Enabling Supply Chain Visibility and Compliance Through Voluntary Information Sharing with Customs

A Case Study of the Global Quality Traceability System in China Customs

Zhou, Xin; Tan, Y.; Rukanova, B.D.

Publication date
2021

Document Version
Final published version

Published in
World Customs Journal

Citation (APA)
Zhou, X., Tan, Y., & Rukanova, B. D. (2021). Enabling Supply Chain Visibility and Compliance Through Voluntary Information Sharing with Customs: A Case Study of the Global Quality Traceability System in China Customs. *World Customs Journal*, *15*(2), 129-150.

Enabling Supply Chain Visibility and Compliance Through Voluntary Information Sharing with Customs: a Case Study of the Global Quality Traceability System in China Customs

Xin Zhou, Yao-Hua Tan and Boriana Rukanova

Abstract

The promotion of digital customs and data analytics have led customs administrations to seek to improve their analytics capabilities and exploit data from the trade community. Despite the increased data analysis capabilities of Customs, the data available to them are still limited to the current mandated declaration. If businesses are willing to share additional commercial information with Customs, it will enable them to make a more accurate risk assessment and ensure compliance. As a new form of Customs and business partnership, voluntary information sharing can be a supplementary data source to the mandated declaration and enable Customs to exploit additional commercial information. This study analysed an exploratory case study on the Global Quality Traceability System (GQTS) initiated by China Customs to investigate how voluntary information sharing can be achieved, and to explore the benefits for the participants. This study demonstrated that voluntary information sharing with Customs implemented through a data pipeline enhanced supply chain visibility and ensured compliance. The private companies who shared information contributed to the supply chain visibility and in return benefited from it.

1. Introduction

The development of digital technology and its implementation in international trade has led customs administrations to seek to improve their analytics capabilities with additional data and advance commercial information. Currently, the primary data sources are supply chain actors. Supply chain actors (that is, exporters, importers and carriers) are obligated by law to submit data to customs administrations regarding exports, transits and imports as part of advance cargo information schemes and actual customs declarations. The data held by Customs should be complete, reliable, accurate, detailed, timely and "fit for the use" (Wang & Strong, 1996). However, in reality, because of the fragmentation of supply chain information, Customs only receives partial information regarding the transactions and international movements instead of complete trade data. The main data source available to customs officers is limited to the current mandated customs import and export declaration. If more data were available for customs administrations, different categories of data could be combined and correlated, allowing the identification of trends and patterns in the subjects of control

(that is, cargo, conveyances and people), and the accuracy of data in question could be ascertained and verified (Okazaki, 2017). However, if Customs increases the fields and documents that must be mandatorily submitted, it will inevitably add to the administrative burden of traders, which is contrary to the minimum information necessary principle stated in the Revised Kyoto Convention.[1] Instead of having merely declaration data available, another possible approach is that Customs collaborates with business and encourage companies to share more commercial data voluntarily as a complementary information source to the traditional mandatory declaration. As a new area of Customs to business collaboration, voluntary information sharing underscores the changing role of Customs to align with business partners in information sharing via digital trade infrastructures (Rukanova et al., 2018), such as data pipelines (Hesketh, 2010), to create public value. A data pipeline can be seen as a web-based, seamless digital infrastructure, which links the systems of multiple parties in the international supply chain (Hesketh, 2009; 2010).

Voluntary information sharing differs from the mandated declaration in various aspects, such as the scope, the transmission, the point of time and the provider of information. In the mandated declaration, the law stipulates what should be submitted (the documents required, the field to be filled), how to submit (the interface between business and customs, such as Single Window), when to submit, and who is obliged to submit (the declarant). In comparison, voluntary information sharing has the nature of a public-private data partnership. The business can share data beyond the scope of the mandated declaration, or transfer data via IT means other than the legally required business and Customs interface, or provide the information in advance of the mandated declaration, or add more parties to the supply chain as information providers, such as the exporter.

This collaborative voluntary information sharing emphasises the 'value proposition', which focuses on both profit maximisation for businesses and public policy goal attainment for governments (Koliba et al., 2017). Despite all the perceived benefits for Customs, however, it is challenging to achieve successful voluntary information sharing considering the willingness of the business, the complexity of governance (Rukanova et al., 2020), and more importantly, the commercial interest. Businesses will cooperate with Customs only when voluntary information sharing can bring commercial interest and trade facilitation, like expedited customs clearance of goods at the border. It has been demonstrated that businesses can benefit from information sharing with their commercial supply chain partners (business-to-business, B2B) to achieve supply chain coordination (Lee et al., 1997). However, the commercial interest in launching business-to-government (B2G) voluntary information sharing is not apparent. This is challenging because businesses and Customs may have conflicting goals despite their common interest in supply chain visibility and security. The primary goal of businesses is to increase profits, following laws and regulations, whereas customs play the dual role of a business partner and police officer (Prokop, 2017). Furthermore, the initial setup and transaction costs with authorities should also be considered (Grainger, 2014).

Despite all the challenges, with the growing evidence showing the value of public-private data collaboration, the purpose of this paper is to investigate how voluntary information sharing with Customs is achieved and what the benefits are for all stakeholders. The first part of the question involves two sub-questions: (1) what to share, or the types of data that are shared voluntarily beyond the scope of the mandatory declaration, and (2) how to share, or what are different approaches through which customs platforms connect to the business IT system. To answer the second part of the research question, we will focus on identifying the benefits of the stakeholders involved. With relatively few examples of voluntary information sharing with Customs at a global scale, our analysis is based on an in-depth case study of the Global Quality Traceability System (GQTS) in China, which is mainly used in trade via cross-border e-commerce channels. As a data pipeline, GQTS enables different parties in the global supply chain such as suppliers, retailers, logistics providers, and third-party quality inspection institutions that join the system voluntarily to share information to prove the quality of their product.

The remainder of the paper is structured as follows: in Section 2, the related literature and theoretical background are reviewed. In Section 3, the research methodology is explained. The background of GQTS is described in Section 4. The research questions are answered in Sections 5 and 6. The findings of voluntary information sharing to customs from the case study are discussed in Section 7. We end this paper with conclusions in Section 8.

2. Literature review

2.1 Cross-boundary information sharing

Cross-boundary information sharing with IT is defined as the collaboration or interconnection of different information systems or telecommunication technologies to share data between entities by using a common conceptual schema (Barki & Pinsonnault, 2005). Yang, Zheng, and Pardo (2012) identified boundaries as being hierarchical, departmental, personal, geographical, developmental, procedural or sectorial. Studies have investigated the determinant factors in cross-boundary information sharing. The factors include organisational and managerial, technological, political, and policy (Yang & Maxwell, 2011; Yang & Wu, 2014; Chen & Lee, 2017). Meanwhile, difficulties in information crossing boundaries are also observed, such as different data formats and system incompatibilities (Comfort, 2007), as well as the cost and complexity of implementation (Fawcett et al., 2007). To overcome these difficulties, studies have emphasised the importance of trust and trust-building for cross-boundary information sharing initiatives (Gil-Garcia et al., 2010) as trust can influence the possibility of information sharing and information quality (Li & Lin, 2006).

From a technical perspective, cross-boundary information sharing is supported by various types of inter-organisational systems (IOS), such as B2B, government-to-government (G2G), or G2B. Studies on cross-boundary information sharing are mostly related to public sectors, such as e-Government (Lee et al., 2011; Navarrete et al., 2010). Although studies have shown that transforming B2G information exchange is the next frontier in reducing government spending while improving performance (Bharosa et al., 2013), little attention has been paid to the voluntary interaction between businesses and the government (Susha et al., 2019; Rukanova et al., 2020). One of the main obstacles is that businesses are often reluctant to share information. The willingness of the business is a determinant factor if they are not obligated to share (Fawcett et al., 2007). Therefore, adopting a partnership–data process perspective is suggested to increase partners' willingness to share information (Du et al., 2012).

2.2 Supply chain visibility

Information sharing between supply chain members can coordinate orders and reduce the bullwhip effect (Lee et al., 1997). In the literature, the topic of supply chain visibility has received increasing attention (Ouyang, 2007; Caridi et al., 2014). Supply chain visibility is considered essential to the performance and competitiveness of the supply network (Bartlett et al., 2007; Pradhan & Routroy, 2018). Increased visibility could increase responsiveness (Williams et al., 2013) and benefit logistics operators (Zhang et al., 2011) especially in the context of the global supply chain. However, the challenge of sharing information in the global supply chain increases when customers and suppliers are spread throughout the world (Shore, 2001). Problems with information transparency remain severe in the extended supply chain (Steinfield et al., 2014). It is often the case that one member of a supply chain may not have detailed knowledge of processes in other parts of the chain (Christopher & Lee, 2004). This lack of visibility increases the vulnerability of supply chains to disturbance or disruption. In particular, governments, especially border control agencies, also require supply chain visibility to improve decision-making and enhance supply chain security for governments

involved in policymaking, monitoring, and control of international trade (Kothmann, 2007; Marcel et al., 2007). Researchers have recommended several approaches to increase supply chain visibility with the support of IT infrastructures, such as inter-organisational information systems (IOIS) (Humphreys et al., 2001) and tracking and tracing systems with radio frequency identification (RFID) (Zhou, 2009; Musa et al., 2014).

2.3 Customs–business partnership

Customs–business partnerships are an implementation of cross-sector collaboration (Bryson et al., 2006). As one of the three pillars in the SAFE Framework of Standards to Secure and Facilitate Global Trade (World Customs Organization [WCO], 2021), it is suggested that each customs administration should establish a partnership with the private sector to promote involvement in ensuring the safety and security of the international trade supply chain. To build successful Customs–business partnerships, voluntary engagement is a key desirable factor, which is based on shared interests and goals, mutual trust and respect (WCO, 2015). In current customs and business partnership programs, such as Authorized Economic Operator (AEO) or Customs-Trade Partnership Against Terrorism (C-TPAT), which are the most influential worldwide, a collaborative relationship is established between government and private sectors. For AEO companies, Customs changes from a transaction-based auditing to a system-based auditing approach because the application of advanced IT serves as signalling for the business that they have good internal controls (den Butter et al., 2012).

Data collaboration for the common good has now been recognised as a good opportunity to enable trust and innovation through public-private partnerships (World Economic Forum [WEF], 2019). However, there are relatively few examples of business-Customs information sharing initiatives in the customs domain and limited research on this topic. Voluntary business-Customs information sharing is not currently necessary for AEO or C-TPAT status worldwide. Using observations of an example of business-Customs information sharing based on a pilot project – FloraHolland − Rukanova et al. (2020) built a theoretical framework to understand the governance process, context, factors and benefits related to voluntary information sharing. As data analysis is increasingly used in border management, the Customs and business partnership is expected to expand to data collaboration. Voluntary information sharing with Customs, although promising, has relatively few successful examples reported on a global scale so far. More studies need to be done to investigate how voluntary information sharing with Customs can be achieved and the incentives for all the parties involved.

2.4 Data pipelines and voluntary information sharing

Real-time, accurate data captured upstream and updated as the goods move in the data pipeline (Hesketh, 2009; 2010), which enhances supply chain visibility and reduces the information fragmentation in global trade. Based on the integrated commercial data from the data pipeline, Customs will make a more accurate risk assessment of the shipments. This approach, in which Customs reuses business data from the existing IT infrastructure of businesses for government control purposes, is described as “piggybacking” (Tan et al., 2011). There are various advantages of piggybacking, including access to better quality of business data from the source.

Piggybacking on the existing IT infrastructure of businesses implies that such a data pipeline is driven by business. Therefore, developing and operating a data pipeline on a global scale must be done by the private sector since government have no jurisdictions outside their countries (Klievink et al., 2012). In current data pipeline research, the initiatives for data pipeline development are mostly business-driven, such as the FloraHolland initiative (Rukanova et al., 2017), the OneTouch case (Hu et al., 2016) and the TradeLens platform (Jensen et al., 2019). The scope of information exchange covered by the data pipelines above are from the seller/consignor to the buyer/consignee and the interactions in between include B2B, B2G and G2G (Rukanova et al.,2018).

The interaction with the government system via a data pipeline means that businesses are willing to share more commercial information with the government voluntarily. Therefore, it is critical to identify the economic drivers for the business (Klievink et al., 2012). In the current research, the benefits from such voluntary sharing are mostly identified as enhanced visibility across supply chains (Jensen et al., 2019) and improved efficiency as well as effectiveness (Rukanova et al., 2020). In addition to the voluntary information sharing with Customs, the current research also shows that combining data pipeline capability with Coordinated Border Management (CBM) can bring more benefits for stakeholders. As shown in the FloraHolland initiative, the collaboration of Customs and plant protection organisations was fostered by parallel procedures based on the data pipeline (Rukanova et al., 2017). This indicates the government may play a bigger role in voluntary information sharing in the context of a data pipeline especially in the case of multiple border agencies. If the government leads a data pipeline, will the objectives, the participants and the benefits for the stakeholders differ from these business-driven initiatives? In this study, we will further discuss the role of government and explore the potential public value that could be created with more parties involved besides business and Customs.

3. Research methods

Case study methodology was employed to conduct this exploratory research. This methodology is appropriate when the research goals are to understand 'whys' or 'hows' (Yin, 2003). Accordingly, the present methodology was designed to understand how and why Customs-business collaboration should be implemented because the importance of such collaboration is most recognised in the literature, but the studies on voluntary information sharing with Customs are limited. The present study focused on the GQTS case from Chinese Customs.

Data were collected from interviews, documents and reports. There were a total of 12 interviewees in the study. The interviewees belong to two major groups, customs officers and participants from the private sector. Among the interviewees from China Customs, some customs experts were from the former China Inspection and Quarantine Bureau (CIQ), who had a background in commodity quality inspection. The interviewees from the private sector included importers, a logistics service provider in a bonded warehouse, a trader and the IT provider of GQTS. In this study, data were collected from interviews with customs officers and from documents provided by two regional customs offices, Fuzhou and Guangzhou, where the GQTS was launched. These interviews provided detailed information regarding the background of GQTS, the motivation of Customs, the key business players in the supply chain and the perceived benefits for each party. Second, data were collected from interviews with the companies who participated in the project. These interviewees explained why and how businesses would join these initiatives, which confirmed what the benefits for the business were. Third, a field investigation was conducted in Pingtan Port, a subordinated customs office of Fuzhou, where many cross-border e-commerce companies participating in GQTS are located. This field investigation allowed researchers to witness the whole customs control process of GQTS.

For data analysis, we focused on what data were voluntarily shared, how they were shared and what were the benefits for the stakeholders. First, we analysed the scope of data voluntarily shared and identified what data were beyond the mandated declaration. Second, we investigated the business-government interface and the process of voluntary sharing. Finally, we analysed whether each party had realised the expected benefits after engaging in voluntary data sharing, including the improvement of business in terms of sales growth and customs clearance time, as well as the value for Customs and customers.

4. Case background

The flow of consignments through cross-border e-commerce channels has rapidly grown in the past few years. These consignments are small parcels that together carry various goods from various sources and consignees, and their shipment represents a considerable challenge for border control agencies. Specifically, Customs requires decisive measures to cope with fiscal, safety and security risks that are entailed by goods of, for example, an illicit, restricted, counterfeit or pirated nature. It is crucial for Customs to access timely and accurate information, ideally from the source company.

The GQTS is an IT platform that makes it possible to integrate information from upstream factories, traders, e-commerce platforms, border control agencies and downstream domestic consumers along the cross-border e-commerce supply chain.[2] It was primarily initiated by the China Inspection and Quarantine Bureau (former CIQ) in 2015 in the Nansha area of the Port of Guangzhou,[3] with the aims of (1) ensuring the quality of imported products and (2) combating piracy and counterfeiting through cross-border e-commerce channels. This platform resulted in a significant increase in trade volume in the Nansha area. In 2015, it was awarded 'Best Practical Case of a Free Trade Zone in the Country' by China's Ministry of Commerce. In 2017, the initiative expanded its scope to the parallel import of vehicles[4] and to export purchases in the market[5] because these two types of trade share common features with business-to-consumer (B2C) e-commerce, such as the small trade volume per order and the presence of multiple sources. These features make it difficult for authorities to identify a product's source and verify the product's quality.

In 2018, the jurisdiction of China Customs was expanded to cover entry-exit inspection and quarantine, enabling Customs to make full use of the data in this platform to prevent a wider range of risks. At present, the GQTS is being piloted in many ports under the authority of China Customs − such as the Fuzhou regional customs office.[6] The GQTS went online in Fuzhou through the China (Fujian) International Trade single-window platform in March 2019 and has been in operation since September 2019. By 2019, 413 companies had access to the system and 1,800,000 commodities had been traced in the Fuzhou region.[7] China's leading cross-border e-commerce B2C platforms, such as Tmall,[8] have since joined the system.

At present, Customs uses GQTS to reduce the following risks: (1) infringement of intellectual property rights, which arises from the import and sale of counterfeit goods (especially luxury goods) without the permission of the brand owner; (2) quality, which arises from the unwanted entry of unsafe or substandard products (because China Customs is also responsible for inspection and quarantine, Customs must ensure that imported goods conform to national regulations governing health, safety, and environmental protection); (3) logistics, which arises from fabricated import logistics data − such as those pertaining to the place of origin − or from the mislabelling of domestic goods as imported goods; and (4) fiscal, which arises from understatement of the real price for tax and duty evasion.

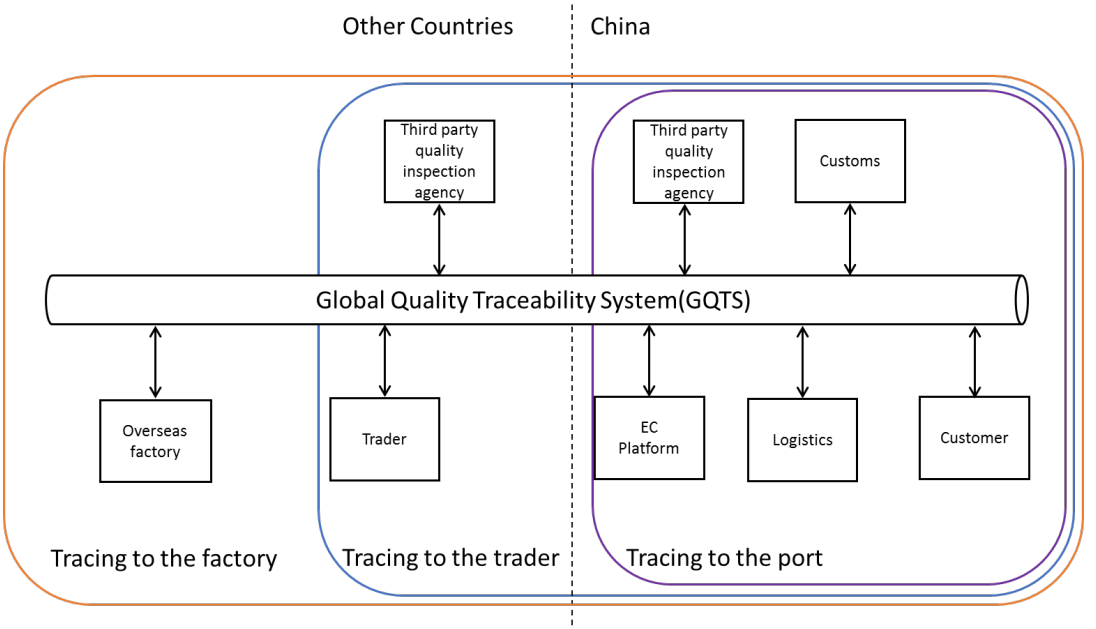
GQTS integrates the data from upstream manufacturers and third-party quality-inspection institutions abroad as well as from traders, e-commerce platforms, domestic logistics providers, border control agencies and consumers. The trader is the one who purchases the goods from multiple sources and exports them to China. For commodity inspection, the importer must submit the inspection certificate, which states that the goods have met the national standards of the importing country. Typically, third-party quality-inspection institutions, which can be domestic or overseas, issue these inspection certificates. The GQTS connects to the corresponding major domestic third-party inspection agency and to some of the third-party inspection agencies abroad who have dual accreditation by the host country and the China National Accreditation Service for Conformity Assessment (CNAS).

GQTS is a typical data pipeline, intending to ensure supply chain visibility for all parties, including the final consumer. The inclusion of the final consumer highlights a special feature of this case, since most of the data pipeline pilots reported in literature focus primarily on providing extra control data for border inspection agencies. In this case, citizens also receive direct benefits from this data in the data pipeline. The system acquires the original information relating to commodity quality from multiple sources − including the manufacturer, trader (distributor), third-party inspection agency, e-commerce platform, logistics provider, border control agencies and the final consumer. All information is shared through the GQTS with all related parties. The GQTS itself does not judge whether the products satisfy the requisite standards but rather ensures supply chain visibility and traceability to guard against counterfeits or substandard products. Specifically, when an offending product is identified, the information in the GQTS can be used to easily identify the parties related to the product. Its traceability can be divided into three levels by the stage the supply chain data source is at:

1. Tracing to the factory. When an upstream factory or brand owner agrees to connect its enterprise resource planning (ERP) system to the GQTS, this connection allows downstream actors to trace the source of production.
2. Tracing to the overseas trader (distributor). If the trader agrees to connect its system to the GQTS, this connection initiates the process of distribution. Therefore, information can be traced to the trader through the GQTS.
3. Tracing to the port. This refers to trade that can be traced at the port level after export or import in China. The information includes the declaration, clearance and local logistics.

Therefore, in the three levels above, details of the content of the traceable information degrades at each level. The data chain of tracing to the factory is the longest and provides complete information, in contrast to the other two. The GQTS can provide different levels of traceability for a given set of participants from various stages in the supply chain. Such a multilevel design provides flexibility for the private sector to join the platform and makes it possible to start small from the port-level information sharing and gradually expand to the upstream supply chain. GQTS architecture is illustrated in Figure 1.

Figure 1: GQTS architecture



Notably, the GQTS extends the data pipeline to the end of the supply chain (that is, the customer) through QR code functionality. Specifically, each product has a unique QR code that can be used to access the information in the data pipeline. After the products enter free circulation, the final customer can access information on the product pertaining to, for example, origin, quality, logistics and clearance through scanning the QR code label on the product with the GQTS app. Every item has its unique QR code. For example, the Japanese-made diapers of Kao Corporation are very popular in China and there are counterfeited products. Thus, Kao Corporation joined the GQTS in Nansha at the factory level. When their diapers are imported into Nansha Port, customers can scan the QR code of the product or the parcel with their smartphones to access product information. All the information is provided by the different parties in the supply chain and integrated into the GQTS.[9] Another example is Red Seal brown sugar, which originated in New Zealand and was imported from Sydney in Australia to Nansha Port in China. The traceable information pertains to the dates and ports of departure and arrival as well as the commodity quality inspection certificate notarised by GIQCI[10] in Australia, an agency that is also recognised by the Port of Nansha.[11] As a government-driven project, customs authorities and local governments in China made the initial investment in GQTS and maintained it. All actors in the supply chain, including consumers, contribute to information sharing and use the platform free of charge. Business users only bear the cost of connecting their in-house IT systems to the GQTS.

5. How is voluntary information sharing with Customs achieved

5.1 What to share

In China, the mandated declaration submitted to Customs in the case of cross-border e-commerce trade includes order data (from transactions on the e-commerce platform), payment data (from consumer payment records) and logistics data (from domestic delivery to consumers), in addition to declarations and the requisite certificates. Typically, traders abroad gather quality-related information from the

manufacturer or the inspection institutions and provide it to the border control agencies. However, such information is second-hand and may be insufficiently reliable for control purposes. With the information voluntarily shared by all parties to the GQTS, especially from factories and institutions overseas, Customs can integrate the fragmented pieces of information in the supply chain to obtain more detailed and original information that goes beyond the scope of the declaration, which is typically submitted by an intermediate trader in the supply chain. The manufacturer or brand owner voluntarily shares production information, and third-party quality-inspection institutions voluntarily share their inspection information. The voluntarily shared information comes directly from upstream parties and is thus more detailed, complete and accurate. A customs officer from the project group with a background in commodity inspection stated the following:

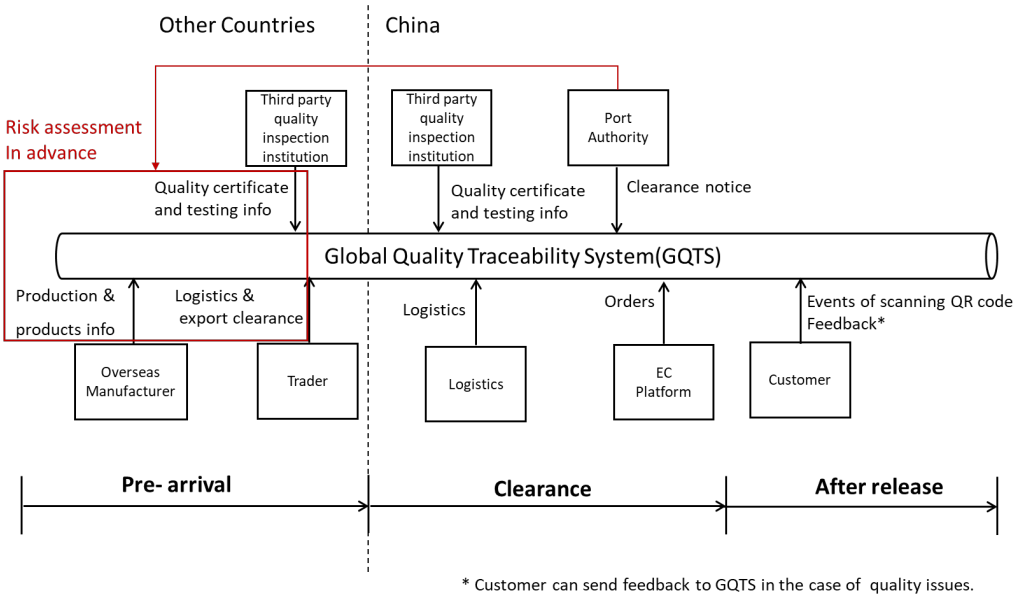
> If the data were not within the scope of the declaration, we used to have no access to them. With the GQTS, data that are scattered across various stages in the supply chain can be collected… Take factory-level traceability as an example. Actors from the whole supply chain − including the manufacturer, trader, warehouse and overseas inspection agencies − will upload product-related data; the content of such data depends on the actor's function in the supply chain. For example, manufacturers upload data on the production date, production line arrangement, raw materials, as well as the date of packaging and delivery, and inspection agencies upload data on the date and results of the inspection.

To ensure the quality of the information imported into the system, the border control agencies will sample and inspect product quality randomly to confirm the information in the GQTS. If the product quality does not conform to the information provided in the GQTS, the businesses concerned will be penalised accordingly. The third-party inspection institution may be disqualified if it has committed fraud.[9] In addition to being used for border control by Customs, the voluntarily shared information on the product is also accessible to other actors in the supply chain for them to manage the supply chain and ensure compliance.

5.2 How to share

As exemplified in factory-level traceability, the data transfer process in the GQTS is illustrated in Figure 2. Before the goods arrive at port, the relevant parties push the information to the GQTS. Specifically, the manufacturer pushes production information, the trader and logistics providers push logistics information and third-party quality-inspection institutions push inspection information. With such information sent in advance, China Customs performs cross-validation and a preliminary risk assessment in advance. When the products arrive at the port, customs conduct risk profiling. If physical inspection is necessary, the Customs officer can scan a QR code to access information about the product in the GQTS, thus speeding up inspection and release. The clearance notice will then be displayed in the GQTS. After the products are released and enter free circulation, customers and local authorities can use the GQTS apps or WeChat applet[12] to scan the QR code on the product to access tracking information. Should the product be of substandard quality, the customer can lodge a complaint or make an inquiry on the GQTS app or WeChat applets. All customer feedback is sent to government authorities and to supply chain partners. Therefore, the flow of information takes the form of a closed-loop information chain, with two-way information flow from the source to the customers and from the customers to the source. Hence the customer knows that their feedback information will have a negative impact on fraudulent parties, and this will provide an extra incentive for the companies to act compliantly.

Figure 2: Information shared on the GQTS



Regarding the interface between business and government, the GQTS is integrated with the in-house ERP systems of users through application program interfaces (API) that are designed for ease of setup and use. A customs officer from the project group with a background in commodities inspection stated the following:

> They connect [to the GQTS] through APIs. It is more convenient. They don't need to fill [the data] in manually. We have prepared several standard interfaces because the IT systems of each company may vary. They may make some slight technical changes to their system…Because many of them have ready-made data and those large enterprises have strong technical teams, it is very convenient for them to connect with us.

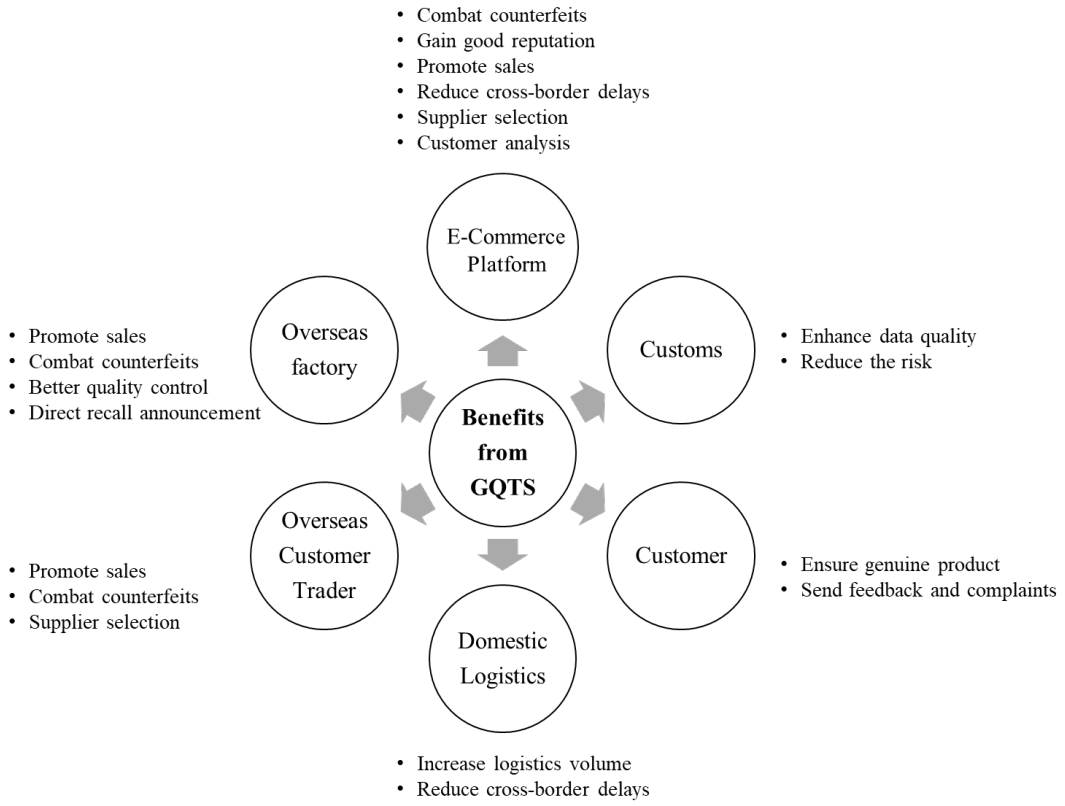
The general manager of Sizhou (a food trading company) recognised this open characteristic, and stated[9] "this system is very open. All qualified notarial, as well as inspection and testing institutions, can connect [to the GQTS] regardless of which country these institutions are located in."

A general manager of a logistics service provider in a bonded warehouse also confirmed that API connection was "affordable and not very complicated."

6. Benefits for all stakeholders

Voluntary information sharing by businesses with Customs in the GQTS reduces information asymmetry and increases supply chain visibility. This benefits government, businesses and consumers yielding a win-win situation that creates public and private value. All participants can benefit from voluntary information sharing, as illustrated in Figure 3.

Figure 3: Benefits for all stakeholders from GQTS



6.1 Benefits for business

6.1.1 Reducing counterfeits and promoting sales

After goods are released, the quality information, which the business voluntarily shares with Customs, as well as the declaration and clearance information, are all available to the final customers by the GQTS. Therefore, the business can prove their products are genuine, gain the trust of customers and promote sales. All the supply chain parties, directly or indirectly, will benefit from this. For the manufacturer and brand owner, they are burdened by the heavy cost of combating counterfeiting and copyright infringement, so they are willing to use the GQTS to reduce such costs. A customs officer from the project group stated that "a famous brand told us that they spend several hundred million renminbi[13] annually on combating counterfeiting. Joining this [the GQTS] is akin to us being able to furnish a certificate of identification: customers can easily distinguish between genuine and counterfeit goods."

In weeding out counterfeits, e-commerce platforms ensure that only genuine goods are sold, which increases consumer trust. A representative of Funsens, a cross-border e-commerce platform, said that the GQTS has not only protected consumer interests but also helped cross-border e-commerce enterprises gain consumer trust. As the logistics manager of an e-commerce platform stated,[14] "this system builds a channel of trust between e-commerce enterprises and customers. From a consumer's perspective, this system better assures them of the product's safety and quality."

This is also confirmed by a manager of an alcoholic beverage importer. He said, "the most important benefit is that we can transfer the quality information to consumers…In the future, the sales volume of trustworthy companies is sure to rise."

Logistics service providers play an important role in the GQTS and they indirectly benefit from sales increases. Their systems in the bonded warehouse are connected to the GQTS and upload information such as storage information and customs release time. They are also in charge of printing and pasting the QR tags on express packages of the products ordered. The increase in sales of e-commerce platforms will also promote the logistics business, so they are willing to share information and provide such extra services for their client.

6.1.2 Reducing cross-border delays

The participants of GQTS noted the benefits of fewer delays when their goods cross the border after voluntarily sharing more information with Customs due to the improved supply chain visibility. Customs can access the quality-inspection reports of overseas inspection agencies, which simplifies business procedures and reduces the need to wait for quality-inspection results upon the arrival of goods. The information shared voluntarily on the GQTS − pertaining to the product name, manufacturer, country of origin and the quality-inspection certificate issued by third-party inspection institutions − prior to the arrival of goods helps Customs at the port of entry to conduct a risk assessment in advance. This greatly reduces customs clearance time when the goods arrive in the port. According to a customs manager of an alcoholic beverage importer, the customs clearance time was significantly reduced after joining the GQTS, "the customs release time used to be 2–3 days. Most of the time, it was two days. Now, the products will be released on the day of arrival except for when the cargo is randomly sampled for inspection."

Since logistics parties can operate more efficiently with the GQTS, their clients, such as e-commerce platforms, can reduce their inventory costs due to fewer inspections and faster customs clearance.

6.1.3 Improving supply chain management

Information sharing is essential to achieve supply chain coordination and reduce the bullwhip effect, in which the fluctuations of orders increase as one moves upstream in the supply chain. For the GQTS, in return for voluntarily sharing the commercial data, businesses gain access to more supply chain data on the respective platforms; these data come from customs authorities and other businesses, allowing the supply chain to be better coordinated and optimised. Firstly, the traceability of the GQTS can help manufacturers and the brand owner improve their quality control using the information on the production line and production batch. For example, a representative of Lesso Group stated that their supply chain includes overseas factories and distributors. Before joining the platforms, quality control of delivered products was difficult for the headquarters of Lesso Group. With direct global traceability from the platforms, they can now trace a product's origin down to the exact factory and even machine, and they can also identify the materials used for every product sold in the overseas market. Another example is Johnson & Johnson (China). Their e-commerce director stated that the GQTS has helped the company solve its reputation problem among Chinese consumers:[15]

> We want to have regular products enter China. Johnson & Johnson has many factories around the world, so the products in China are sourced from all over the world. With this system, we can trace the origin of imported shipments to ensure that products are highly compliant.

Secondly, manufacturers can use the recall module in the GQTS to contact the end users of a product to be recalled. Manufacturers used to find it difficult to notify customers of a recall of some specific batch of products from the global market. The recall notification module in the GQTS was thus designed to remedy this by sending a recall message to the customer that bought the product. Thirdly, the statistics of scanning events can be reused by the business for commercial purposes. After the products enter

free circulation, the QR code scan events will be recorded by the GQTS if customers scan the code on the products. If the e-commerce platforms can access the aggregated data of scanning events in certain regions, they can perform market analysis and plan sales promotion according to the customer regional distribution data indicated by the scanning events. In sum, the GQTS provides end-to-end traceability across the supply chain with the information channel extending to the final customer. All private-sector entities − including upstream manufacturers, traders or downstream cross-border e-commerce platforms − can use the platform's data to improve their supply chain decision-making, such as that pertaining to quality control, supplier selection or consumer analysis.

6.2 Benefits for the government

The GQTS was driven by border control agencies in China, including Customs and the former CIQ. As a government authority, Customs has aligned goals with business on promoting the growth of trade volume, facilitating trade and ensuring product quality. In addition, voluntary information sharing through the GQTS helps Customs to enhance their data quality and reduce their risk.

6.2.1 Enhancing data quality

With integrated information, the GQTS remedies the problem of information fragmentation in the case of goods that are imported in small quantities − such as those from cross-border e-commerce. These pieces of information constitute proof of the product's authenticity; thus, Customs can better ensure the quality of these goods. The GQTS − in establishing a global data pipeline for cross-border e-commerce throughout the entire supply chain − has successfully integrated data on production, logistics and consumer feedback as well as from quality-inspection reports. Furthermore, customer feedback provides the best verification of a product's quality. The detailed information comes from a wide range of sources along the entire global supply chain. The GQTS has expanded the scope and depth of data at Customs' disposal.

It is important to point out that significant improvement of customs data quality relies on the broad coverage of the tracing system for companies and commodities. Although more and more companies have joined the GQTS, currently the proportion of participants in total is still relatively small due to voluntary sharing rather than compulsory engagement. In addition, more domestic and foreign notarisation institutions and testing institutions still need to be included in the system. The more data providers that join the system, the more significant the improvement of customs data quality, and thus more trade facilitation can be provided to trade.

6.2.2 Reducing the risk

With more information voluntarily shared, Customs makes risk assessment more accurate and reduce the risks of counterfeiting. The QR code-accessible information provided by manufacturers and brand owners indicates a product's quality, which allows non-compliant actors to be expelled from the market, thereby reducing counterfeiting risks. Businesses that voluntarily share their data exhibit a willingness and capacity for compliance, which allows Customs to categorise these businesses as being low risk. These businesses should also have access to incentives and simplified customs clearance procedures, which would allow Customs to concentrate its compliance resources on high-risk entities. Voluntary information sharing is decisive in helping Customs not only reduce but also detect counterfeiting risks. Using the original information in the traceability system, Customs can optimise the establishment of risk indicators and generate rules for risk profiling. Besides counterfeiting risks, Customs can also identify the risk of understating the price by cross-validating a declaration against data in the GQTS, which reflects the product's real transaction price. Also, Customs greatly benefits

from receiving risk-relevant data in advance, so they can also do the risk assessment before the goods arrive in the destination port, Guangzhou. Hence for these goods, customs clearance times in Guangzhou can be significantly reduced, and Customs can offer more trade facilitation to trade.

6.3 Benefits for customers

The GQTS provides a public service to customers. Customers can access detailed information on a product − such as those pertaining to its manufacture, quality-inspection results and import history − by scanning the product's QR code through mobile apps or a WeChat applet. In recent years, it is popular for the retailer to provide a traceability function to the customers. Many companies also provide QR code functionality and tracking information to customers. However, the information comes from company databases, and there is a risk that companies tamper with such data deliberately. In contrast, the GQTS data are validated by Customs and are thus perceived by consumers to be more authentic and reliable. This was confirmed by the manager of an alcoholic beverage importer, who stated "the most important benefit is that we can transfer the quality information to consumers, and it is accurate and reliable since it is from customs."

Moreover, by lodging a complaint via the GQTS apps or WeChat applet, customers can seek redress from government agencies against being sold a defective product. In the case of products recalled by the manufacturer, customers receive timely recall announcements, allowing them to cease using a defective, and potentially dangerous, product.

7. Discussion

7.1 Creating supply chain visibility with data pipelines

The GQTS is a government-driven initiative aimed at encouraging businesses to voluntarily share additional information with Customs. However, information flow is not limited to one-way transfers from B2G. Instead, B2B, G2B, customer-to-business (C2B), and customer-to-government (C2G) information-sharing play indispensable roles in these initiatives. In this case study, the government provided the platform and enabled information exchange among private-sector entities. In doing so, the government achieved its objective of improving risk management by integrating fragmented pieces of information provided by various public-sector entities. In return, these private-sector entities enjoyed the benefits of increased sales, fewer cross-border delays and other supply chain optimisation opportunities. Thus, supply chain visibility served the interests of both the public and private sectors.

As a data pipeline, the GQTS has made visible end-to-end quality-related information pertaining to the global supply chain and highlights the two-way flow of information. In previous studies, the data pipeline has (1) a scope extending from the seller in the country of origin to the buyer in the destination country and (2) the objective of 'getting data from the source' (Hesketh, 2010), both of which imply that information flows from the upstream to downstream of the supply chain. However, the data pipeline in the GQTS is featured by information flow in two directions. Consumer feedback on poor quality products sent to the government (C2G) and businesses (C2B) plays an indispensable role in a closed-loop information chain and thus contributes to public value. Consumer feedback is visible to the supply chain partners as well as to Customs. The transparency of feedback puts pressure on the business to take measures to prevent poor quality goods in the future. This makes it then more attractive for consumers to add feedback information because they know Customs is aware of faulty products.

Traditionally, the relationship that businesses have had with Customs has revolved around compliance, avoiding penalties, and reducing the risk of supply chain disruptions, and business-Customs cooperation has centred on supply chain security and trade facilitation. If Customs has already done its utmost to facilitate trade, further improvements must therefore come from businesses. In the voluntary information sharing initiatives, the sharing of more data with Customs does not simply entail more simplified customs procedures for the participant, and legal requirements limit how far Customs can simplify their procedures. Therefore, as shown in this case study, with the information shared by the supply chain members, Customs has encouraged business participation through underscoring the commercial incentives afforded by improved supply chain visibility − a measure that goes beyond the streamlining of customs clearance, such as the reduction of inspection rates or giving priority to inspection.

7.2 Piggybacking and data reuse

The concept of piggybacking initially referred to Customs piggybacking on the existing IT infrastructure of businesses, doing so to reuse business data for policing compliance. Such piggybacking allows Customs to get access to better quality data from the source (Tan et al., 2011). As indicated in the case study, like the piggybacking and reuse of commercial data by the government for regulatory purposes in business-driven projects, businesses can also piggyback on government platforms to reuse data for commercial use. In the case of the GQTS, Customs uses the data for quality control, risk management and customs clearance of imported products. Businesses also reuse such data to conduct their own customer analytics and quality control, and consumers use such data to protect their interests. The declarations, which are submitted by the business to the government (B2G), are now shared with customers (G2C) for the products they bought, and reused as proof of product quality. Such reuse of data resulted in the formation of data collaboration partnerships among business, government and customers in the GQTS.

7.3 The role of government in voluntary information sharing

The GQTS in this case study is driven by the government and has yielded good results. This finding contrasts with those in the literature stating that data pipelines must be business-driven because of limitations in funding and in IT expertise and the government's inability to reach beyond jurisdictional limits (Klievink et al., 2012). Our analysis showed that the data pipeline can be government driven. Information sharing could be achieved on a voluntary basis instead of a mandated manner. If the government provides the incentive for the actors involved, there is no need for the jurisdiction outside the hosting country.

One advantage of a government-driven platform is to benefit a wider range of private sectors. In the FloraHolland initiative, the government was actively involved in working with the business to identify win-win scenarios. However, the business participants, who were also the main beneficiaries, were limited to a specific supply chain in this business-driven project. As a government-driven initiative, the GQTS was an open platform to meet the common needs of multiple stakeholders. According to interviews, some companies intended to provide traceability to consumers themselves, but the threshold for building a cross-border information communication platform was relatively high, especially for small cross-border e-commerce platforms. The GQTS met the common needs of these companies.

Another advantage of a government-driven platform is to engender trust. The GQTS transfers the information voluntarily shared and declared by business to customers. Its information flows from business-to-government-to-customers (B2G2C). In the view of customers, the data from the

government is more reliable than from business. Therefore, in the GQTS case, the government played a dominant role in coordinating stakeholders and ensuring the reliability of data in G2B and G2C data sharing.

7.4 Coordinated Border Management in the data pipeline

The case study also illustrated the critical role of the Coordinated Border Management (CBM) approach in the data pipeline. The GQTS was initiated by departments of the former CIQ and was further developed after the integration of the former CIQ duties and work force into China Customs in 2018. The GQTS facilitates intra-agency cooperation, which became the priority for China Customs after inspection, and the quarantine bureau was absorbed into China Customs.

The concept of a data pipeline was proposed for the customs field and was highlighted in the WCO's integrated supply chain management (ISCM) guidelines (WCO, 2018). In addition to customs authorities, other border control agencies have also called for seamless information exchange along the supply chain. The combination of data pipeline capabilities with the CBM approach was also exemplified in the FloraHolland case (Rukanova et al., 2017). In that case, the agencies cooperating with customs were the plant protection organisations. In the GQTS, intra-agency cooperation is involved in the commodity quality inspection department. Generally, the risk management of commodity quality inspection is obliged to extend to the upstream factories, which is consistent with the idea of obtaining data from the source in the concept of the data pipeline in the customs domain. Therefore, this example illustrates the value of building a data pipeline through cooperation between Customs and those agencies.

8. Conclusion

This study explored a type of business-government data partnership where businesses voluntarily share information with Customs using a new IT platform provided by the government. The main research question of this paper is *how voluntary information sharing with Customs is achieved* and *what the benefits are for all stakeholders.* This paper conducted a case study on the GQTS, a pilot project that has been recently adopted by several regional customs authorities in China. The first part of the main research question was answered by answering the sub-questions of *what to share and how to share.* We found that the data sources were expanded to include more parties upstream and downstream in the supply chain, and the shared data were more granular than those in the mandated declaration. The three-level traceability made the platform more flexible and scalable for the private sectors to join in. To answer the second part of the main research question, the benefits for all the stakeholders were explored. With these voluntary information sharing initiatives, customs enhanced data quality and improved risk management. Businesses gain consumer trust regarding the quality of their products, which increases sales. Furthermore, businesses benefit from the reduction of the flow of counterfeit goods masquerading as theirs, reduced cross-border clearance time and more optimal supply chain operations. In particular, the GQTS exemplified the extension of the current data pipeline to the final consumer to ensure data integrity throughout the supply chain. This active role of the final consumer is a novel feature that has not yet been described in the previous data pipeline literature. It provides an extra control function to companies in the data pipeline, in addition to the customs and third-party inspection controls. Thus, one could argue that in the GQTS the final consumer enhances the customs control function in the data pipeline. At the same time, this consumer feedback also supports the seller of goods, because it provides valuable marketing information which enables the seller to develop more attractive sales offerings, and hence increase its sales volumes to the consumers. Therefore, data

interaction in data pipelines should not be limited to its B2G and G2G. B2B, G2B, C2B and C2G information sharing also contributed to improving supply chain visibility, thereby generating public value.

As noted in the literature review, to solve the problem of poor data quality in the global supply chain, Hesketh (2010) proposed the concept of a data pipeline. Klievink et al. (2012) investigated this concept with respect to its potential benefits for businesses and government, noting that a data pipeline must be business-driven; however, that study found it challenging to identify the economic drivers for businesses. By contrast, in this study, the government led the data pipeline project. Customs can still obtain data from overseas sources that are outside its jurisdiction through voluntary information sharing mechanisms. This analysis indicated that with the right incentives, upstream companies abroad can be motivated to share their commercial data. Furthermore, the data pipeline concept implemented in the quality control of cross-border e-commerce in the GQTS enriches research on aligning data pipelines with CBM innovation.

Because research on data pipeline innovations has been centred on western countries, this study's investigation of a data pipeline in the Chinese context provides a fresh perspective into voluntary B2G information sharing. Now the system has been extended from one port to several ports in China. However, the initiatives are still regional pilots rather than general nationwide practices, which leads to the limited generalisation of this case study. How these initiatives perform over the long term and whether they can be implemented at a national level require further research. Furthermore, the benefits of voluntary information sharing enjoyed by businesses depend on local customs policies, which vary between countries. Such variability also affects how a program is designed and what the economic drivers are. Thus, follow-up research is needed to study the projects of different types of platforms (driven by business or government) in different countries to obtain a more overall understanding of the incentives for stakeholders.

Acknowledgements

This research is supported by Ministry of Education (MOE) in China, Humanities and Social Sciences Project of "Information collaboration mechanism for cross-border supply chain compliance" (No.19YJC630235). This research was also partially funded by the PEN-CP Project (nr. 786773) and the PROFILE Project (nr. 786748), which are funded by the European Union's Horizon 2020 research and innovation program. Ideas and opinions expressed by the authors do not necessarily represent those of all partners.

References

Barki, H., & Pinsonneault, A. (2005). A model of organizational integration, implementation effort, and performance. *Organization Science*, *16*, 165–179.

Bartlett, P. A., Julien, D. M., & Baines, T. S. (2007). Improving supply chain performance through improved visibility. *The International Journal of Logistics Management*, *18*(2), 294–313.

Bharosa, N., Janssen, M., van Wijk, R., de Winne, N., van der Voort, H., Hulstijn, J., & Tan, Y.H. (2013). Tapping into existing information flows: The transformation to compliance by design in business-to-government information exchange. *Government Information Quarterly*, *30*, S9–S18.

Bryson, J. M., Crosby, B. C., & Stone, M. M. (2006). The design and implementation of cross-sector collaborations: Propositions from the literature. *Public Administration Review*, *66*(s1), 44–55.

Caridi, M., Moretto, A., Perego, A., & Tumino, A. (2014). The benefits of supply chain visibility: A value assessment model. *International Journal of Production Economics*, *151*, 1–19.

Chen, Y., & Lee, J. (2017). Collaborative data networks for public service: Governance, management, and performance. *Public Management Review*, *20*(5), 672–690.

Christopher, M., & Lee, H. (2004). Mitigating supply chain risk through improved confidence. *International Journal of Physical Distribution & Logistics Management*, *34*(5), 388–396.

Comfort, L. K. (2007). Crisis management in hindsight: Cognition, communication, coordination, and control. *Public Administration Review*, *Supplement to 67*, 189–197.

den Butter, F. A. G., Liu, J., & Tan, Y.H. (2012). Using IT to engender trust in government-to-business relationships: The Authorized Economic Operator (AEO) as an example. *Government Information Quarterly*, *29*(2), 261–274.

Du, T. C., Lai, V. S., Cheung, W., & Cui, X. (2012). Willingness to share information in a supply chain: A partnership-data-process perspective. *Information & Management*, *49*(2), 89–98.

Fawcett, S. E., Osterhaus, P., Magnan, G. M., Brau, J. C., & McCarter, M. W. (2007). Information sharing and supply chain performance: The role of connectivity and willingness. *Supply Chain Management: An International Journal*, *12*(5), 358–368.

Gil-Garcia, J. R., Guler, A., Pardo, T. A., & Burke, G. B. (2010). Trust in government cross-boundary information sharing initiatives: Identifying the determinants. *Journal of South American Earth Sciences*, *44*, 1–10.

Grainger, A. (2014). Trade and customs compliance costs at ports. *Maritime Economics & Logistics*, *16*(4), 467–483.

Hesketh, D. (2009). Seamless electronic data and logistics pipelines shift focus from import declarations to start of commercial transaction. *World Customs Journal*, *3*(1), 27–32.

Hesketh, D. (2010). Weaknesses in the supply chain: Who packed the box? *World Customs Journal*, *4*(2),3–20.

Hu, R., Tan, Y. H., & Heijmann F. (2016). A new approach to e-commerce customs control in China: Integrated supply chain: A practical application towards large-scale data pipeline implementation. *World Customs Journal*, *10*(2), 65–82.

Humphreys, P. K., Lai, M. K., & Sculli, D. (2001). An inter-organizational information system for supply chain management. *International Journal of Production Economics*, *70*(3), 245–255.

Jensen, T., Hedman, J., & Henningsson, S. (2019). How Tradelens delivers business value with blockchain technology. *MIS Quarterly Executive*, *18*(4), 221–243.

Klievink, B., van Stijn, E., Hesketh, D., Aldewereld, H., Overbeek, S., Heijmann, F., & Tan, Y.H. (2012). Enhancing visibility in international supply chains. *International Journal of Electronic Government Research*, *8*(4), 14–33.

Koliba, C., Koliba, C., Wiltshire, S., Scheinert, S., Turner, D., Zia, A., & Campbell, E. (2017). The critical role of information sharing to the value proposition of a food systems network. *Public Management Review*, *19*(3), 284–304.

Kothmann, D. (2007). Global trade system: Development update. In: Bichou, B., Bell, M.G.H., & Evans, A. (Ed.). *Risk management in port operations, logistics and supply-chain security* (pp. 35–54). Informa Law from Routledge.

Lee, H., Padmanabhan, V., & Whang, S. (1997). Information distortion in a supply chain: The bullwhip effect. *Management Science*, *50*, 1875–1886.

Lee, J., Kim, H. J., & Ahn, M. J. (2011). The willingness of e-Government service adoption by business users: The role of offline service quality and trust in technology. *Government Information Quarterly*, *28*(2), 222–230.

Li, S., & Lin, B. (2006). Accessing information sharing and information quality in supply chain management. *Decision Support Systems*, *42*(3), 1641–1656.

Marcel, P. A, van Oosterhout A. W., & Veenstra, M. A. G. M. (2007, September 20–21). *Visibility platforms for enhancing supply chain security: A case study in the port of Rotterdam.* Proceeding of the International Symposium on Maritime Safety, Security and Environmental Protection, Athens.

Musa, A., Gunasekaran, A., & Yusuf, Y. (2014). Supply chain product visibility: Methods, systems and impacts. *Expert Systems with Applications*, *41*(1), 176–194.

Navarrete, C., Gil-Garcia, J. R., Mellouli, S., Pardo, T. A., & Scholl, J. (2010). Multinational e-Government collaboration, information sharing, and interoperability: an integrative model. *Hawaii International Conference on Systems Science*. IEEE Computer Society.

Okazaki, Y. (2017). Implications of big data for customs – how it can support risk management capabilities. *WCO Research Paper*, No. 39. http://www.wcoomd.org/-/media/wco/public/global/pdf/topics/research/research-paper-series/39_okazaki_big-data.pdf?la=en

Ouyang, Y. (2007). The effect of information sharing on supply chain stability and the bullwhip effect. *European Journal of Operational Research*, *182*(3), 1107–1121.

Pradhan, S. K., & Routroy, S. (2018). Improving supply chain performance by supplier development program through enhanced visibility. *Materials Today: Proceedings*, *5(*2, Part 1), 3629–3638.

Prokop, D. J. (2017). *Global supply chain security and management: Appraising programs, preventing crimes*. Butterworth-Heinemann.

Rukanova, B., Henningsson, S., Zinner Henriksen, H., &Tan, Y. H. (2018). Digital trade infrastructures: A framework for analysis. *Complex Systems Informatics and Modeling Quarterly*, *14*, 1–21.

Rukanova, B., Huiden R., & Tan, Y. H. (2017). Coordinated Border Management Through Digital Trade Infrastructures and Trans-National Government Cooperation: The FloraHolland Case. In: M. Janssen et al. (Eds.), Electronic Government. EGOV 2017. *Lecture Notes in Computer Science*, vol 10428. Springer. https://doi.org/10.1007/978-3-319-64677-0_20

Rukanova, B., Tan, Y. H., Huiden, R., Ravulakollu, A., & Heijmann, F. (2020). A framework for voluntary business-government information sharing. *Government Information Quarterly*, *37*(4), 101501. https://doi.org/10.1016/j.giq.2020.101501

Shore, B. (2001). Information sharing in global supply chain systems. *Journal of Global Information Technology Management*, *4*(3), 27–50.

Steinfield, C., Markus, M. L., & Wigand, R. T. (2014). Through a glass clearly: standards, architecture, and process transparency in global supply chains. *Journal of Management Information Systems*, *28*(2), 75–108.

Susha, I., Grönlund, Å., & Van Tulder, R. (2019). Data driven social partnerships: Exploring an emergent trend in search of research challenges and questions. *Government Information Quarterly*, *36*(1), 112–128.

Tan, Y.-H., Bjørn-Andersen, N., Klein, S., & Rukanova, B. (Eds.). (2011). *Accelerating global supply chains with IT-innovation. ITAIDE tools and methods*. Springer Science & Business Media. DOI 10.1007/978-3-642-15669-4.

The WCO Secretariat. (2019). E-commerce security and safety concerns require forceful action. *WCO news*, *90*, 65–70. https://mag.wcoomd.org/magazine/wco-news-90/e-commerce-security-and-safety-concerns/

Wang, R. Y., & Strong, D. M. (1996). Beyond accuracy: what data quality means to data consumers? *Journal of Management Information Systems*, *12*(4), 5–33.

Williams, B. D., Roh, J., Tokar, T., & Swink, M. (2013). Leveraging supply chain visibility for responsiveness: The moderating role of internal integration. *Journal of Operations Management*, *31*(7), 543–554.

World Customs Organization (WCO). (2015, June). Customs-Business Partnership Guidance. http://www.wcoomd.org/-/media/wco/public/global/pdf/topics/facilitation/instruments-and-tools/tools/customs-business-partnership-guidance/customs—business-partnership-guidance.pdf?db=web

World Customs Organization (WCO). (2018, June). Customs Guidelines on Integrated Supply Chain Management-ISCM Guidelines. http://www.wcoomd.org/media/wco/public/global/pdf/topics/facilitation/instruments-and-tools/tools/safe-package/guidelines-on-iscm.pdf?la=en

World Customs Organization (WCO). (2021, June). SAFE Framework of Standards to Secure and Facilitate Global Trade – 2021 edition. http://www.wcoomd.org/-/media/wco/public/global/pdf/topics/facilitation/instruments-and-tools/tools/safe-package/safe-framework-of-standards.pdf?la=en

World Economic Forum (WEF). (2019, April). Data collaboration for the common good: enabling trust and innovation through public-private partnerships. http://www3.weforum.org/docs/WEF_Data_Collaboration_for_the_Common_Good.pdf

Yang, T., & Maxwell, T. A. (2011). Information-sharing in public organizations: A literature review of interpersonal, intra-organizational and inter-organizational success factors. *Government Information Quarterly*, *28*(2), 164–175.

Yang, T., & Wu, Y. (2014). Exploring the determinants of cross-boundary information sharing in the public sector: An e-Government case study in Taiwan. *Journal of Information Science*, *40*(5), 649–668.

Yang, T., Zheng, L., & Pardo, T. (2012). The boundaries of information sharing and integration: A case study of Taiwan e-Government. *Government Information Quarterly*, *29*, S51–S60.

Yin, R., K. (2003). *Case study research: design and methods* (3rd ed., S. Robinson, Ed.). Applied Social Research Methods Series. Sage Publications, Inc.

Zhang, A., N., Goh, M., & Meng, F. (2011). Conceptual modelling for supply chain inventory visibility. *International Journal of Production Economics*, *133*(2), 578–585.

Zhou, W. (2009). RFID and item-level information visibility. *European Journal of Operational Research*, *198*(1), 252–258.

Notes

1 It is stated that "the customs shall limit the data required in the goods declaration to only such particulars as are deemed necessary for the assessment and collection of duties and taxes, the compilation of statistics, and the application of customs laws" (General Annex Standard 3.12, Revised Kyoto Convention).

2 Guangzhou Nansha New Area Innovation Work Bureau, China (Guangdong) pilot free trade zone. Introduction of global traceability center, November 11, 2019, accessed June 6, 2020. http://ftz.gzns.gov.cn/zwgk/tzgg/201911/W020191111534983840175.docx (in Chinese).

3 Guangzhou Daily. The first cross-border e-commerce commodity quality tracing platform in China for the pilot free trade zone was officially launched in Nansha, June 3, 2015, accessed June 6, 2020. http://ftz.gzns.gov.cn/zwgk/qydt/content/post_3859192.html (in Chinese).

4 The parallel import of vehicles refers to vehicles imported by traders from overseas markets for sale without authorisation of the brand's manufacturer.

5 Market purchase trade pertains to how the trader purchases commodities in the approved market agglomeration area and handles export clearance formalities at the place of purchase. This trade mode is created for 'multi-variety, multi-batch and small batch' foreign trade transactions in the professional market. The maximum value of goods is US$150,000 within one customs declaration.

6 General Administration of China Customs. Fuzhou Customs global quality traceability system has been running for half a year; 207,000 commodities have been traced, October 18, 2019, accessed June 6, 2020. http://www.customs.gov.cn//customs/xwfb34/302425/2647110/index.html (in Chinese).

7 Statistics provided by Fuzhou Customs, China.

8 Tmall is a subsidiary of Alibaba Group.

9 China Business. Scanning a code to check the source of Kao's diapers in the Guangdong Nansha free trade zone, October 25, 2016, accessed June 6, 2020. https://www.yicai.com/news/5142574.html (in Chinese).

10 GIQCI is an independent and nongovernmental third-party notary institution recognised by the ILAC-MRA/CNAS (International Laboratory Accreditation Cooperation-Mutual Recognition Arrangement/China National Accreditation Board for Laboratories).

11 The Port of Nansha extends commodity quality traceability to overseas. November 23, 2015, accessed June 14, 2020. http://ftz.gzns.gov.cn/zwgk/qydt/content/post_3858832.html (in Chinese).

12 WeChat applets, or typically called WeChat Mini Programs, are a kind of app that can be used on WeChat without needing to be downloaded or installed.

13 Nearly a million US dollars.

14 Wang, Pingtan Times, Global Quality Traceability System helps Pingtan build an internationally renowned shopping island without counterfeit goods, October 14, 2019, accessed June 6, 2020, http://www.china-fjftz.gov.cn/article/index/aid/13145.html (in Chinese).

15 Scanning a code allows for tracking the global quality of commodities; relevant systems will be promoted in the Guangdong Inspection and Quarantine Bureau within the year, October 24, 2016, accessed June 6, 2020. https://www.sohu.com/a/117050626_119689 (in Chinese).

Xin Zhou

Xin Zhou is an associate professor in the Department of Customs Administration at Shanghai Customs College. She holds a PhD in management science from Tongji University in China and an Executive Master of customs and supply chain compliance from Rotterdam School of Management, Erasmus University in Netherland.
Her research interests focus on risk management of customs, data analysis, and supply chain management. She has been working on projects on eCustoms and risk management of customs including business and government information collaboration for global supply chain compliance, data mining on risk analysis, and risk measurement.

Yao-Hua Tan

Yao-Hua Tan is full professor of Information and Communication Technology at the Delft University of Technology. He is program director of the master program in Customs and Supply Chain Compliance at the Rotterdam School of Management. He was also Reynolds visiting professor at Wharton Business School. He has published five books and over 220 conference papers and journal articles. He was coordinator and scientific director for the EU funded ITAIDE (2006–2010), CASSANDRA (2010–2014) and CORE (2014–2018) projects. He was also the vice-chair (2012–2014) of the Committee on Trade of the Trade Division at the United Nations Economic Commission for Europe. He also regularly acts as an expert for various Dutch government committees and the European Commission.

Boriana Rukanova

Boriana Rukanova is a senior researcher at Delft University of Technology. She has been working on a series of EU-funded innovation projects in eCustoms and international trade such as ITAIDE (2006–2010), CORE (2014–2018), PROFILE (2018–2021) and PEN-CP (2018–2023). Her research interests include initiation and upscaling of digital trade infrastructures, business-government information sharing, and the use of big data and analytics. Her research appears in leading international journals such as Government Information Quarterly, European Journal on Information Systems, Electronic Markets, Transforming Government: People, Processes and Policies, book chapters and proceedings of international conferences.