in countries like Argentina and Uruguay. A survey of 87 WCO member countries identified data confidentiality and a secure IT environment as the main benefits of blockchain in customs administration (WCO, 2022). The long-term integration of customs offices into blockchain networks could provide access to reliable, real-time information, enhancing the tracing and verification of import and export processes (Open Logistics Foundation, 2023). In this context, the Korean Customs Administration has already piloted a cross-border data exchange program using blockchain between South Korea and Vietnam, demonstrating its suitability for establishing automatic, secure data exchange between customs administrations (Kang, 2019).

Global trade is the lifeblood of modern economies, facilitating the movement of goods and services across borders and contributing significantly to economic growth and development. However, the customs processes integral to global trade are often fraught with challenges that hinder efficiency and transparency. Ensuring the security and confidentiality of trade data, tracing the movement of goods through the supplychain, and expediting customs clearance procedures are some of the critical issues faced by customs authorities worldwide. These challenges can lead to delays, increased costs, and potential fraud, ultimately affecting the overall efficiency of global trade operations (Choi, 2017).

1.2. Research Questions and Objective

Based on the explained customs and trade conditions, this study aims to answer the following questions:

1. How can blockchain technology be utilized to enhance customs risk management for illegal trade?
2. How feasible is the implementation of blockchain in customs administration?
3. What are the challenges of implementing blockchain in customs administration?

By answering those questions, this study aims to evaluate the potential of blockchain technology to enhance security and improve traceability of goods in international trade. The expected benefits include providing a comprehensive understanding of how blockchain can address critical challenges in customs processes, offering insights for policymakers and stakeholders in the global trade industry on implementing blockchain solutions.

2. LITERATURE REVIEW

2.1. Regulation and Policy Related to Export and Import in Indonesia

Regulation governing export and import activities plays a critical role in international trade, influencing economic growth and competitiveness. Ezzel and Foote (2019) argue that stringent export controls reduce revenue that domestic companies rely on to invest in technologies crucial for long-term competitiveness and job creation. Controlling cross-border trade involves a blend of regulations, oversight, and enforcement actions to ensure adherence to laws and safeguard economic interests. Governments implement regulations specifying procedures and documentation for lawful trade, with customs authorities inspecting goods at entry and exit points to ensure compliance. Comprehensive documentation, such as invoices, packing lists, and certificates of origin, is essential for tracking goods.

The control of imports in Indonesia is regulated by Minister of Finance Regulation No. 190 of 2023. Importers must prepare customs documents when conducting import activities. Once submitted, customs officers determine whether a document inspection suffices or if a physical inspection is required. Submission must include supporting documents like the Bill of Lading or Airway Bill and other relevant information. Physical inspections verify the quantity and type of goods, specifications, origin, and check for undeclared items.

Regarding exports, according to Minister of Finance Regulation No. 155 of 2022, exporters must submit export declarations. Goods are considered exported once assigned registration numbers and loaded onto the transport departing the customs territory. Customs officers review declarations for completeness, export duty accuracy, and regulatory compliance. Physical inspections are conducted selectively based on risk management. Reconciliation of the export declaration with outward manifests ensures

data accuracy. Under Indonesian export regulations, supervision is required only until goods depart from the customs territory, with no provisions ensuring arrival at the destination.

KB and KITE scheme receive special attention for export purposes. According to Minister of Finance Regulation No. 131 of 2018, as amended by MoF Regulation No. 65 of 2021, a KB is a designated facility for storing imported goods or goods from within the customs territory, intended for processing before exportor further importation. In a KB, fiscal incentives are provided for goods entering from outside the customs area for production, not consumption. These incentives include suspension of import duties, exemption from excise duties, and/or exemption from import-related taxes. Fifty percent of total production in the KB must be exported. If sold locally, companies must repay the fiscal incentives. Goods exported outside the customs territory must comply with export regulations without repaying fiscal incentives.

Conversely, according to MoF Regulation No. 145 of 2022, the KITE scheme allows the refund of import duties on goods imported for processing, assembling, or incorporation into other goods intended for export. Only raw materials intended for export qualify, meaning they will be processed into finished goods for export. Upon exporting the finished goods, companies submit a report to Indonesia Customs to request the refund, which customs officers evaluate to ensure eligibility before payment.

2.2. Blockchain in General

Blockchain is a decentralized digital ledger technology that records transactions across multiple computers in a way that ensures the security and transparency of the data. Each transaction is added to a block, which is then linked to the previous block, forming a chain. This structure guarantees that once data is recorded, it cannot be modified without altering all subsequent blocks, thereby ensuring a high level of security and transparency within the blockchain. The decentralized nature of blockchain eliminates the need for a central authority, reducing the risk of data manipulation and enhancing trust among participants (Nakamoto, 2008). This technology is particularly beneficial in sectors that require high levels of data integrity and transparency, such as finance, supply chain management, and healthcare (Swan, 2015).

The theoretical framework for blockchain technology is grounded in its fundamental principles of decentralization, transparency, and immutability. Decentralization means that the control and verification of transactions are distributed across the network, which reduces the risk of a single point of failure. Transparency ensures that all transactions are visible to all participants, fostering trust and accountability. Immutability means that once data is recorded, it cannot be changed or deleted, providing a secure and permanent record of transactions. These principles form the basis for blockchain's potential to revolutionize various industries by enhancing security, efficiency, and trust (Yaga et al., 2019).

2.3. Examples of Blockchain Implementation Project South Korea

South Korea's Customs Service (KCS) is actively piloting blockchain technology to modernize its customs processes and enhance trade facilitation. Kang (2019) explains that the initiative aims to streamline the sharing of information between various stakeholders in import-export activities, such as exporters, shippers, and customs authorities, by using a permissioned blockchain infrastructure called "hyper-ledger fabric." This technology enables real-time data sharing, improves data accuracy, and reduces the risk of falsification, ultimately enhancing the efficiency and reliability of the customs clearance process. In addition to the operational benefits, KCS's blockchain initiatives also focus on establishing trust in cross-border data exchanges, particularly with countries like Vietnam. One significant pilot project involves the electronic sharing of certificates of origin, which is a critical document in international trade that verifies the origin of goods for tariff purposes. By digitizing this process, KCS aims to facilitate smoother trade flows and reduce the administrative burden on businesses. These efforts are part of South Korea's broader vision to integrate blockchain technology into its customs systems, ensuring that all actors in the logistics chain can access accurate and timely information, thereby enhancing overall trade efficiency (Kang, 2019). Ahn (2023) highlights that South Korea and Vietnam are currently implementing a Memorandum of Understanding (MoU) signed

in 2022. This MoU is designed to facilitate system development in Vietnam and establish a connection between the systems of the two countries, reflecting the ongoing collaborative efforts to enhance technological integration.

TradeLens

TradeLens, a blockchain-based platform by Maersk and IBM, enhances logistics transparency and efficiency by providing real-time data access to all supply chain participants. It reduces delays and improves coordination by offering a shared view of transaction data, eliminating inefficiencies of traditional paper-based systems. This visibility enables better decision-making, improved compliance, faster issue resolution, and fosters trust among stakeholders by ensuring everyone has access to the same information. (Jones, 2020).

However, despite its potential, TradeLens has encountered significant challenges, including limited adoption and resistance from stakeholders hesitant to abandon established practices. The platform's success relies on widespread participation, which has been difficult to achieve. Baruffaldi and Sternberg (2018) note that while blockchain can greatly improve supply chain transparency and efficiency, its widespread adoption faces substantial organizational and regulatory hurdles, such as ensuring data privacy, standardizing data formats, and creating legal for cross-border data sharing. These challenges highlight the importance of stakeholder engagement and the need for robust cross-border agreements to realize blockchain's full potential in global trade logistics.

3. RESEARCH METHODOLOGY

This study utilizes a qualitative research methodology, ideal for exploring the complexities of integrating blockchain technology into customs and trade processes, and also a deep understanding of the challenges and opportunities in this domain. The research design consists of three main components: a systematic literature review, case studies, and expert interviews. The literature review examines academic articles, industry reports, and white papers on blockchain applications in trade and customs. This review is crucial for identifying key themes, benefits, and challenges associated with blockchain implementation, offering a foundational understanding of its current state in customs and trade (Creswell & Poth, 2016).

The study also includes case studies to provide practical insights into how blockchain can enhance the efficiency, security, and transparency of customs operations. By analyzing projects such as TradeLens and Project South Korea, the study identifies best practices and potential pitfalls relevant to the Indonesian context (Yin, 2009). In addition to the literature review and case studies, expert interviews were conducted with professionals in National Logistics Ecosystem (NLE), KITE, KB, enforcement, and customs international relation. These interviews offer firsthand insights into the specific challenges and opportunities within Indonesian customs and trade, complementing the findings from the literature and case studies. This multi-method approach provides comprehensive analysis of blockchain's role in customs and trade, particularly in Indonesia, ensuring a well-rounded perspective on its potential integration.

4. RESULTS AND FINDINGS

4.1. Monitoring of Import and Export in Indonesia

Indonesian Customs has established a system for monitoring import and export activities. In addition to traditional physical enforcement methods, Indonesian Customs has incorporated advanced technological tools. Based on the interview to the professional in customs enforcement, this institution utilizes mirror analysis techniques as part of a risk assessment framework to oversee import and export operations (personal communication, August 12, 2024). The outcomes of this analysis facilitate early detection and enable the agency to assess whether further investigation is warranted to identify potentially fraudulent activities in the import and export processes.

Geourjon, et.al (2023) explained mirror data analysis involves comparing the trade flows reported bythe exporting country with those reported by the importing country for the same product and time frame to identify discrepancies. Customs administrations use this analytical approach for effective risk management and control in overseeing international trade, ensuring compliance with import/export regulations, and collecting duties and taxes. Given the vast scale of global trade, customs must focus on high-risk transactions; otherwise, resources may be strained, leading to ineffective inspections, increased trade costs, and higher risks of collusion. However, customs procedures in developing countries often lag

behind best practices in risk analysis and control selection.

In Indonesia, the practice of mirror analysis involves comparing Indonesian trade data with information from third-party institutions, such as Global Trade Atlas, which aggregate and provide data from various countries (Indonesia Customs, 2022). The implementation of this practice encounters severalchallenges, including the necessity for officers with the expertise to accurately interpret and analyze the data, as failure to do so can lead to misinterpretation. Furthermore, issues related to data trustworthiness also emerge, whether concerning Indonesian data or data from third parties. These concerns may involve the reliability of the data or the consistency of data standards.

Different enforcement methods are employed for the export of goods under fiscal facilities such as KB and KITE. According to professionals in KITE (personal communication, August 12, 2024), the monitoring of exported products relies on documentation and the oversight of customs officers who track the movement of goods entering and exiting of the zone. Goods are considered exported once loaded for transport to the export destination, with reconciliation between export documents and the outward manifest serving as evidence. For KITE, professionals highlight that control also involves data from Bank Indonesia, known as "Export Proceeds" (Devisa Hasil Export), which is automatically exchanged with Indonesian Customs (personal communication, August 12, 2024). However, challenges such as lag time and data discrepancies can arise, with missing data from Bank Indonesia not necessarily indicating fraud but potentially reflecting systemic issues in data exchange.

4.2. Blockchain Concept for Customs Administration

As a part of the logistics system, the blockchain concept for customs administration can be built in B2G and national inter-agency coordination or G2G scenarios (Ganne, 2018). Blockchain's decentralized, secure structure enhances information sharing among government agencies, fostering more effective B2G and inter-agency collaboration (WCO, 2017). G2G, although still in its infancy, can be applied to reduce the risks associated with certain types of cross-borders G2G processes. Ganne (2018) provides an example, specifically illustrating the sharing of information regarding authorized economic operators. Implementation of AEO mutual recognition agreements (MRA) faces various challenges, including manual processes for sharing sensitive and/or confidential data with low security and integrity standards, difficulties in establishing the origin and traceability of data and ensuring secure access, inability to provide benefits Real-time AEO, and the inability to react in real-time when a suspension occurs, with all possible consequences for supply chain security.

Additionally, the application of blockchain in the context of customs shares similarities with the concept of Central Bank Digital Currencies (CBDCs), which has been applied in protoype G2G scenario. As discussed by Noor (2023), CBDCs, like blockchain, provide a transparent and immutable ledger, offering enhanced capabilities for monitoring and preventing corruption in financial transactions. Implementing blockchain in customs could similarly reduce risks associated with cross-border trade, ensuring greater data integrity and security.

4.3. Feasibility of Applying Blockchain for Customs Administration

Blockchain can enhance security, transparency, and efficiency in cross-border customs processes by providing a tamper-proof record of all transactions related to goods movement. A blockchain-based system utilizes decentralized ledgers, allowing all stakeholders to access the data involved in the trade process. The immutable nature of blockchain ensures that once data is recorded, it cannot be altered, thus reducing the risk of fraud and unauthorized modifications (Yaga et al., 2019). Moreover, the transparency providedby blockchain allows all participants to view the same information, thereby increasing trust and reducing disputes. Building on the addressed in the previous section, blockchain technology offers customs authorities the capability to effectively monitor export and import activities. Customs officials from both the exporting and importing countries will have access to the blockchain to ensure that exported goods reach their intended destination. This system also helps mitigate the risk of undetected imports entering the country. In addition, utilizing blockchain technology can enhance customs risk management by maximizing

mirror analysis. Rather than relying on third-party data, blockchain can provide more reliabledata that is supported by government authorities from the relevant countries, facilitating more accurate mirror analysis.

Smart contracts, which are self-executing agreements with terms encoded directly into their software, can automate compliance processes by initiating predefined actions, such as verifying document authenticity or confirming the receipt of goods, upon fulfillment of specific conditions. This automation significantly reduces the need for manual interventions, speeding up the customs clearance process and lowering operational costs (Treiblmaier, 2018). Specifically in relation to preventing circumvention and transshipment, blockchain technology can also be used to prevent these two actions. McDaniel & Norberg (2019) explain that circumvention is the practice of sending goods to neighboring countries before the destination country to avoid tariffs imposed on goods from the country of origin. Today, Many countries combat trade circumvention by applying regulations like antidumping duties broadly. Blockchain can offer a solution by enabling customs administrations to easily verify and demonstrate the origin of goods, benefiting both senders and customs agencies.

Based on interviews conducted with customs international relations experts in Indonesia (personal communication, August 13, 2024), the handling of circumvention in countries, including Indonesia, has been managed under the Customs Mutual Assistance Agreements (CMAA) scheme. CMAA is a bilateral agreement between two countries that allows them to cooperate in customs matters. The aim of the CMAA is to facilitate the exchange of information, technical assistance, and support in enforcing customs-related laws, as well as to combat transnational crimes such as smuggling, tax evasion, and illegal trade. Indonesia has established 10 CMAA agreements, beginning with the Netherlands (2003), followed by the United States (2006), Hong Kong (2017), the Republic of Korea (2019), the United Arab Emirates (2019), Australia (2020), Malaysia (2021), Timor Leste (2021), Papua New Guinea (2023), and Iran (2023). Under this agreement, if there is an allegation of a customs offense or circumvention in one of the CMAA partner countries, the other country can request information about the allegation. The CMAA agreements are valid indefinitely unless revised or terminated. Currently, the exchange of data and information under CMAA is done manually, which means resolving allegations of circumvention can be time-consuming, depending on the readiness of the required data.

4.4. Pilot Project for Indonesia and Malaysia

Given the existing cooperation between Indonesia and Malaysia, along with their geographical proximity and the volume of trade between the two countries (Figure 3), a pilot project to implement blockchain in customs processes could be highly feasible. The proposed blockchain system would build on the current data exchange agreement under the Customs Mutual Administrative Assistance (CMAA), which governs data sharing between the two countries, albeit currently on a request basis.

For the pilot project, we propose two concepts. The initial process before implementing blockchain would involve each country sharing data through manual data exchange at the end of their customs processes. Figure 4, 5, and 6 compare the Current System with the proposed Blockchain System Concept for Indonesian and Malaysian customs.

In the Current System, as shown in Figure 4, each country operates its own independent customs system, and data exchange depends on specific agreements, typically requiring a formal request. This means that data is shared only after the completion of each country's customs process, creating inefficiencies and delays. The reliance on formal requests and manual exchanges not only slows down the overall customs process but also increases the risk of errors and discrepancies. However, the current system does offer full autonomy for each country, allowing them to maintain complete control over their customs operations without external dependencies, which may be viewed as an advantage for countries seeking greater control over their trade data. On the other hand, the lack of real-time data sharing and limited visibility across borders hampers the efficiency and transparency of the process.

The first concept, shown in Figure 5, introduces a fully integrated blockchain system that both Indonesia and Malaysia would use. In this system, importers and exporters would input their trade data into a shared blockchain platform that both countries' customs authorities could access. This system would allow for real-time data sharing, ensuring that both customs officials

and stakeholders have immediate access to the same information, reducing delays and improving transaction verification processes. The transparency offered by this real-time system would significantly enhance the efficiency of customs operations, fostering trust among stakeholders. However, this solution also comes with challenges, particularly in terms of implementation costs. Developing and maintaining a shared platform would require significant financial investment, and coordinating between the two countries on governance, standards, and security measures could prove complex. Additionally, while the system would enhance collaboration, it might reduce the autonomy of each country, as they would need to operate within a shared infrastructure, potentially raising concerns about data control.

The second concept, illustrated in Figure 6, suggests maintaining separate customs systems in each country while introducing a blockchain platform to facilitate data exchange. In this setup, importers and exporters would primarily interact with their respective national systems, but the necessary data would be shared between Indonesia and Malaysia via the blockchain platform. Customs authorities would then access this shared data for verification and monitoring. This hybrid approach allows each country to maintain greater control over their systems, which is beneficial for countries that prioritize retaining independence over their customs operations. At the same time, it provides the advantages of blockchain, such as secure and transparent data sharing, without the need for full system integration. However, because the countries would still rely on separate systems, some delays might persist, as full real-time interaction would not be achieved. Additionally, technical challenges could arise in ensuring that the separate systems communicate seamlessly with the blockchain platform.

In both proposed systems, the blockchain platform would include a robust verification process to ensure that the import data from Indonesia matches the export data from Malaysia, and vice versa. This would help reduce fraud, as any discrepancies or suspicious data would trigger immediate notifications to customs authorities in both countries. By allowing customs officials to access the data whenever needed for monitoring imports and exports, the blockchain would not only enhance transparency but also provide a real-time mechanism for addressing any irregularities in trade transactions. However, while both systems aim to improve efficiency, the first, fully integrated model provides the most comprehensive solution, while the second, partially integrated model offers a compromise that retains more independence for each country's systems. The pilot project could target key trade routes and commodities, allowing customs to test and refine the blockchain system before broader implementation, showcasing its benefits in streamlining and securing global trade. By creating a real-time, transparent platform for data exchange, the project has the potential to revolutionize how cross-border transactions are managed, particularly by reducing delays and improving data accuracy.

However, implementing a blockchain-based system comes with several challenges. One significant hurdle is the need for new regulations in both Indonesia and Malaysia to ensure that the blockchain platform is legally binding. Developing these regulations could be particularly complex due to the sensitive nature of the trade data being exchanged and the differing legal frameworks of the two countries. Additionally, the pilot project must address critical issues such as data interoperability between existing systems, technical system integration, and active engagement from all stakeholders, including both government and industry players, to ensure the platform's success.

Collaboration between the customs authorities of both countries, as well as the involvement of industry stakeholders, will be crucial in developing a robust and effective blockchain platform. The final design of the system should be thoroughly discussed between the Indonesian and Malaysian customs administrations to ensure it meets the specific operational, legal, and technical requirements of both countries. By addressing these challenges collaboratively, the pilot project can lay the groundwork for the wider adoption of blockchain technology in cross-border trade, thereby enhancing regional and global trade efficiency (Kouhizadeh et al., 2021).

4.5. Benefits of Applying Blockchain in the Global Trade Through Customs Administration Enhanced Security

Blockchain's immutable ledger ensures data integrity and prevents fraud by making it difficult for any single entity to alter records. This enhanced security is vital for customs

processes, where data accuracy and authenticity are critical. Insights from expert interviews revealed that one of the significant challenges in customs is ensuring that goods benefiting from trade facilities, such as tax exemptions, are genuinely exported rather than being distributed domestically (personal communication, August 9, 2024). Blockchain's tamper-proof record-keeping can effectively address this issue by providing a verifiable trail of goods from origin to destination, thereby preventing fraud and ensuring compliance with regulatory requirements (Mendling et al., 2018).

Moreover, blockchain improves customs risk management by enabling reliable data directly from related countries, enhancing data quality for mirror analysis. It also secures data exchanges, preventing leaks and unauthorized access, ensuring more efficient and secure customs processes compared to the manual exchanges under the CMAA framework.

4.6. Transparency and Data Integrity

Blockchain technology offers unparalleled transparency, as all stakeholders have access to the same real-time information, increasing trust and reducing disputes. This transparency is particularly beneficial in resolving issues related to discrepancies in trade documentation, which can lead to misleading information about transactions between countries. Expert interviews highlighted the problem of illegal exports, where discrepancies between the volume and type of goods declared in the sender country and those received in the destination country often go unnoticed (personal communication, August 8, 2024). Furthermore, the implementation of blockchain technology requires data reconciliation between the relevant countries first. This is necessary because different countries typically have varying data recording models. Without proper reconciliation, there is a risk of data misinterpretation, which could lead to inconsistencies and potential issues in the trade process. Blockchain's ability to provide a shared, immutable record allows customs authorities to verify that the exported goods match the imported goods and ensures that data across different authority is consistently reconciled, effectively preventing such illegal activities and discrepancies (Hofmann et al., 2017).

4.7. Efficiency and Process Automation

Implementing a blockchain platform for real-time cross-border trade transactions can greatly improve customs risk management, enabling timely inspections and enhancing global trade oversight. This reduces delays and illegal trading while promoting fair practices. Additionally, blockchain with smart contracts can automate processes, addressing issues like trade circumvention by verifying the true origin of goods.. According to insights from the expert interviews, a system that can enforce strict compliance checks, ensuring that goods declared as originating from a particular country genuinely meet the criteria (personal communication, August 8, 2024). Additionally, by automating these processes, blockchain can enhance the efficiency of customs operations. Studies indicate that blockchain technology can reduce customs processing times by up to 50%, underscoring its potential to revolutionize trade (Kshetri, 2018).

4.8. Challenges on Implementing Blockchain Technology Cost of implementing blockchain technology

As transaction volumes grow, maintaining a blockchain network incurs significant costs due to the need for substantial computational power, storage, and network maintenance. Verifying transactions across multiple nodes and storing large data volumes, especially on public blockchains, increases operational expenses (Gencer et al., 2018). Moreover, the scalability of blockchain technology remains a challenge. While blockchain can handle a limited number of transactions efficiently, scaling the system to accommodate large volumes of trade data can be problematic. Solutions such as sharding and off-chain transactions are being developed to address these issues, but they are not yet widely implemented. These scalability challenges need to be overcome to fully realize the potential of blockchain in customs processes (Zheng et al., 2017).

The TradeLens experience highlights the importance of stakeholder engagement and regulatory support for blockchain initiatives. Despite its potential, TradeLens faced challenges like limited adoption and resistance from key stakeholders, including shipping companies and customs authorities. Interviews with Indonesian customs officials (personal communication, August 8, 2024) revealed that, prior to TradeLens' bankruptcy, the platform's usage in Indonesia was notably low. This low adoption rate was largely

attributed to the high usage costs, which became a significant barrier for users. This resistance highlights the necessity of effective communication and collaboration to build trust and encourage participation in blockchain projects. Stakeholders' concerns about data privacy, competitive advantage, and the costs associated with transitioning to a new system must be addressed through transparent dialogue and cooperative efforts. The interviews also suggested that it might be more effective for governmental entities to create and maintain such systems to overcome these cost barriers and encourage broader adoption.

4.9. Cross-Border Agreement Requirements

The successful implementation of blockchain in customs processes hinges on the establishment of robust cross-border agreements. These agreements must address critical issues such as data sharing, privacy, and regulatory compliance, which are often challenging to negotiate and implement. One of the significant challenges highlighted in expert interviews is that each country typically operates its own customs system and may be reluctant to share data with others (personal communication, August 8, 2024). Reluctance to adopt blockchain arises from concerns over data security, sovereignty, and competitive advantage. Effective implementation requires countries to agree on common data exchange standards, which involves complex, time-consuming negotiations. Compliance with varying national data privacy regulations is also crucial to maintaining the system's integrity.

International cooperation and regulatory harmonization are key challenges to blockchain adoption in customs. Countries must collaborate to create legal frameworks for secure data exchange, addressing data ownership, access rights, and dispute resolution. Overcoming these challenges will foster a conducive environment for successful blockchain implementation in customs operations (Kouhizadeh et al., 2021). The failure of TradeLens highlights the need for a supportive regulatory environment. Regulatory uncertainty and lack of clear guidelines hinder blockchain adoption. Engaging with regulators to create frameworks that address costs and promote government-led initiatives is crucial for the success of future blockchain projects (Baruffaldi & Sternberg, 2018).

5. CONCLUSIONS

The increase in global trade brings several challenges in ensuring compliance across international transactions, posing difficulties for customs administrations worldwide, including Indonesian customs, in monitoring fair global trade. The integrity of customs data is a robust solution for overseeing trade between countries. To achieve this, effective tools are needed to create reliable data for monitoring, and blockchain presents itself as a potential solution.

Blockchain technology has significant potential to transform cross-border customs processes by enhancing security, transparency, and efficiency. Its decentralized nature and immutable ledger system ensure that once data is recorded, it cannot be altered or deleted, thereby reducing the risk of fraud and unauthorized alterations. This enhanced security is crucial for customs processes, where data integrity is paramount. Additionally, blockchain's transparency allows customs authorities to access consistent information, increasing trust, reducing disputes, and improving the efficiency and effectiveness of risk management systems. By ensuring better control over trade compliance, blockchain can contribute to the creation of fair-trade practices. However, the implementation of blockchain in customs processes faces several challenges. High costs associated with maintaining a blockchain network present a significant barrier. The decentralized verification process and data storage requirements can be expensive. Additionally, the need for robust cross-border agreements to address data sharing, privacy, and regulatory compliance is critical. Resistance from stakeholders and the lack of clear regulatory frameworks can hinder the adoption of blockchain technology in customs processes. Therefore, successful implementation requires addressing these challenges through collaboration and supportive policies.

To leverage the benefits of blockchain in customs risk management, it is recommended that Indonesia initiates a pilot project to implement a shared blockchain platform for cross-border trade with Malaysia. This project should serve as a practical test case to explore the feasibility and impact of blockchain technology on customs risk management.

Supportive regulatory frameworks are essential for the pilot project's success. These frameworks should address critical issues such as data sharing, privacy, and compliance to ensure the blockchain platform operates securely and efficiently. Policymakers must collaborate to establish common standards and protocols for data exchange, ensuring interoperability between the systems of both countries. Furthermore, measures should be implemented to manage and mitigate the costs associated with blockchain technology, such as exploring cost-sharing models and leveraging existing infrastructure. This pilot project could provide valuable insights and set a precedent for broader adoption of blockchain in customs risk management across the region.

REFERENCES

Ahn, K. (2023). Blockchain based E-C/O system in KCS (Korea Customs Service). Korean EODES

Annur, C. M. (2021, August). Customs action against 14,308 illegal import case up to July 2021 [Bea Cukai tindak 14.308 impor ilegal hingga Juli 2021]. Databooks. Retrieved from the Katadata website: Katadata. https://databoks.katadata.co.id/datapublish/2021/08/26/bea-cukai-tindak-14038- impor-ilegal-hingga-juli-2021#:~:text=Proporsi%20penindakan%20impor%20ilegal%20untuk%20benih%20dan%20obat%20masing%2Dmasing,mesin%20sebesar%201%2C16%25

Arfin. (2023, December). Investigating coruption cases: Misuse of bonded zone facilities [Menelusuri kasus korupsi: Penyalahgunaan fasilitas kawasan berikat]. Ministry of Finance. Retrieved from the Balai Diklat Pontianak website: https://bppk.kemenkeu.go.id/balai-diklat-keuangan-pontianak/artikel/menelusuri-kasus-korupsi-penyalahgunaan-fasilitas-kawasan-berikat-976101

Baruffaldi, G., & Sternberg, H. (2018). Chains in chains-logic and challenges of blockchains in supply chains. In The Digital Supply Chain of the Future: Technologies, Applications and Business Models.

Choi, Y. S. (2017). Customs Policies and Trade Efficiency'. WCO Research Paper, (42).

Creswell, J. W., & Poth, C. N. (2016). Qualitative inquiry and research design: Choosing among five approaches.Sage publications.

Damayanti, A. (2024, July). Illegal textile imports from China are still rampant, entrepreneurs reveal evidence [Impor tekstil ilegal dari China masih marak, pengusaha beberkan bukti ini]. Retrieved from the DetikFinance website: https://finance.detik.com/berita-ekonomi-bisnis/d-7425037/impor-tekstil- ilegal-dari-china-masih-marak-pengusaha-beberkan-bukti-ini

Ezell, S., & Foote, C. (2019). How stringent export controls on emerging technologies would harm the US Economy. Information Technology and Innovation Foundation, May, 20.

Gencer, A. E., Basu, S., Eyal, I., Van Renesse, R., & Sirer, E. G. (2018). Decentralization in bitcoin and ethereum networks. In Financial Cryptography and Data Security: 22nd International Conference, FC 2018, Nieuwpoort, Curaçao, February 26–March 2, 2018, Revised Selected Papers 22 (pp. 439-457). Springer Berlin Heidelberg.

Geourjon, A. M., Lporte, B., & Montagnat-Rentier, M.G. (2023). The Use of Mirror Data by Customs Administrations. Washington, DC: International Monetary Fund.

Hofmann, E., Strewe, U. M., & Bosia, N. (2017). Supply chain finance and blockchain technology: the case of reverse securitisation. Springer.

Indonesia Customs (2023). Economy Impact 2023 [Dampak Ekonomi tahun 2023]. Indonesia Customs.

Jones, M. (2020). How TradeLens is breaking down barriers while crossing oceans. Retrieved from the IBM website: https://www.ibm.com/blogs/ibm-anz/how-tradelens-is-breaking-down-barriers-while- crossing-oceans/

Kang, T. I. (2019, February). Korea pilots blockchain technology as it prepares for the future. Retrieved from the WCO website: https://mag.wcoomd.org/magazine/wco-news-88/korea-pilots-blockchain-technology-as-it-prepares-for-the-future/

Kouhizadeh, M., Saberi, S., & Sarkis, J. (2021). Blockchain technology and the sustainable supply chain: Theoretically exploring adoption barriers. International journal of production economics, 231, 107831.

Kshetri, N. (2018). 1 Blockchain's roles in meeting key supply chain management objectives. International Journal of information management, 39, 80-89.

McDaniel, C. A., & Norberg, H. C. (2019). Can blockchain technology facilitate international trade?. Mercatus Research Paper.

Mendling, J., Weber, I., Aalst, W. V. D., Brocke, J. V., Cabanillas, C., Daniel, F., ... & Zhu, L. (2018). Blockchains for business process management-challenges and opportunities. ACM Transactions on Management Information Systems (TMIS), 9(1), 1-16.

Ministry of Finance of the Republic of Indonesia. (2021). Ministry of Finance Regulation Number 131/PMK.04/2021 regarding Bonded Zone [Peraturan Menteri Keuangan Nomor 131/PMK.04/2021 tentang Kawasan Berikat].

Ministry of Finance of the Republic of Indonesia. (2022). Ministry of Finance Regulation Number 145/PMK.04/2022 regarding Refund of import duties paid on imported goods and materials for processing, assembly, or attachment to other goods for export purposes [Peraturan Menteri Keuangan Nomor 145/PMK.04/2022 tentang Pengembalian Bea Masuk yang Telah Dibayar atas Impor Barang dan Bahan untuk Diolah, Dirakit, Dipasang pada Barang Lain dengan Tujuan untuk Diekspor].

Ministry of Finance of the Republic of Indonesia. (2022). Ministry of Finance Regulation Number 155/PMK.04/2022 regarding Customs Provisions in the Export Field [Peraturan Menteri Keuangan Nomor 155/PMK.04/2022 tentang Ketentuan Kepabeanan di Bidang Ekspor].

Ministry of Finance of the Republic of Indonesia. (2022). Ministry of Finance Regulation Number 190/PMK.04/2022 of 2022 regarding Imported Goods for Use [Peraturan Menteri Keuangan Nomor 190/PMK.04/2022 tentang Impor Untuk Dipakai].

Ministry of Investment, Trade and Industry. (2023). Malaysia External Trade Statistics [Media Statement]. Retrieved from the Malaysia External Trade Development of Corporation website: https://www.matrade.gov.my/en/export-to-the-world/211-malaysian-exporters/trade- performance-2023.

Ministry of Trade of The Republic of Indonesia. (n.d.). Non-oil and gas exports by destination country [Ekspor non migas menurut negara tujuan]. Satu Data Kementerian Perdagangan. Retrieved from Ministry of Trade of The Republic of Indonesia website: https://satudata.kemendag.go.id/data-informasi/perdagangan-luar-negeri/ekspor-non-migas-negara.

Ministry of Trade of The Republic of Indonesia. (n.d.). Non-oil and gas exports by country of origin [Impor non migas menurut negara asal]. Satu Data Kementerian Perdagangan. Retrieved from Ministry of Trade of The Republic of Indonesia website: https://satudata.kemendag.go.id/data-informasi/perdagangan-luar-negeri/impor-non-migas-negara.

Nagy, J., & LeDrew, W. (2022). Customs Enforcement and Cooperation with Other Administrations.

Strengthening Customs Administration in a Changing World, 175.Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system.

Noor, M. A. (2023, September). Central Bank Digital Currency: The Potential Cure for Corruption in Indonesia?. Retrieved from https://www.thejakartapost.com/opinion/2023/09/29/cbdc-a- potential-cure-for-corruption-in-indonesia.html.

Okazaki, Y. (2018). Unveiling the Potential of Blockchain for Customs. WCO Research Paper No. 45

Open Logistic Foundation. (2023, June). Open Customs Blockchain: The missing piece to unlocking the broad application of distributed ledger technology for Customs? Retrieved from the WCO website: https://mag.wcoomd.org/magazine/101-issue_2_2023/open-customs-blockchain/Statistics Indonesia. (2024). Import Value [Nilai Impor]. Retrieved from

the Statistics Indonesia website https://www.bps.go.id/id/statistics-table/2/NDk3IzI=/nilai-impor--maret-2024.html

Swan, M. (2015). Blockchain: Blueprint for a new economy. " O'Reilly Media, Inc.".

Treiblmaier, H. (2018). The impact of the blockchain on the supply chain: a theory-based research framework and a call for action. Supply chain management: an international journal, 23(6), 545-559.

Wang, Y., Han, J. H., & Beynon-Davies, P. (2019). Understanding blockchain technology for future supply chains: a systematic literature review and research agenda. Supply Chain Management: An International Journal, 24(1), 62-84.

World Customs Organizations (2017). "Blockchains", Information Management Sub-Committee, 72nd meeting, 19 April 2017, Brussels: WCO.

World Customs Organization. (2022). The role of advanced technologies in cross-border trade: A customs perspective. WTO Publications

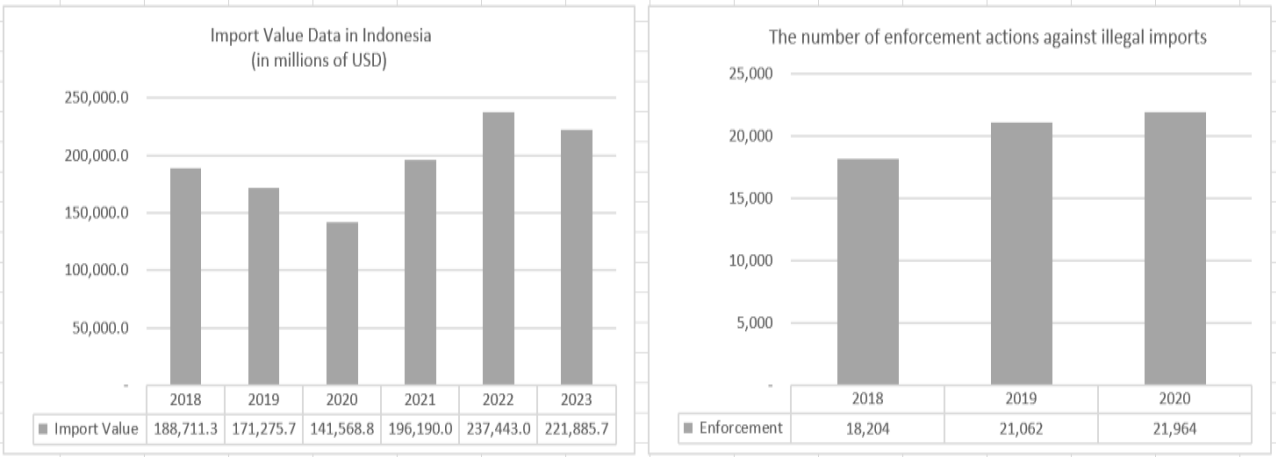
Yaga, D., Mell, P., Roby, N., & Scarfone, K. (2019). Blockchain technology overview. arXiv preprint arXiv:1906.11078.

Yin, R. K. (2009). Case study research: Design and methods (Vol. 5). sage.

Zheng, Z., Xie, S., Dai, H., Chen, X., & Wang, H. (2017, June). An overview of blockchain technology: Architecture, consensus, and future trends. In 2017 IEEE international congress on big data (BigData congress) (pp. 557-564). Ieee.

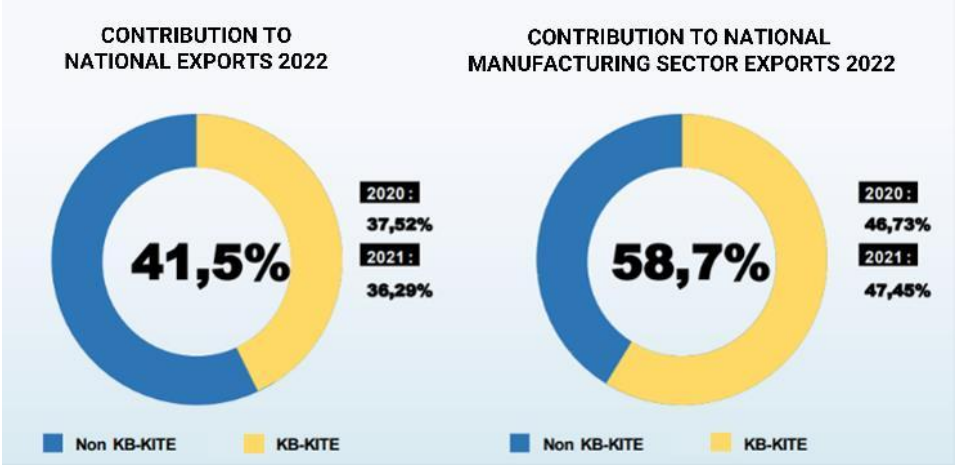
APPENDIX

Figure 1. Import Value and The Number of Enforcement to Illegal Imports



Source: Adapted from Statistics Indonesia (2024) and Annur (2021)

Figure 2. Contribution of KB-KITE to National Exports



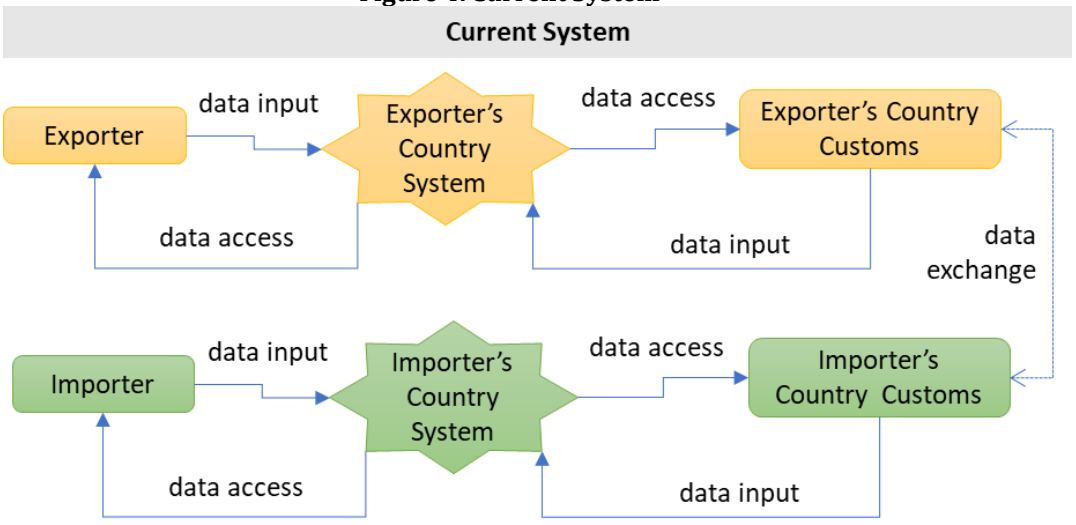
Source: Indonesia Customs (2023)

Figure 3. Indonesia and Malaysia Trading Partners 2023

Rank	Indonesia		Malaysia	
	Major Export Markets	Major Import Sources	Major Export Markets	Major Import Sources
1	China	China	Singapore	China
2	USA	Japan	China	Singapore
3	India	Thailand	USA	USA
4	Japan	South Korea	Hongkong	Taiwan
5	Philipine	USA	Japan	Japan
6	Malaysia	Australia	Thailand	Indonesia
7	South Korea	Singapore	ROK	ROK
8	Singapore	Malaysia	Vietnam	Thailand
9	Vietnam	India	Indonesia	Saudi Arabia
10	Taiwan	Vietnam	Australia	Australia

Source: Adapted from Ministry of Trade of Republic of Indonesia (n.d) and Ministry of Investment, Trade and Industry of Malaysia(2023)

Figure 4. Current System

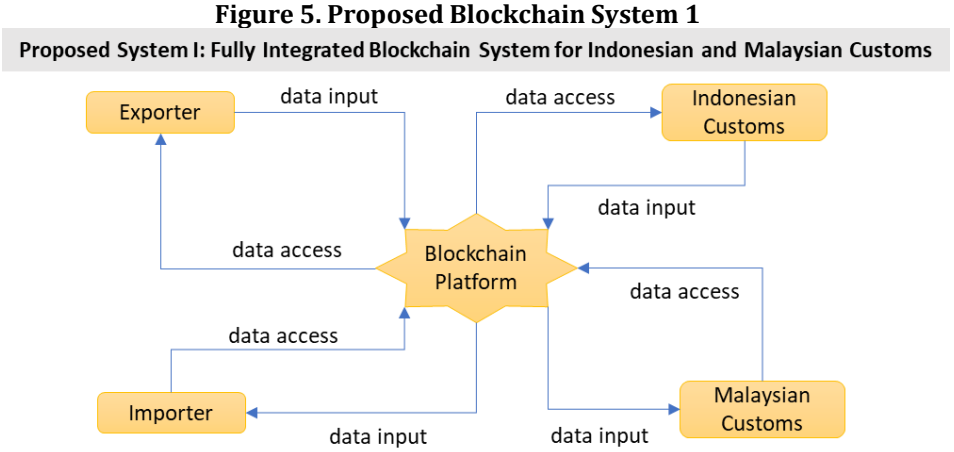


Features:

- Each country is running their own system
- Data/information-sharing depends on country's agreement (typically based on request and subject to approval)

Source: Author's own

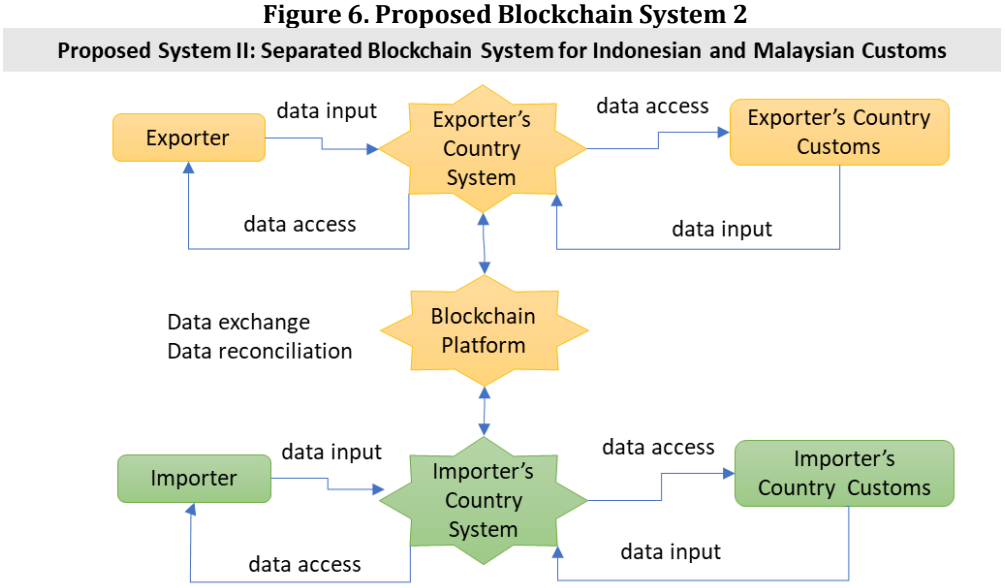
Figure 5. Proposed Blockchain System 1



Features:
- Partner countries build and jointly run the system
- Real-time information-sharing
- Data access are limited for each authorized entity (only relevant data can be accessed)

Source: Author's own

Figure 6. Proposed Blockchain System 2



Features:
- Partner countries or third party build a separate system for data exchange
- The separate system serves as platform for exchanging and reconciling data
- Data access are limited for custom's authority

Source: Author's own

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