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Study on the Application of Global Data Standards for Supply Chain Connectivity – Phase 2

APEC Policy Support Unit
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EXECUTIVE SUMMARY

The uses of Global Data Standards (GDS) are relevant to most phases of the supply chain, starting from the exporters, third party logistics providers, customs and/or border agencies up till the importers. The aim of this project is to examine how the application of GDS can improve the visibility and efficiency of the supply chain based on three GDS pilot projects. The performance is evaluated in terms of visibility/traceability, risk management/integrity, responsiveness, collaboration, and innovation. GDS can improve these processes by providing a common language to identify, capture and share supply chain data with all stakeholders along the supply chain with the use of radio frequency identification (RFID) tags and barcodes as well as the Electronic Product Code Information Services (EPCIS) platform. As border processes and transactions are made increasingly electronic, GDS can act as a common platform to ensure smooth data exchange between the public and private-sector organisations.

Three pilot projects, specifically Asparagus from Peru to the US; Durian from Malaysia to China and Hong Kong, China; and Tequila from Mexico to the US, are conducted to explore the benefits and costs of applying GDS at the product level. These three pilots are the continuation of the previous two self-funded pilots on boxed meat and wine. The benefits and costs of applying GDS on supply chain performance for each nominated trade route are identified based on reports from firms participating in the pilots and from the respective GS1 offices.

Three tasks are carried out to identify the impact of GDS on each supply chain. The first is to conduct baseline surveys to identify the existing extent of supply chain visibility stakeholders have. The second step is to determine key performance indicators (KPIs) associated with each measure of efficiency, visibility/traceability, risk management/integrity, responsiveness, collaboration, and innovation. Lastly, the impact of GDS on each supply chain is identified and evaluated based on the submitted reports from GS1 offices.

A number of benefits are identified following the evaluation of the pilot projects. Significant savings are reported due to the reduction of efforts and time spent on information search and consolidation efforts. GDS enables better tracking and sharing of information with all stakeholders facilitating greater visibility along the supply chain through the use of EPCIS digital platform. GDS also allows accurate and timely capture of data, thus reducing regulatory compliance errors. Additionally, clearer and more accessible information because of GDS helps companies to save detention related costs. The following table summarises the key benefits of GDS.

ASPARAGUS	
Attributes	**Key benefits**
Visibility and Risk Management	Visibility within the supply chain increased to 100%. The cost and time of searching for information reduced by 50%, that is, a decrease of USD 16,500 per year and 750 hours per year respectively (including benefits from temperature monitoring).
Responsiveness	Responsiveness improved as time spent accepting a pallet, truck attention time, and preparing pallets and Unit Load Devices (ULDs) for air dispatch reduced by 20%, 40% and 50% (6 minutes to 3 minutes per pallet) respectively.
DURIAN	
Attributes	**Key benefits**
Visibility	Visibility within the supply chain (for exporter and importer) increased to 100%. Additionally, exporter reported that improved product traceability and visibility is estimated to give a benefit of USD 1,354.
Compliance	Shipment detention reduced to 0%, and full information and documentation visibility was reported. This allows an estimated saving of USD 1,919 from improved management of additional delays and reduction of compliance time and costs. Additionally, avoidance of spoilage of products while in transit is likely to bring a saving of USD 112,867 per container.
Data Accuracy, Completion and Consistency	Real time data could be captured and retrieved enabling an increase in visibility of 60%. Exporter also reported that reduced manual processes, improved customer reporting and improved data quality is expected to provide a total savings and benefits of USD 2,144.
Responsiveness in Authentication and Product Recall	100% visibility and information for authentication is achieved. Responsiveness in authentication and product recall is little without GDS as there is limited visibility and tracking facilities. With the real time data tracking in place, each package can be recognized by its Serial Global Trade Item Number (SGTIN), hence making the product authentication and recall possible as well as easier and quicker to handle.
Cold Chain Integrity	Temperature recording in the EPCIS platform for verification improved the integrity of the product. Improved product integrity is estimated to provide a benefit of USD 1,241.
TEQUILA	
Attributes	**Key benefits**
Visibility	Visibility within the supply chain increased to 100%.
Risk Management	Improved detection of forged and missing products.
Responsiveness	Responsiveness improved as the adoption of RFID allowed an increase in efficiency in the reading speed of products in pallets, reducing reception time per full truck by 30%. Pallet assembly time reduced by 30% (9 hours to 6 hours) due to less time needed for documentation.
Collaboration	Significant cost savings are expected through better collaboration and sharing of information through the use of ezTRACK instead of through emails and phone calls.

On the other hand, there are also costs entailed with the adoption of GDS which arise from subscribing to the GS1 service, obtaining equipment and software, carrying out data cleaning and adjustment, and training of staff.

The pilots have demonstrated the potential benefits (and costs) that could be delivered by GDS as reported by GS1 offices and stakeholders. Whether these benefits could be further realised in the long-term, would be dependent on the firms' adaptation process of using the GDS system. Once a firm is more familiar with GDS, it could develop more efficient processes for operating the system and costs could be further reduced, and it may find additional benefits of GDS application in the long-term.

There are several drivers that determine the adoption of GDS. One of the main drivers for its implementation is the firm's technological capacity. The size of the company is another determinant as it establishes the potential for GDS to simplify processes and the ability to afford the system. The need for product authenticity to maintain the firm's goodwill and integrity also promotes the adoption of GDS. Lastly, high regulatory risk that could lead to costly detention encourages firms to adopt a more efficient mode of data exchange.

There are several main challenges to GDS adoption including the lack of awareness of the possible uses of GDS and the need for stronger justification to change existing systems. Better collaboration and engagement among supply chain stakeholders to further understand the opportunities as well as the challenges for GDS implementation is necessary to improve its wider adoption.

Following the 2016 APEC Ministers Responsible for Trade (MRT) statement that encouraged officials to explore next steps for the wider use of GDS in the APEC region, the following approaches could be considered:

1. Expand the application of GDS towards improving border management and inspection.
2. Expand the application of GDS to other types of products.
3. Realising the importance of Public and Private Partnership.
4. Providing necessary incentives to facilitate GDS adoption.

Further suggestions for the way forward of GDS implementation have also been discussed in the 2017 GDS Workshop. A summary of those discussions is available in the appendix.

1. INTRODUCTION

EVOLUTION OF SUPPLY CHAINS

The rising trend of global supply chains has brought many opportunities and benefits to traders. Supply chain fragmentation across the globe carries the opportunities of lower cost derived from lowering inventory, cheaper outsourcing or offshoring and faster response to consumers' demand.

Malik, Ruwadi and Niemeyer (2011) explained that lower inventory costs could be achieved by moving production closer to where the demand is. This is made possible via fragmentation of production process and later assembly of the different components into finished goods, supported by better visibility of the different supply chain operations. Malik et. al. (2011:7) further gave an example of how a company has managed to combine various stock-keeping units (SKUs) into semi-finished components that can be quickly assembled into finished products to meet customer orders, hence resulting in lower inventory costs.

While supply chain fragmentation has its benefits, it also leads to firms having to manage increasingly complex processes of supply chains. For example, Financial Times reported that 10,000 new SKUs are introduced into the US consumer goods market each year. On the other hand, increases in the number of cross-border SKUs could enable a more efficient supply-chain operation and in the end reduce the total number of SKUs; this is done by manufacturing products to serve several economies at the same time.[1] For customs, the growing number of Mutual Recognition Agreements (MRAs) in Authorised Economic Operators (AEOs) for instance, also added to the complexity of information sharing that collect and exchange business data across different stakeholders; this is where increased automation and the adoption of sensors and other networked "machines" could potentially facilitate the development of more frictionless trading communities (Dun & Bradstreet, 2016).

TRADE FACILITATION EFFORTS IN APEC

APEC has continuously sought to advance trade facilitation by improving supply chain connectivity and performance. The Supply Chain Connectivity Framework Action Plan 2010-2015 aims to improve time, costs and uncertainty of supply chain performance in APEC. Other initiatives such as the Bogor Goals and WTO Trade Facilitation Agreement (TFA) commitments of member economies also seek to promote efficiency in supply chain management through more efficient border procedures and simplification of regulatory compliance.

[1] Source: The complexities of simplifying by Louise Lucas and Barney Jopson (FT, September 21, 2011).

ROLE OF GDS IN FACILITATING TRADE

The pilot projects in this report examine how the application of Global Data Standards (GDS) can improve supply chain performance in terms of efficiency, visibility/traceability, risk management/integrity, responsiveness, collaboration, and innovation. This is done through ensuring consumer safety by regulating temperatures, reducing the risk of counterfeit products and providing traceability, amongst others. Earlier studies highlighted the following benefits of the application of radio frequency identification (RFID) as shown in the table below.

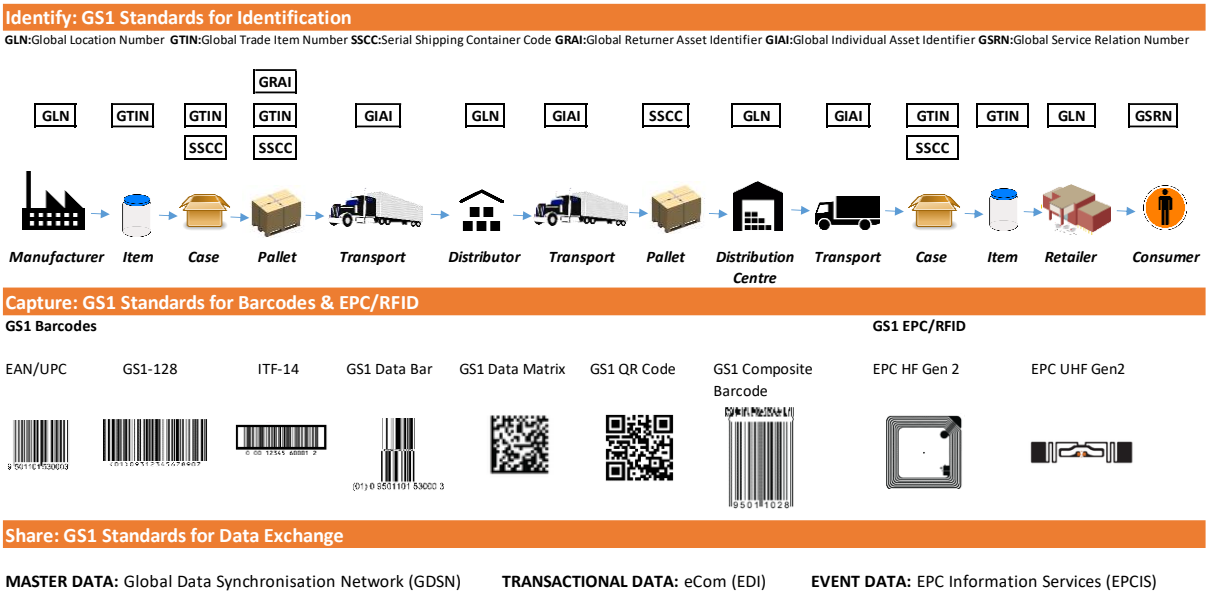
Table 1. Frequently Mentioned Benefits of RFID in the Fast Moving Consumer Goods (FMCG) Supply Chain

	Industry Studies and Trade Publications									**Company Information**			**Survey Results**		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	∑
Handling efficiency	x	x	x	x		x	x	x	x	x	x	x	x	x	13
Out-of-stock	x		x		x	x	x	x	x	x	x	x	x	x	12
Inventory reduction	x	x	x				x	x	x		x*		x	x	9
Order reconciliation	x	x	x	x	x	x	x		x			x			9
Theft	x	x	x			x	x	x	x	x			x		9
Unsaleables		x	x				x	x	x	x					6
Production planning	x				x				x			x			4
Promotion execution					x		x	x	x						4
Traceability					x				x			x			3
Product diversion		x					x		x						3

Source: Tellkamp (2006). *Improved internal inventory management

GDS provides a common language to identify, capture and share supply chain data to stakeholders along the supply chain through the use of various data standards included in barcodes and RFID tags. As transactions become increasingly electronic, a common platform such as GDS, is important to ensure interoperability and seamless data exchange between private and public-sector organisations.

Figure 1. Various GS1 Standards



Source: Adapted from GS1 Hong Kong project report.

This report explores the costs and benefits of implementing GDS in relevant aspects of the supply chain, including but not limited to exporters, third party logistics providers, customs and/or border agencies and importers. The findings from the GS1 New Zealand report on GDS and Border Agencies are included. Key drivers and the way forward are also examined.

2. OBJECTIVES OF THE STUDY

The aim of the study is to explore the benefits and costs of three pilot projects on the application of GDS at product level, particularly on how GDS could improve supply chain visibility and traceability. Supply chain visibility could be defined as "the availability and transparency of information about products (quality, location, point of sale data, etc.) between the different supply chain actors" (Semianiaka and Silina, 2012). Other definitions of Supply Chain (SC) visibility are provided in the table below.

Table 2. Definitions of SC visibility

Definition	Reference
Visibility means that important information is readily available to those who need it, inside and outside the organisation, for monitoring, controlling, and changing SC strategy and operations, from service acquisitions to delivery	Schoenthaler (2003)
[Visibility is] the extent to which actors within a SC have access to or share information which they consider as key or useful to their operations and which they consider will be of mutual benefit	Barratt and Oke (2007)

[Visibility is] the ability to be alerted to exceptions in SC execution, and [to] enable action based on this information.	McCrea (2005)
[Visibility is] capturing and analysing SC data that informs decision-making, mitigates risk, and improves processes	Tohamy (2003)

Source: Caridi et al (2014).

For each trade route nominated by the participating member economies and based on a set of pre-determined indicators and benchmarks, the benefits and costs of GDS application on supply chain performance are identified based on the report from respective GS1 offices and firms participating in the three pilots.

The three pilot projects utilised GDS at several levels as follows:

1. Serial Global Trade Item Number (SGTIN) is a randomised unique number assigned to each single product item and combined with the Global Trade Item Number (GTIN) to produce a unique identification to the package.
2. Global Trade Item Number (GTIN) is assigned to each product type, GTIN contains the ID of the product, brand owner information together with the documentation and certification details. GTIN identification facilitates the tracking and authentication of the item and allows for the retrieval of additional information including batch number, expiry date and the number of scans performed on a specific serial number.
3. At the carton and up to the pallet level, Serial Shipping Container Code (SSCC) is applied. SSCC, which is linked to the information of each single SGTIN contained in the logistic units, provides information about the quantity and specific product information and certification via the Electronic Product Code Information Services (EPCIS) (Mi-Trace) platform. SSCC label is printed using the GS1-128 barcode and attached to every carton and pallet.
4. Global Shipment Identification Number (GSIN) carries the information on the entire shipment. GSIN is printed onto the logistic label together with SSCC in text format to indicate that the group of SSCCs are on the same shipment reference so as to to increase the efficiency of custom clearance on the shipment. GSIN number is printed together with the SSCC on the logistic label in a readable number format.
5. Global Individual Asset Identifier (GIAI) is used to capture the information on the asset used along the supply chain. GIAI will carry the information of the cold chain truck, the container used for the shipment as well as the vessel number or the flight number used for the shipment during the transportation from the processing plant to the terminal.
6. The Global Location Number (GLN) is used to identify the location where the event occurred and to identify the stakeholder of the event.

The pilot projects use interoperable cloud-based EPCIS platforms (such as ezTRACK or Mi-Trace) to capture data throughout the supply chain (including cargo movement). This will provide visibility and data sharing to the relevant parties, hence enabling better communications among the stakeholders. This will also enable real-time package tracking including, for certain pilots, capturing temperature information of the cargo during shipment.

3. METHODOLOGICAL FRAMEWORK

The steps involved in identifying the cost and benefit data relevant to each pilot supply chain comprised of the following three tasks:

1. Conducting baseline surveys to establish the extent of supply chain visibility stakeholders have before commencing the pilot project.
2. Establishing key performance indicators (KPIs) associated with efficiency, visibility/traceability, risk management/integrity, responsiveness, collaboration, and innovation; and
3. Identifying and analysing the impact of implementing the GDS on each supply chain.

The information on costs and benefits is obtained from the firms as reported in the GS1 local offices' Project Reports and based on the questionnaire developed by the APEC Policy Support Unit (PSU) and GS1 Hong Kong. Participating firms also provide additional information through the baseline survey.

LIMITATIONS

There are some limitations to the pilots that could perhaps be addressed in future studies.

- As the pilot companies already use some basic form of GDS (barcodes) prior to the pilot, the results obtained may therefore not be representative of the full benefits and costs of a firm with no basic GDS system in place prior to adopting the GDS system.
- Some benefits are not quantifiable as the pilots are still in a discovery or proof-of-concept phase.
- Some key benefits such as avoidance of detention (or spoilage) costs is difficult to predict, hence they should be viewed as indicative.

4. IDENTIFIED BENEFITS AND COSTS OF GLOBAL DATA STANDARDS

A. ASPARAGUS

Peru is considered a world leader in asparagus production, accounting for 14% of global asparagus farm area and second only to China in terms of production. Of Peru's total asparagus exports, 64% go to the United States and the remaining 36% go to Europe and Asia. In 2016, asparagus exports amounted to USD 405 million (in FOB terms) with the US as the main exports destination accounting for USD 258 million (64% of total amount).

In the Asparagus GDS pilot, the Peru Exporter is the first entity of the supply chain. It grows, packs and exports asparagus. Specifically, Peru Exporter carries out the process of raw material

reception, washing and cooling, finished goods selection and packaging, finished goods palletising, and finished goods dispatch.

The goods are then received by the Peru third-party logistics (3PL) company that carries out all the tasks involved in getting the fresh asparagus to the importer. It refrigerates and stores the asparagus at the export terminal, fumigates the products, maintains correct temperature control, and ensures quality control throughout the process of delivering them to the customer. During this process, Peru's Customs and Tax Administration (SUNAT) manages the implementation of government taxes and inspection of export goods in Peru. The US Customs and Border Protection (CBP) carries out a similar task on the side of the United States.

The US Importer, initiates the process by making an order for asparagus. For the purpose of this study, it is also the end-point of the supply chain when it receives the imported asparagus. The pilot does not cover the distribution and retail part of the supply chain in the United States. The diagram for the Asparagus pilot scope is provided below.

Figure 2. Pilot Scope for Asparagus

Source: Adapted from GS1 Peru Project report for Asparagus (2016).

Asparagus Exporter

Peru Exporter deals with export shipping where it processes goods and cargo declarations. It produces its own products and commonly has 130 items in its catalogue with each averaging about USD 4 in value. Exporter's average order size is 140 boxes and an average shipment weighs about 5 kilogrammes. The average range of order is about 5 pallets and is valued at USD 10,500. Typically, Exporter needs 8 hours for an order to be ready for shipment and delivers it within 2 days.

Exporter shares and receives information from the manufacturer, forwarder, customs broker, inbound and outbound transport company, outbound warehouse (3PL storage), the shipping line, export stevedore, export customs agency and the export port authority. Most of the communication with these parties take place through emails and phone calls. The only

communication done online (i.e., electronic data interchange (EDI)/web platform) is with the Port Authority.

The time and costs involved in the tasks carried out by Exporter, which involve inputting raw material receipt information, processing and dispatching information, and confirming arrival information, take 2 hours on average and cost USD 10 per hour. The most frequent and expensive source of delay in the supply chain is from product deterioration and spoilage, occurring 36 times a year and costing about USD 200,000. Delays in customs clearance and regulatory uncertainties could cost Exporter USD 60,000 a year, while delivery delays are estimated to cost USD 20,000. Theft and counterfeit products are not deemed very serious by Exporter. The firm's main concerns with improving supply chain performances are related to cold chain, product traceability, quality management and legal compliance, in order of importance.

Third-Party Logistics (3PL)

The 3PL is responsible for collecting goods and processing export goods and cargo declarations. Their products are obtained from farmers and producers. The company's average range of order is 2 to 20 pallets and its order size is 20 pallets, valued at USD 36,000. Its average shipment weighs about 14,000 kilogrammes. 3PL takes 6 hours for the products to be ready for shipment and about 6 to 10 hours to complete the entire order.

3PL communicates with its manufacturer, forwarder, outbound and inbound transport company, and export customs, quarantine and port authority. These communications predominantly occur over EDI and emails, although some communications with quarantine and port authority offices are still done through phone calls.

The tasks carried out by 3PL include cargo acceptance, handling and security and on average take up 0.3, 0.4 and 0.2 hours, respectively, to perform. Cargo acceptance is the one task that is likely to incur extra costs if there are errors in transcribing the data and related overtime. The average additional time per consignment because of the error is about 0.1 hours.

The most important sources of costs within the company are delays in delivery and inefficient inventory management. Other less important sources of costs include product deterioration, counterfeit products, theft, delays in customs clearance, and uncertainties in customs regulations. 3PL's main business concerns related to improving their supply chain performance include product safety from theft, product traceability, and efficiency in logistics, inventory management or warehousing.

Pre-Pilot Conditions

Baseline surveys were conducted to determine the supply chain visibility of stakeholders prior to the commencement of the pilot. The baseline established would then enable the measurement of the benefits and costs associated with the use of GDS.

Table 3 below shows the baseline for five key performance indicator (KPI) metrics—visibility, risk management, responsiveness, collaboration and level of use of GDS—for the four main companies in the supply chain. For visibility, the KPI metrics measured are asparagus supply chain visibility, and information search cost and time. The metrics used for risk management are temperature monitoring and access to order fulfilment cycle time. Responsiveness is measured through acceptance or reception time per pallet, truck attention time and pallet assembly time per pallet. Stakeholder communication and engagement is used to calculate collaboration. Finally, level of use of GDS prior to the pilot is recorded.

Table 3. Baseline Indicators: Asparagus Supply Chain

KPI Metrics	Exporter	3PL	Customs Authorities	Importer
Performance Attribute**: Visibility**				
1. Asparagus Supply Chain Visibility	80%			
2. Information search cost	USD 33,000/year			
3. Information search time	1,500 hours/year			
Performance Attribute**: Risk Management**				
4. Temperature monitoring	USD 33,000/year			
5. Access to Order Fulfilment Cycle Time (in each part of the process identified)	Access their part of the supply chain	Access their part of the supply chain	None or limited Access	Access their part of the supply chain
Performance Attribute**: Responsiveness**				
6.Acceptance/Reception time per pallet (minutes)		2 minutes		
7. Truck attention time (minutes)		25 minutes		
8. Pallets and Unit Load Devices (ULDs) assembly times for air dispatch (minutes)		6 minutes		
Performance Attribute**: Level of use of GDS**				
9. Standards use	70%*	100%**	0%	50%

Source: GS1 survey. *Results from GS1 Global GTC - Global Traceability Conformance Programme Audit, applied by GS1 Peru. ** Frio Aereo has been certified in GS1 Global GTC - Global Traceability Conformance Programme in 2012 and has been renewing their certificate each year

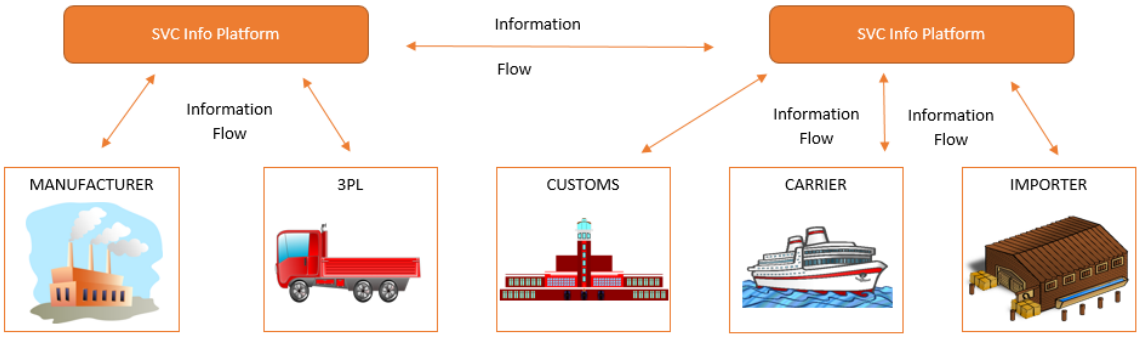
GDS Intervention/Implementation

Exporter carried out five of their shipments using the GDS system during the pilot. It did not use GDS prior to the pilot because the company did not see any added value in generating Serial Shipping Container Code (SSCC) since the 3PL company assumed that role. However, it asserted that it will seek to implement the new GDS system on its own within a year or two even if it were not selected for the pilot project.

The focus of the Asparagus GDS pilot is to facilitate a way in which all actors participating in the entire supply chain - from the field, manufacturer to logistic operators - 3PLs or Carriers, Customs, until their arrival to the customer in their final destination - can monitor, track and trace the products in real time. The aim is to increase visibility throughout the supply chain through the use of the ezTRACK visibility platform. Automatic/RFID identification solutions coordinated with the handheld's device programme and integrated with the ezTRACK tool provide visibility.

In addition to supporting the pilot with the ezTRACK visibility platform, GS1 Hong Kong also defined the final fields in each stage of the supply chain along with the GS1 Global Standards. Training sessions were conducted for the Peruvian staff responsible for registering information onto the visibility platform. RFID encoders and readers were also installed in Exporter and 3PL to facilitate contact-free reading and verification after dispatch from Exporter. The diagram for the Supply Chain Visibility (SCV) Platform is provided below.

Figure 3. Supply Chain Information Platform



Source: Adapted from GS1 Peru Project report for Asparagus (2016).

The main intervention for the Asparagus GDS pilot is to enable pallet-level visibility from the Exporter to 3PL. Prior to the pilot, Exporter would have handwritten stickers on their pallets indicating information such as origin, type of asparagus, number of boxes per pallet, packing date, weight, etc. Upon reaching 3PL's facilities, staff will input this handwritten pallet-level information into a computer and print out a GDS-compliant barcode that will allow the pallet to have visibility from 3PL to Importer. In the Asparagus pilot, visibility is defined using the Global Traceability Conformance Programme (GTC).

Impact/Post Pilot Benefits and Costs

With the GDS system, visibility is improved throughout the supply chain. At any point of the process, information can be attained from the cloud. Based on the KPI measurements, the overall visibility of the fresh asparagus supply chain was 100% as all the parties involved were able to access information on each of the processes in the supply chain.

Since measurement of temperature is a critical factor for food safety risk management in fresh products supply chain, it was important during the pilot project and throughout the supply chain that temperatures be tracked. Temperatures were successfully maintained between 2 and 5 degrees Celsius throughout the transportation from the Exporter plant in Peru to Importer in the US. There was also a 100% utilisation rate of GDS during all the processes of the fresh asparagus supply chain. The pilot facilitated the identification of product code, batch number, packing date and the identification of each pallet using RFID technology. The following data standards were applied during the pilot: GTIN 13, Product Traceability Initiative (PTI) GTIN 14 label, and SSCC/GS1 128.

There were also improvements made by the individual stakeholders in the supply chain. Time and resources used by Exporter for searching and consolidating information from shipping processes, temperature measurement and calls for visibility (consolidated into one single cloud tool, ezTRACK, in the pilot project) improved by 50%. As reported by the firm, time spent on the aforementioned tasks was reduced from 1,500 hours a year to 750 hours a year, equivalent to a reduction in costs from USD 33,000 to USD 16,500 yearly.

Subsequently, the 3PL firm improved its process and truck reception times by 20% and pallets and Unit Load Devices (ULD) assembly times for air dispatch were reduced by 50% (from 6 minutes to 3 minutes per pallet). Truck attention time reduced as the pallets were more easily identifiable with the use of RFID readers that produced information, like dispatch order, dispatch advice, content and temperature amongst others, from ezTRACK.

There was also added benefit to government representatives who obtained more comprehensive information in real time for risk management purposes and allowed them to make more informed analyses.

Further results from the pilot can be seen in table 4 as provided by the GS1 Peru project report and may be compared with table 3.

Table 4. Key Performance Indicators: Asparagus Supply Chain

KPI Metrics	Exporter	3PL	Customs Authorities	Importer
Performance Attribute**: Visibility**				
1. Asparagus Supply Chain Visibility	100%			
2. Information search cost	Reduced by 50% USD 16,500 per year*			
3. Information search time	Reduced by 50% 750 hours per year*			
Performance Attribute**: Risk Management**				
4. Temperature monitoring	Reduced by 50% USD 16,500 per year*			

KPI Metrics	Exporter	3PL	Customs Authorities	Importer
5. Access to Order Fulfilment Cycle Time (in each part of the process identified)	100% Visibility	100% Visibility	100% Visibility	100% Visibility
Performance Attribute**: Responsiveness**				
6.Acceptance/Reception time per pallet (minutes)		Reduced by 20%		
7. Truck attention time (minutes)		Reduced by 40%		
8. Pallets and Unit Load Devices (ULDs) assembly times for air dispatch (minutes)		Reduced by 50%		
Performance Attribute**: Level of use of GDS**				
9. Standards use	100%	100%		

Source: GS1 survey. Note: * These benefits should be treated as a combined benefit from the reduction of information search time and cost.

When asked to estimate the benefits of using GDS, Exporter ranked more predictable operations to be the most important and of the highest value to the business. It also identified better matching of supply and demand and improved customer reporting to be of beneficial value to the company. GDS was expected to provide medium-level benefits such as reduced manual processes like labelling and data entry, and improved communication between supply chain partners as well. 3PL also expected many benefits of the GDS system. Most of the high-level benefits were from improved inventory and logistical management and avoidance of various costs, as well as facilitating data visibility and customer reporting (table 5). On the other hand, 3PL only expected a low level of benefits in terms of compliance with Customs requirements or clearance.

Table 5. Estimated Benefits from GDS - 3PL

Expected benefit to my business	Degree of benefits
Cost minimisation when things go wrong	High
Earlier notification of transport schedules	High
Improved ability to identify trends	High
Better matching supply to demand	High
Improved customer reporting	High
Reduced manual processes (e.g., labelling; data entry)	High
Improved data quality	High
Inventory management	High
Improved communication between supply chain partners	High
Improved product traceability and visibility	High
Meet trading partner requirements	High

Source: GS1 survey.

3PL had used GDS prior to the pilot project to record all the transactions in order to identify the products during acceptance and handling. They expected the additional benefits of better integration within the supply chain and greater visibility with the pilot project.

Total costs incurred in participating in the Asparagus GDS pilot (as reported by GS1 Peru) can be categorised into equipment and software costs and costs related to participation in GS1. Equipment costs included rental of RFID equipment, purchase of RFID tags and SSCC labels and acquiring other equipment like laptops, cell phone and Wi-Fi connection. Temperature pods were provided as free samples by the provider. Software costs involved attaining interfaces with ezTRACK and handheld developments, and technical RFID support. GS1 participation costs were derived from consultant services and travelling costs. In summary, the total GDS participation cost for the pilot is as follows:

- Equipment cost : USD 5,050
- Software cost : USD 7,300
- GS1 Peru participation costs : USD 6,000
- **Total investment cost : USD 18,350 (summation of the above)**

The highest degree of costs of using GDS are expected from staff time for training, integration with proprietary platforms, GDS equipment and installation, and GDS service subscription. On the other hand, data cleaning and adjusting to data formats are considered relatively low-level costs.

Table 6 shows the estimated costs of the GDS system as reported by a firm. Exporter expected high costs related to adjusting to new data formats, on-boarding suppliers, integrating with proprietary platforms, and purchasing and installing GDS equipment. Cleaning up data and subscribing to GDS services were medium-level expected costs. The costs for training and staff training time were expected to be low.

Table 6. Estimated Costs of GDS - Asparagus Exporter

Estimated costs to business	Degree of costs*	Estimated Value (USD)
Cleaning up data	M	5,000
Adjusting to new data formats	H	10,000
Training costs	L	1,500
Staff time for training	L	1,500
On-boarding suppliers	H	n.a.
Integration with our proprietary platforms	H	n.a.
GDS equipment and installation	H	n.a.
GDS service subscription and/or retainer	M	n.a.

Source: GS1 survey. Note: L=Low, M=Medium, H=High.

Comparing Costs and Benefits

The main quantitative benefits reported by the pilot are from the time and resources used by Exporter for searching and consolidating information from shipping processes, temperature measurement and calls for visibility (consolidated into one single cloud tool, ezTRACK, in the pilot project) of USD 16,500 yearly. There are also other benefits - the reduction in truck reception times by 20% and assembly times for air dispatch by 50%.

For the costs of GDS implementation, the total cost of investment is USD 18,350. Meanwhile, the firm also reported that they need to spend USD 15,000 for adjusting and cleaning up data and around USD 3,000 for training.

It is difficult to directly compare the cost and benefit figures as the timeline for these figures are different. The benefit streams could still be received in the coming years, whereas the investment costs of applying GDS could be expected to become smaller as firms become more familiar with GDS practices and Standard Operating Procedures (SOPs).

B. DURIAN

Malaysia is one of the top exporters of Durian with an export value of USD 17 million and a volume of 20 thousand tonnes. For China, durians rank fourth in terms of its fruit imports. Between 2010 and 2015, Chinese imports of durian increased at 12% per annum in terms of weight and 31% in value (at an average price of USD 1.90 per kg)[2].

Musang King (also known as *Mao Shan Wang* in Mandarin) is a very popular and premium durian variant in China which is exclusively available in Malaysia. Musang King Durians would easily be sold in China at about RM200 to RM300 per kilogramme (around USD 47-70)[3].

The Durian Traceability Project tracks the supply chain of Musang King Durian from Malaysia to China and Hong Kong, China. Several firms are involved in this pilot, including the Exporter, 3PL Company, Customs Authorities and Importer.

Durian Exporter

The Durian Exporter has several roles to play in the supply chain. It buys durians from the farm and exports them. In preparation for exporting, the firm insures the cargo, makes customs declarations and obtains export licenses. The firm then processes the goods declaration and clears the goods. It then transports and delivers the goods, provides status reports and cargo declarations and advice on the dispatch.

The average order size is 500 units and is valued at RM 500,000. The weight of an average shipment is about 5 tonnes. It takes a week for the products to be ready for shipment. It takes ten days for the customer to receive the goods from the time of placing the order.

Communication takes place with all partners of the supply chain and is usually conducted via emails. The most time spent by the Exporter is on packing the products with Global Trade Item Number (GTIN) assignment which takes 192 hours on average. The other time-consuming tasks in descending order of time consumed are: customs clearance procedure, arrangement for

[2] http://www.thestar.com.my/business/business-news/2017/05/13/the-china-factor-in-durian-prices/

[3] http://www.channelnewsasia.com/news/asiapacific/malaysia-plans-to-export-musang-king-durians-to-china-minister-8845116

transportation, and recording time and details of the 3PL logistics and of cross border transportation.

Tasks with high risk to go wrong are caused by container detention at the customs port and the quality of raw materials in which an additional time of 360 hours and 24-48 hours respectively are spent. The most important sources of delay or inefficiencies arise from product deterioration, uncertainties in customs regulations and treatment of goods, delays in customs clearance and counterfeit products.

Pre-Pilot Conditions

Table 7 below shows the baseline for six performance attributes of the three main stakeholders in the supply chain: real time package tracking; compliance; data accuracy, completion and consistency; responsiveness in authentication and product recall; cold chain integrity; and platform collaboration and data exchange.

For real time package tracking, the KPI metric measured is visibility (traceability). The metrics used for compliance are efficiency, integrity and visibility (information). Data accuracy, completion and consistency is measured through innovation (data analytics). Integrity (authenticity) and innovation (customer services) are the KPIs for responsiveness in authentication and product recall. Under cold chain integrity, the KPI is quality. Lastly, for platform collaboration and data exchange the KPIs are efficiency (time), visibility (traceability) and innovation (customer services).

Table 7. Baseline Indicators: Durian Supply Chain

KPI Metrics	Exporter	Customs Authorities	Importer
Performance Attribute**: Real Time Package Tracking**			
1. Visibility (Traceability)	40% (manual tracking process)		40% (manual tracking process)
Performance Attribute**: Compliance**			
2. Efficiency (Time & Cost)	Time delays due to shipment detention and incomplete documentation.		
3. Integrity (Authenticity)	Occasional shipment detention		
4. Visibility (Information)	Information and documentation is insufficient	Information & documentation is insufficient	
Performance Attribute**: Data Accuracy, Completion and Consistency**			
5. Innovation (Data Analytics)	Manual data capture and retrieval	Manual data capture and retrieval	Manual data capture and retrieval
Performance Attribute**: Responsiveness in Authentication & Product Recall**			
6. Integrity (Authenticity)	Not Available		Not Available
7. Innovation (Customer Services)	Not Available		Not Available

KPI Metrics	Exporter	Customs Authorities	Importer
Performance Attribute**: Cold Chain Integrity**			
8. Integrity (Quality)	Manual temperature record and verification		Manual temperature record and verification
Performance Attribute**: Platform Collaboration and Data Exchange**			
9. Efficiency (Time)	Not Available		Not Available
10. Visibility (Traceability)	Not Available		Not Available
11. Innovation (Customer Services)	Not Available		Not Available

Source: GS1 survey.

For the firms involved in the Durian pilot, a general description on how they were managing their process flows without GDS is as follows:

- Manually record the information on papers
- Product information is attained via the documentation and sent to the importer
- Communication occurs via phone or email to know the status of the shipment
- Normally it will take one (1) day or 24 hours to receive feedback on the package tracking
- Receive the product and shipment packing list from the exporter
- Backward tracking from one stakeholder to another to ensure product quality
- The exporter spends 5 working days to complete the compliance for durian export.

GDS Intervention/Implementation

The focus of the Durian GDS pilot is to explore and verify:

- how better visibility and risk management processes in the international supply chain can improve Malaysian exports to China and Hong Kong, China; and
- how smarter use of supply chain data can enable new ways to improve consumer safety, improve supply chain efficiency and demonstrate added value to industry, customs, health authorities/food safety authorities for multi jurisdiction product identification and supply chain visibility (including to reduce the risk of counterfeiting by enabling authentication of product by the consumers).

The main intervention is by using the GS1 standards supported by the Electronic Product Code Information Services (EPCIS) data sharing platform to improve the Musang King Durian supply chain from Malaysia to China and Hong Kong, China through cross-border trading traceability.

Impact/Post Pilot Benefits and Costs

The following describes the benefits as reported by the firm involved in the pilot.

With regard to real time package tracking, prior to GDS, the firm used manual tracking by email and phone with data recorded on paper. As a result, it took at least half a day to get the information and status of the package at a specific process upon request. GDS allows real-time package tracking via the system enabling an immediate retrieval of information (real-time) for the package at the point of request (on-line).

With regard to compliance, prior to GDS implementation, there was the possibility of errors arising or incomplete documentation because of manual recording. A minimum of five working days was required to rectify an error or to resubmit related documentation during which detention costs were incurred by the exporter. With GDS, the contents of a container, pallet or carton box can be easily retrieved by scanning the logistic label barcode attached to the parent logistic level[4]. This includes the certifications information and documentation required for the customs and port clearance. Through the system, errors can be corrected immediately and detention at the port can be avoided. The product information of the items or products shipped (Serial Global Trade Item Number or SGTIN) is also uploaded onto the EPCIS platform to be made available to the custom and port authority for clearance and safety inspection, including the certification details, production details and necessary required documents.

With reference to data accuracy, completion and consistency, manual data analytics may need time to organise and input the data (such as truck number, flight number, air waybill, etc.) before it can be analysed; while with GDS, the data can be analysed immediately upon request as it is instantaneously available and is more likely to be accurate.With the data captured using GS1 keys such as the Serial Shipping Container Code (SSCC) and Global Location Number (GLN) at different points, the status and data of a package including the event details like location, shipment details, time of capture and captured event is made available in real time.

Responsiveness in authentication and product recall is little without GDS as there is limited visibility and tracking facilities. With the real time data tracking in place, each package can be recognised by its SGTIN, hence making the product authentication and recall possible as well as easier and quicker to handle.

With regard to cold chain integrity, in the absense of GDS, the temperature is manually recorded and kept as separate logs for further verification should there be any dispute or quality issue on the packages. In the Durian GDS pilot, the temperature was recorded in the EPCIS platform to provide visibility and immediate verification to the stakeholders. GDS will have temperature records at different stages to determine when and where the discrepancy appeared.

[4] Product information visibility on the content in the cartons or containers and enabling the utilisation of Global Shipment Identification Number (GSIN) in identifying identical groups of packaging on a similar shipment.

Lastly, platform collaboration and data exchange[5] is modest without the GDS system in place. There are instead separate proprietary platforms for each stakeholder to store their own data. There is however a need for immediate (real-time) traceability and manual tracking from the respective stakeholder based on the process. With the use of GDS, all data within the supply chain are stored in the interoperable EPCIS platform to provide full transparent visibility and linkage to the information of the package at any stage of the process. Product tracking, product information, shipment status, export documentation, etc. are all available online via the platform. By placing all the necessary documents on the digital platform, it is ensured that the full information and documents are in place. This can be compared to the previous way of dealing with the documents where each time the custom asked for a missing documentation, the exporter had to resubmit the document. In addition, due to differing standards of recognition at different ports there was always a problem of insufficient or un-recognised documentation. With GDS, stakeholders across the supply chain would have a better and continuous tracking and data exchange on the product movement.

For example, in Malaysia, the Mi-Trace system uses GDS to provide full compliance on certification for verification purpose at the border and local authorities which includes the following (among others): Halal, Export Permit, Hazard Analysis and Critical Control Point (HACCP), Malaysian Good Agricultural Practices (MyGAP), Good Farm Practice Scheme Malaysia (SALM), and Good Manufacturing Practices (GMP).

With regard to non-quantifiable benefits, the key benefit of GDS implementation comes in the form of 100% visibility, an increase from the baseline level of 40%. Visibility under GDS is described to have the following characteristics:

- Allocate identifier to each individual item and logistics unit using SGTIN and SSCC.
- Identify the same shipment batches using GSIN.
- Location of the capture point defined by GLN.
- Transportation and asset used across the supply chain defined by Global Individual Asset Identifier (GIAI).

Further details for the KPIs are provided in table 8 below.

[5] The pilot project involved two different EPCIS platforms from the source to the destination: Malaysia Mi-Trace and China EPCIS Platform. These two platforms are being tweaked and made to be interoperable to support the information from Malaysia to outbound and the inbound to the China market.

Table 8. Key Performance Indicators: Durian Supply Chain

KPI Metrics	Exporter	Customs Authorities	Importer
1. Visibility (Traceability)	100%		100%
Performance Attribute**: Compliance**			
2. Efficiency (Time & Cost)	0% shipment detention & 100% documentation compliance		
3. Integrity (Authenticity)	0% shipment detention at custom		
4. Visibility (Information)	Full information and documentation in place	Full information and documentation in place#	
Performance Attribute**: Data Accuracy, Completion and Consistency**			
5. Innovation (Data Analytics)	Real Time data capture and retrieval. Increased the visibility by 60%	Real Time data capture and retrieval. Increased the visibility by 60%	Real Time data capture and retrieval. Increased the visibility by 60%
Performance Attribute**: Responsiveness in Authentication & Product Recall**			
6. Integrity (Authenticity)	Provide 100% visibility and information for authentication		Provide 100% visibility and information for authentication
7. Innovation (Customer Services)	Provide 100% visibility and information for authentication		Provide 100% visibility and information for authentication
Performance Attribute**: Cold Chain Integrity**			
8. Integrity (Quality)	Temperature to be recorded in the EPCIS platform for verification		Temperature to be recorded in the EPCIS platform for verification
Performance Attribute**: Platform Collaboration and Data Exchange**			
9. Efficiency (Time)	Real Time data capture and retrieval		Real Time data capture and retrieval.
10. Visibility (Traceability)	Real Time data capture and retrieval		Real Time data capture and retrieval
11. Innovation (Customer Services)	Real Time data capture and retrieval		Real Time data capture and retrieval

Source: GS1 survey. Note: # A firm reported that the potential benefits of GDS for customs are derived through the provision of product information visibility on the content in the cartons or containers and by enabling the utilisation of GSIN in identifying identical groups of packaging on a similar shipment. Furthermore, the firm reported that the content of a container, pallet or carton box can be easily retrieved by scanning the logistic label barcode attached to the parent logistic level, including the certifications information and documentation required for the customs clearance.

Certain benefits reported by one firm is provided in the table below.

Table 9. Estimated Benefits from GDS - Durian Exporter

Estimated benefit to business	Estimated value (USD)
Reduced manual processes (e.g., labelling; data entry)	1,129
Improved product integrity	1,241
Improved ability to identify trends	451
Improved product traceability and visibility	1,354
Improved exceptions management e.g., improved management of additional delays (avoidance, detection, and mitigation)	790
Reduced time and cost to comply with border agencies or Customs (e.g., in terms of clearance and/or release of goods)	1,129
Improved communication between supply chain partners	677
General cost minimisation	564
Cost minimisation when things go wrong	112,867
Improved customer reporting	564
Improved data quality	451

Source: GS1 survey.

The highest estimated benefit highlighted by the firm is on 'cost minimisation when things go wrong'. If a container is being detained at the port and causes damage to the products, it will cost half a million Malaysian Ringgit which is equivalent to USD 112,867 per container.

Other significant benefits come from the reduction of manual processes and improved product integrity. The other benefits mentioned are improvement in: the ability to identify trends, traceability and visibility, management of delays, communication between supply chain partners, customer reporting and data quality.

There are costs involved in adopting the GDS system as well as specified in table 10.

Table 10. Estimated Costs from GDS - Durian Exporter

Estimated cost to business	Estimated value (USD)
Adjusting to new data formats: • Changes in business procedure and processes to cater for the new data formats. • Labelling and packaging design printing for the new data formats (QR Code and SGTIN barcode).	10,926
Training costs: • Training costs may emerge from providing training to the Solution Providers on the GS1 keys, to the exporter on the GS1 standards and the procedure based on the business steps, to the logistics providers on data capture, etc. • Each training might engage 2 trainers and the trainees can range up to 20 persons.	1,580
Staff time for training (5 days)	1,242
Integration with proprietary platforms: • Fine tuning the EPCIS platform to be able to communicate and interoperate with the EPCIS platform of China and Hong Kong, China.	5,463

• Travelling cost to go on site to study the processes and how to adapt the EPCIS platform to integrate with the stakeholder (processing plant) proprietary platforms. • On-Site survey and monitoring of the data capture process throughout the shipment.	
<u>GDS equipment and installation:</u> • EPCIS platform hosting servers. • Data capture devices – Scanners/Readers. • Temperature Logger. • PCs and Laptops.	3,386
GDS service subscription and/or retainer	7,000
Additional staff to support the development and implementation of the GDS project	98,330#

Source: GS1 survey. Note: #1: staff cost for 2 headcounts on 3-year contracts.

Based on the costs reported by the firm, the highest cost will be incurred through the "Additional staff to support the development and implementation of the GDS project", costing a total of USD 98,330. This cost item is spent for hiring additional staff (2 persons) to support the development and implementation of the GDS project under a 3-year contract. Despite the seemingly high amount, the firm itself considered this as 'low' since the cost will be spread over the years. Cost of adjusting to new data formats is estimated to reach USD 10,926; while integration with proprietary platforms and GDS equipment/installation are likely to reach USD 5,463 and USD 3,386 respectively. These costs, according to the firm, are most likely to be a one-time setup cost with few additional costs for future shipments.

Comparing Costs and Benefits

Based on table 9, GS1 reported the following estimated potential benefits from the implementation of GDS for the completed four shipments (in USD):

- Potential benefit from one shipment: 1,129 + 1,241 + 451 + 1,354 + 790 + 1,129 + 677 + 564 + 112,867# + 564 + 451 = US$ 121,217 (#damage cost to the entire container if relevant)
- Potential benefit from four shipments: 4 x USD 121,217 = **USD 484,868**

The benefits reported above should be treated as indicative, since the largest share of the benefits come from avoiding detention costs which contribute towards 93% of the total benefit.

Further details on the detention costs of a one (1) day delay are as follows:

- Storage/bunking of reefer container at port premises: RM 1,000/day
- Product damage per container: RM 17,000 /day or RM 500,000/month

Detention rarely happens, probably once in 2-3 months, or around four times in a year. With an average of 14 shipments per year, the probability of having a detention during a particular shipment is roughly 4/14 or 28.6% The damage, however, affects the whole container, which costs about half a million Ringgit. The detention at China customs (AQSIQ) is usually caused by the lack of genuine certification and the documentation submitted. As such the benefits from

avoiding detention should be adjusted to take into consideration the probability of occurrence by assigning a weight of 28.6%. The estimation of benefits then becomes:

- Potential benefit from one shipment: 1,129 + 1,241 + 451 + 1,354 + 790 + 1,129 + 677 + 564 + (112,867 x 28.6%) + 564 + 451 = US$ 40,630
- Potential benefit from four shipments: 4 x USD 40,630 = **USD 162,520**

The set-up or investment costs for these benefits, as reported by the firm, are the following (please refer to table 10):

- 10,926 + 1,580 + 1,242+ 5,463 + 3,386 + 7,000 + (98,330 x (3/36)) * = **USD 37,791** for four shipments
  (*three months allocation of staff cost)

C. TEQUILA

Around 79% of Mexico's Tequila exports is to the US. This amounted to about 132.4 million litres in 2014 (Tequila Regulatory Council, February 6, 2015). Also in 2014 in Mexico, 40,000 litres of adulterated ethyl alcohol was confiscated due to allegedly being supplied to the illegal market of alcoholic beverages (COFEPRIS http://www.cofepris.gob.mx/Documents/NotasPrincipales/07032014.pdf). Hence, the pilot project is relevant to Mexico as it aims to improve exchange of information between the different actors in the Tequila supply chain so that products can be better identified and which will then lead to the reduction of smuggling and product forgery.

Four Tequila companies were selected to participate in the pilot and two responded to the survey. Two shipments were conducted for each company under the project. The main partners in contact with the firms include the customs agencies, transport and forwarding companies and the importer warehouse. GDS may improve the most important sources of delay for these firms: inefficient inventory management and warehousing.

In order to develop the pilot, two evaluation stages were considered. The first one consisted of product identification, by placing the radio frequency labels and taking liquid product identification as a reference[6]. The second part consisted of evaluating the interface between the data generated and the ezTRACK™ tool, which would allow knowing when the relevant events occur during the Tequila exports. Surveys from two of the four exporters are summarised below.

Exporter 1

Exporter 1 processes goods and cargo declarations, applies security checks and clears goods. It also requests for payments and issues statements.

[6] Liquid may interfere with the reading or transmission of the radio frequency labels.

The goods are produced by the Exporter. The average size of an order is 1,000 units and is valued at about USD 35,000. The weight of an average shipment is 20,000 kilogrammes. It takes two days for the products to be ready for shipping and the common range for delivery time on these goods is about 4 to 6 weeks. Communication by the Exporter to the forwarder, customs broker, outbound transport company, export and import customs agency and the importer warehouse mostly occurs though emails.

Container loading and documents discharge each costs less than USD 100 on average. The tasks that are most likely to go wrong are lack of timely weight information which would add on seven days to the consignment and cost an additional USD 1,000. Delays in customs can also lead to an additional 6 hours and cost USD 300. The most important sources of delay or inefficiency in the supply chain are inefficient inventory management, delays in customs clearance, product deterioration and delays in delivery. Out of these the most commonly occurring inefficiency is from inventory management which happens seven times within a year. Additionally, exceptional cost (out of normal situation) incurred from a delayed shipment could cost the company USD 1,500.

Exporter 2

Exporter 2 plays the following roles in the supply chain. It engages in forming a purchase contract and placing orders. It also carries out several activities in exporting the goods. This includes booking for transportation, insuring cargo, making their declarations, obtaining export licenses, processing the goods and cargo declarations, clearing the goods, transporting and delivering the goods, providing cargo declarations and advising on dispatch. The firm also requests for and orders payments.

The average order size is 1,000 cases and the average shipment weighs about 20 tonnes. The delivery time for the goods varies from 30 days (plus transit for priority markets) to 42 days (plus transit for the rest of the markets).

The Exporter carries out communication with the forwarder, customs broker, outbound transport company, 3PL storage, exports customs, food safety regulator and the importer warehouse. Most of this communication is carried out through email, office phone and mobile devices. Communication with the manufacturer and the importer warehouse is also facilitated through a web platform (electronic data interchange or EDI).

Average time per consignment for container loading is 1 hour and for documents discharge is 8 hours. Forty-eight hours are spent on average per consignment in completing export customs formalities. Manoeuvres in export customs is the one task that is likely to go wrong, resulting in an additional 2 to 3 days of delay. The most important sources of delay or inefficiency in the supply chain arise from delays in customs clearance and delivery, uncertainties in customs regulations, theft and inefficient inventory management. The most commonly occurring inefficiency recorded is from thefts that occur around 9 times within a year.

Pre-Pilot Conditions

Baseline surveys were conducted to determine the supply chain visibility of stakeholders prior to the commencement of the pilot study. The baseline indicators would then be compared to the results of the pilot to enable the measurement of benefits and costs associated with the use of GDS.

All four pilot companies already use a basic level of GDS (barcodes) prior to the pilot. GS1 set this as a criterion in selecting companies, as a firm with no GDS experience would have required 3 to 6 months of preparation before the pilot could commence.

Five performance attributes were measured to determine the baseline as seen in the table below. These were visibility, risk management, responsiveness, collaboration and level of use of GDS. Tequila supply chain visibility is the criteria under the visibility attribute. The key metrics measured under risk management are forgery, missing product and access to order fulfillment cycle time. Pallet assembly time per pallet and acceptance or reception time per pallet indicate responsiveness. Collaboration's key performance metric is stakeholder's communication and engagement. Lastly, the level of use of GDS is monitored.

Table 11. Baseline Indicators: Tequila Supply Chain

KPI Metrics	Exporter Company	Customs Authorities	Client in US
Performance Attribute**: Visibility**			
1. Tequila Supply Chain Visibility	70% ~ 80% Mix between technology and manual controls, still depends on human factors	70% ~ 80%. A third party to inform custom authorities when they are going to receive a shipment	70% ~ 80%. Use email or phone call to inform about shipment development and the arrival date
Performance Attribute**: Risk Management**			
2. Forgery	50% ~ 60%. Have their own systems to provide assurance on the legality of their products. It is not possible to identify forgery when it happens		
3. Missing product	0%. It is only possible to detect the missing product at the distributor before the last consumer		0%. Only able to detect the missing products until the next stakeholder is receiving or selling the product
4. Access to Order Fulfilment Cycle Time (in each part of the process identified)	Information sharing/exchange by email or phone calls, no automation		Checking of invoices to be received by using email or phone calls.
Performance Attribute**: Responsiveness**			
5. Pallet assembly time per pallet (minutes)	For documentation, it takes 9 hours to complete the shipment file		

KPI Metrics	Exporter Company	Customs Authorities	Client in US
6. Acceptance/Reception time per pallet (minutes)			Around 30 minutes
Performance Attribute**: Collaboration**			
7. Stakeholders communication and engagement	90% of communication is conducted by email or phone calls		90% of communication is conducted by email or phone calls
Performance Attribute**: Level of use of GDS**			
8. Standards use	On average, using 70% of identification standards		70%. Only use the barcode of the case during product reception

Source: GS1 survey.

Firms also mentioned that the most important sources of delays or inefficiencies within their supply chains are mostly related to inventory management and delays in customs clearance. Delays in customs clearance also depend on sea freight schedules that are not totally accurate.

GDS Intervention/Implementation

The GDS project in Mexico tracked the trade of Tequila from Mexico to the US. A total of 8 shipments from four stakeholders in Mexico were shipped to four different locations in the US during the pilot. Four different indicators were measured by the different companies, depending on which event or benefit is most relevant to them:

- Uniqueness/forgery: to identify bottles with missing labels; this is to detect forgery.
- Missing box: to identify missing boxes by detecting the missing label.
- Full trailer: to identify the full content of two containers containing 23 and 26 pallets.
- Regular shipment: to identify regular shipment of 160 boxes (equivalent to two pallets).

The characteristics of the GDS implementation in the Tequila pilot is described below:

- RFID tags were placed on tequila boxes to be scanned using the ezTRACK tool developed by GS1 Hong Kong. The information contained in the labels should be standardised, and the actors involved in the exports chain of products must have the technological infrastructure to perform label reading, since otherwise they would have to do it manually.
- The data captured was made available on-line (cloud-based) and accessible through the internet through the Electronic Product Code Information Services (EPCIS) platform.
- Access was enabled for end-to-end visibility so that the data can be viewed by all actors in the supply chain, from the manufacturer to the consumer.

Prior to GDS implementation, the customer would only be aware of missing products at the final destination. After implementation, ezTRACK can be used to determine the point at which the product went missing.

Impact/Post Pilot Benefits and Costs

Firms that completed the baseline survey indicated that they are mainly involved in the export processes: processing goods declaration, applying security checks and clearing goods. Preparing the shipment for transport and actually transporting the goods may also be involved. As such, GDS is useful to these firms because of the real-time visibility that it offers to all supply chain partners during the export process.

Below are the KPI results which can be compared to the baseline KPIs.

Table 12. Key Performance Indicators: Tequila Supply Chain

KPI Metrics	Exporter Company	Customs Authorities	Client in US
Performance Attribute**: Visibility**			
1. Tequila Supply Chain Visibility	100% supply chain visibility by using the ezTRACK platform	100% supply chain visibility by using the ezTRACK platform	100% supply chain visibility by using the ezTRACK platform
Performance Attribute**: Risk Management**			
2. Forgery	Demonstrate the ability to detect forgery by using RFID technology in conjunction with ezTRACK		
3. Missing product	Demonstrate the ability to detect missing product by using RFID technology in conjunction with ezTRACK		Demonstrate the ability to identify missing product by using RFID technology in conjunction with ezTRACK
4. Access to Order Fulfilment Cycle Time (in each part of the process identified)	100% supply chain visibility by using the ezTRACK platform	Customs authorities can use ezTRACK as a monitoring system	Integrate all the BizSteps to share information and complete the order fulfilment cycle
Performance Attribute**: Responsiveness**			
5. Pallet assembly time per pallet (minutes)	6 hours for documentation		
6.Acceptance/Reception time per pallet (minutes)			To reduce the reception time by 30% (per full truck); to obtain an immediate inventory of the products they are receiving
Performance Attribute**: Collaboration**			
7. Stakeholders communication and engagement	Allow collaboration and sharing of information in a structured way by using ezTRACK (100%)	Allow collaboration and sharing of information in a structured way by using ezTRACK (100%)	Allow collaboration and sharing of information in a structured way by using ezTRACK (100%)
Performance Attribute**: Level of use of GDS**			
8. Standards use	Able to use the GS1 EPCIS standard in the supply chain		Able to use the GS1 EPCIS standard in the supply chain

Source: GS1 survey.

The GS1 Mexico project report stated that the pilot has shown that it is possible to trace the Tequila supply chain by identifying products with RFID labels. The report also mentioned the following benefits - the adoption of RFID has increased efficiency in the reading speed of products contained in a pallet and has reduced operating time by 30% in operating time (from document issuance related to lots and shipment quantities) before the shipment is dispatched; from 9 hours to 6 hours. More specifically, the GS1 Mexico project report noted that obtaining the detailed data of the products contained in an average pallet with a handheld scanner takes one minute, as compared to a radio-frequency tunnel that only takes from 5 to 10 seconds.

The RFID tag carries more information than just the barcode, that is, product identification information and specific data related to the production lot number, expiration date and other user-defined data for more critical monitoring. Hence, it can be used to check if bottles of Tequila have been replaced by counterfeit ones by tracking if all bottles have a unique RFID tag. Bottles without the tag would be deemed fake, and the stage at which this occurs can also be determined by ezTRACK.

For the uniqueness/forgery test, Exporter 1 was able to identify 11 replaced bottles without labels and immediately reported them. This would help prevent forgery. Similarly, GDS can determine if the load is complete at the time of shipment and hence track missing bottles within a box. If the scanner fails to detect the exact number of tags, then the number of missing bottles and the stage at which they disappeared can be determined.

For a regular shipment with 160 boxes, Exporter 2 monitored the shipment and noted regular shipment with the identification of 160 boxes. The pilot found that while visibility is increased for regular shipment, processing time is also increased; however, the exact number is unclear.

A full trailer consisting of 2,595 bottles in two full containers was reported to have better efficiency in data capturing using GDS. The two full containers were identified with the correct number of boxes during the pilot by Exporter 3.

Exporter 4 noted one missing box of its supposedly full 73 boxes as only 72 of them were identified. The result gives the ability to identify missing boxes. However, these pilots on forgery and missing product only test the functionality of GDS, and cannot accurately measure the total reductions in forgery for the overall process.

Two exporting firms also reported the following estimated benefits from GDS. Exporter 1 ranked improved product traceability and visibility as the most important. It also identified improved data quality, improved communication between supply chain partners, improved inventory management and customer reporting to be of beneficial value to the company.

Exporter 2 mentioned improved data quality, improved product traceability and visibility, better matching of supply and demand and improved exceptions management to provide the highest degree of estimated benefits.

Table 13. Estimated Benefits from GDS - Exporter 2

Estimated benefit to business	Degree of benefits
Improved exceptions management e.g., improved management of additional delays (avoidance, detection, and mitigation)	High
Better matching supply to demand	High
Improved data quality	High
Improved product traceability and visibility	High

Source: GS1 survey.

There are some limitations involved in the process as well. Firstly, to enable traceability through the supply chain, the information contained in the labels should be standardised. Secondly, the stakeholders involved in the exports chain of products must have the technological infrastructure to perform label readings to avoid having to do it manually. Thirdly, the RFID tag can only be scanned through certain non-metallic packaging to ensure proper readings.

Exporter 1 estimated costs from GDS equipment and installation to be the highest at USD 2,000. Training costs and GDS service subscription and/or retainer were also noted as some of the higher degree costs involved in the use of GDS at USD 1,000 each.

Table 14. Estimated Costs of GDS - Exporter 1

Estimated cost to business	Estimated Value (USD)
Adjusting to new data formats	300
Training costs	1,000
Staff time for training	300
Integration with our proprietary platforms	500
GDS equipment and installation	2,000
GDS service subscription and/or retainer	1,000

Source: GS1 survey.

Comparing costs and benefits

The Tequila pilot focused on proving the ability of GDS to detect forgery and missing products such that it could prevent thefts. Additionally, the pilot tested the accuracy of RFID scanning in both the regular shipment and two containers. The pilot shows that the GDS system by using RFID has been able to detect forgery and missing products, and the accuracy of data being captured from shipments is good.

Quantifying the benefits of GDS' ability to detect forgery would depend on the application of GDS in individual companies. The potential benefits of reducing forgery in the tequila industry are substantial. The GS1 Tequila project report, citing data from Euromonitor International, noted that 43% of alcoholic beverages have their origin in forgery, illegal sales and

undervaluation. The Tequila report also noted that in 2015, the industry suffered annual losses of 20 billion pesos, with a tax evasion of up to 6 billion pesos.

The adoption of RFID has increased efficiency in the reading speed of products contained in a pallet and has reduced operating time by 30% (from document issuance related to lots and shipment quantities) before the shipment is dispatched; from 9 hours to 6 hours.

In terms of costs, the highest cost for GDS application in one firm is related to GDS equipment and installation, followed by GDS service subscription and training costs.

5. GDS AND BORDER CONTROLS

GS1 New Zealand provided an examination on how GDS could further contribute to supply chain risk management issues at the border. The full report is available in the following link: http://www.gs1nz.org/files/8615/0956/7866/Final_GDS_report_11_July.pdf.

The report highlighted that GDS can play an important role in improving the functioning of border agencies by: making electronic trade data directly available from data storage systems; using barcodes which contain more information compared to HS tariff codes; providing full visibility of cargo movements; and by allowing electronic verification if documentation errors arise. In summary, GDS could improve the accuracy and comprehensiveness of data and focus the agency resources on more targeted activities and inspection.

The GS1 New Zealand report identified the following areas where GDS could assist the border agencies with clearance and risk management:

- GDS acts as a supplementary information provider in the facilitation of trade by existing border agency processes and systems and complements existing risk management tools.

- GDS can reduce data problems which include insufficient data due to damage to manually recorded information, lack of unique identifiers and data errors. Data errors on GDS systems are reduced as many stakeholders test the accuracy of the data on a daily basis as compared to data entered on a single trade window system. Costs and time related to detention and elaborate checks are thus saved.

- GDS can also assist in the implementation of several articles in the WTO Trade Facilitation Agreement. Several examples are provided as follows:
  - As per article 7 (7.1.1 and 7.1.2), GDS can help in facilitating pre-arrival processing procedures through electronic B2G product information submissions. A unique reference code assigned to each product will enable retrieval of detailed information for risk assessments.

- In relation to risk management for trade facilitation agreement (articles 7.4.1, 7.4.2, 7.4.3 and 7.4.4), GDS can enable the identification of low-risk consignments and facilitate their quick release.
- With reference to articles 7.7.2 and 7.7.3, GDS will assist in managing records for internal controls and supply chain security under the Authorised Operators, as well as by ensuring low documentary and data obligations, fewer physical inspections, quicker release times and single customs declarations.
- GDS can facilitate quicker identification of goods, enabling a speedier release of perishable goods (articles 7.9.1, 7.9.2, 7.9.3 and 7.9.4).
- GDS can also support the use of single windows for better storage of data and uniform data sharing standards (article 10.4).

Currently, there are some agencies that have applied GDS but only to a limited extent. The GS1 New Zealand report cited the following examples from the US:

- Applying the GS1 Global Trade Item Number (GTIN) into risk assessment of toys.
- Application of an EDI portal and GTIN data on products to clear boxed meat shipments with damaged or missing shipping marks.

The following are the main challenges to GDS adoption identified by the report: (i) lack of awareness of the possibilities with the use of GDS; and (ii) the need for stronger justification. Many border agencies have purpose-built systems that have a fairly reasonable standardised system in place and will need stronger justification for change. Better collaboration and engagement to further understand the opportunities and potential as well as challenges for GDS implementation are therefore necessary to encourage GDS adoption.

6. CONCLUSION AND THE WAY FORWARD

The three GDS pilots show how GDS can improve supply chain visibility for three products: Asparagus, Durian, and Tequila. The following are the key benefits from the implementation of GDS:

1. Better tracking and sharing of relevant information with public and private stakeholders. The Asparagus pilot reported a benefit of USD 16,500 yearly as a result of less time and resources used by Exporter for searching and consolidating information from shipping processes and temperature measurement. The advantages of using GDS throughout the supply chain from GTIN 13 for the tied asparagus, GTIN 14 for the dispatch boxes and GS1 128 / SSCC for the pallets, provide the basis for improving efficiencies in the supply chain. In particular to the Asparagus supply chain pilot, there was a decrease in costs for all actors involved because they were able to communicate efficiently by using the common

language enabled by GDS. Consequently, this helped in avoiding errors that would have added to logistical costs and lowered competitiveness.

2. Faster and accurate capturing of products information shortening the time required for regulatory compliance and reduce error. The Asparagus pilot reported a reduction in truck reception times by 20% and assembly times for air dispatch by 50%. The Tequila pilot reported that the adoption of RFID increased efficiency in the reading speed of products contained in a pallet and reduced operating time by 30% (from document issuance related to lots and shipment quantities) before the shipment was dispatched; from 9 hours to 6 hours.

3. Prevent detention of products (improved exceptions management). GDS reduces the time spent at customs clearance due to incomplete documentation resulting in detention. Hence added costs resulting from the delays can be avoided by the exporter. Overall, lesser time and effort have to be spent on checking product related information compared to before the implementation of GDS. Detention costs could be large. The Durian pilot mentioned that it could cost the company USD 112,867. One Asparagus exporter also mentioned that delays in customs could cost them USD 40,000 a year with 12 number of occurrences in a year.

4. Improvement in supply chain integrity. The digital EPCIS platform enables easier data tracking and exchange, ensuring on-line and real-time monitoring of shipments. Temperature information is important to be monitored continuously particularly for perishable products. One Asparagus exporter reported that product deterioration/spoilage could cost them USD 200,000 a year. Concerning integrity, every scanned barcode including Serial Global Trade Item Number (SGTIN) will be captured onto the EPCIS platform, thereby providing specific information on every scanned item. This will enable fraud and counterfeit to be detected for further analysis if required. GDS has contributed towards an innovation that transforms the way data is recorded, from a manual method to recording it onto a digital EPCIS platform. The GS1 tag standards are able to capture data onto a shared cloud platform and provide high-efficiency gains.

In the implementation of the pilots, the following key costs are identified:

- GS1 service subscription fees: For the three pilots, these fees ranged from USD 6,000 to USD 7,000 depending on the length of subscription and services adopted.

- Equipment and software costs: The costs for RFID equipment and software ranged from USD 3,386 to USD 5,050 (equipment) and USD 5,463 to USD 7,300 (integration with propriety platform/software).

- Data cleaning and adjustment: Adjusting to new data formats was estimated to cost around USD 300 to USD 11,000. The amount would differ depending on the level of

GDS functionality being applied to particular products. Data cleaning is reported to cost around USD 5,000.

- Staff training: Staff training costs were reported to be around USD 1,000 to USD 1,580. This involved operating ezTRACK visibility platform, the reading in the RFID equipment and the operation of the temperature pods.

- Additional human resources: One of the pilots reported needing additional dedicated staff to support the development and implementation of the GDS project which could amount to USD 98,330 for three years (two additional staff under a three-year contract).

Based on the experience from the three pilots, the following drivers could be identified in adopting GDS:

- Size of the company: Bigger companies with complex operations will require GDS to simplify and improve their supply chain visibility. Bigger companies will also be more able to afford the costs of implementing GDS.

- Need for authenticity: The Durian pilot specifically indicated that the need to maintain brand reputation and product uniqueness has encouraged them to adopt GDS. The Tequila pilot also noted the importance of maintaining their supply chain integrity to prevent theft and forgery.

- High regulatory risk: High regulatory risks that cost companies substantial detention expenses would encourage further adoption of GDS that enables seamless data exchange across the different stakeholders.

- Technological capacity: Technology is one of the key success factors for adopting GDS, but it could also become the barrier. The adoption of RFID and similar technologies may not be at the same level of maturity in different economies and this would slow down the awareness of the benefits that GDS could bring and the kind of standards it requires (see Huber and McCathie, 2007). The performance of a supply chain will be driven in particular by the extent to which technology and supply chain systems across partners are integrated; this has been quoted as one of the major barriers to identification standards adoption.

The GDS Phase 1 report covering two pilots (boxed meat and wine) has noted that firm-level benefits vary significantly and the business case will depend on the existing capability and scale of trade. There is a more general benefit in relation to regulatory reporting of cargo and enabling of dashboard reporting using GDS-compliant visibility platforms in which the automated event data could be used to reduce counterfeiting and guaranteed economy-of-origin, authenticity, and pedigree of products.

Moving forward, having GDS would enable machine to machine (M2M) automation that further streamlines the documentation and compliance processes. RFID application of GDS strengthens the efficiency of the data capture process with sufficient accuracy. MiMOS in Malaysia has enabled automation in their system, allowing automatic updating of certain certificates, and providing seamless data exchange and verification between public and private organisations. Additionally, the Durian pilot reported that an algorithm could be developed into the system to trigger an alert to any condition of risk related with products, enabling firms to take needed actions to prevent losses or reduce wastage. Related to M2M, Telkamp (2006: 58) noted that "Data objectivity can be enhanced as the RFID tags are identified automatically without human intervention. This limits the possibilities for manual interventions and therefore can make the data more believable, e.g., when a retailer wants to prove to a manufacturer that certain products were not in a delivery."

In addition to communication standards, standardisation of information will greatly facilitate better data exchange and collaboration. Data standards, such as Global Trade Item Number (GTIN), could be further harmonised to streamline the required information and to exchange the information across different stakeholders with better accuracy (including on-line and real-time updates).

Better collaboration and engagement to further understand the opportunities as well as the challenges for GDS implementation, are necessary to gradually improve its wider adoption. Once stakeholders realise the benefits of GDS, commitments for further application of GDS could be secured. For instance, the Durian pilot report noted that complete end-to-end information captured by the EPCIS platform opens the possibility of performing advance analysis and data analytics by the stakeholders.

Following the 2016 APEC Ministers Responsible for Trade (MRT) statement that encouraged officials to explore next steps for the wider use of GDS in the APEC region, the following approaches could be considered:

1. **Expand the application of GDS towards improving border management and inspection.** The GS1 New Zealand report highlighted the potential benefits of GDS to improve customs inspection as well as towards better trade facilitation. The GDS pilots under Phase 2 had included border agencies in the pilot implementation of GDS.

   The 2017 GDS workshop, convened under the APEC Committee on Trade and Investment, also highlighted the future or possible plans of customs to adopt GDS into their single window or Authorised Economic Operator (AEO) programmes. GS1 Peru noted interest from the Peruvian government to build a unique Integrated Risk Management System based on visibility and GDS, with the participation of main government agencies including sanitary, agricultural and taxes (electronic invoice), within the Peruvian single window initiative. Peru's Ministry of Foreign Trade and Tourism is also currently considering a proposed GDS project incorporating a visibility tool into the Foreign Trade Single Window and the use of electronic seals. Further suggestions on the way forward for GDS

implementation were also discussed in the 2017 GDS Workshop. A summary of those discussions is available in the appendix.

New Zealand Customs mentioned its Trade Single Window (TSW) that was developed as part of the Joint Border Management System (JBMS). The TSW uses WCO Data Model 3 to improve risk and intelligence capability, and provides the basis for new business models in the future by enabling the streamlining of border processes and reducing data duplication. New Zealand Customs is also trialling two proof of concepts which leverage on the adoption of GDS to facilitate customs clearance of low-risk trans-Tasman sea-freight and low-value e-commerce goods.

While GDS has been applied more widely in the private sector, further adoption by government agencies may support the wider adoption of GDS.

2. **Expand the application of GDS to other types of products.** There have been queries on whether GDS could be applied in other types of products besides fast-moving consumer goods (FMCG). Other APEC fora such as the Life Sciences Innovation Forum (LSIF) has published the "APEC's Supply Chain Security Toolkit for Medical Products" to guide the governments on how to achieve better supply chain integrity for pharmaceutical products. The areas covered range from Good Manufacturing Practice, to Product Security, and Track and Trace systems. The LSIF example shows the application of GDS on sensitive products like pharmaceuticals, dangerous or prohibited goods, and certain categories of food for animal and human consumption, as a regulatory requirement for product traceability for public health and safety.

3. **Realising the Importance of Public and Private Partnership.** The implemented pilots show opportunities for closer collaboration between the private and public agencies in implementing GDS. In Malaysia, the Mi-Trace system, a technology platform developed by MIMOS (a private agency under the Ministry of Science, Technology and Innovation) in collaboration with the Department of Agriculture and Federal Agricultural Marketing Authority, uses GDS for verification purpose at the border and local authorities which includes the following: Halal, Export Permit, Hazard Analysis and Critical Control Point (HACCP), Malaysian Good Agricultural Practices (MyGAP), Good Farm Practice Scheme Malaysia (SALM), and Good Manufacturing Practices (GMP). More collaboration between the public and private sectors will encourage mutual understanding and further improve trade facilitation efforts.

4. **Providing necessary incentives to facilitate GDS adoption.** The GDS workshop discussed the possibility of using some sort of incentives for wider GDS adoption. Developing certain incentives to encourage GDS application will encourage more awareness towards the potential benefits and further application of GDS.

APPENDIX: SUMMARY OF GDS WORKSHOP DISCUSSION

**Workshop on the Application of Global Data Standards (GDS)
for Supply Chain Connectivity
Date: 23 August 2017, Wednesday
Venue: Ballroom 2, Saigon Prince Hotel, Ho Chi Minh City, Viet Nam**

The workshop was divided into the following sessions: Study on the applications of Global Data Standards (GDS) for APEC Supply Chain Connectivity; Experience sharing on the outcome of the pilot projects; Case sharing on facilitation and GDS and promoting wider adoption of GDS.

1. Study on the applications of Global Data Standards for APEC Supply Chain Connectivity

In this session, Mr Akhmad Bayhaqi from APEC Policy Support Unit discussed the results of Phase 2 GDS Pilot Projects which cover the following products: Asparagus, Durian and Tequila. The three pilots have applied GDS standards such as Serial Global Trade Item Number (SGTIN), Global Trade Item Number (GTIN) and Serial Shipping Container Code (SSCC) combined with interoperable cloud-based EPCIS platforms (such as exTRACK or Mi-Trace) to capture data throughout the supply chain including cargo movement in order to provide visibility and data sharing to relevant parties, hence enabling on-line and real-time communication among supply chain stakeholders.

The following are the key benefits highlighted by the pilot projects: reduced information search costs; faster and accurate capturing of products information; prevented detention of products; reduced time required for regulatory compliance; improved traceability among stakeholders; and the ability to detect missing and forgery products. On the other hand, the application of GDS may involve the following costs: service subscription fees; equipment and software costs; data cleaning and adjustment costs; and staff training. Depending on the firms' adaptation process of using the GDS system, the benefits can be further expanded in the long-term. Once a firm is more familiar with GDS, it can develop more efficient processes for operating the system and potentially reduce the costs further.

However, there are several main challenges to GDS adoption. The main one is the lack of awareness of the possible uses of GDS and the need for stronger justification to change existing systems.

Mr Nick Allison from GS1 New Zealand reported his findings of exploring how GDS could help improve border risk management. Good risk management systems involve determining risk, undertaking risk analysis and then prioritising the use of resources such that border agencies can be more efficient in identifying wanted goods and allocating their resources to detect unwanted goods. Benefitting from such a system will require good data management. Problems such as insufficient data, untimely data, entry errors and non-unique data could harm

the efficient inspection process of border agencies. GDS can help to overcome these data problems and make customs inspection more targeted and focused.

As for the next steps, Mr Allison provided the following recommendations:

1. APEC should engage with border agencies to scope business needs and understand how GDS can assist with risk management and rapid border clearance well in advance of GDS pilots.
2. Pilots should continue – but pilots need to be led by border agencies or through a private-public partnership.
3. Pilots that engage border agencies should focus on:
    i. adding supplemental data to enhance existing agency processes, especially in areas of regular high volume trading.
    ii. supporting new agency initiatives such as Authorised Economic Operator (AEO)/trusted trader programmes aimed at faster border clearance, where GDS could substantially enhance agencies processes.
    iii. management of high risk/value goods, e.g., traceability and authentication of products.

2. Experience Sharing on the Outcome of Pilot Projects

In this session, pilot stakeholders shared their hands-on experiences in participating in the GDS projects, from training to streamlining and enhancing current operations/processes, capturing data/information and finally overcoming the challenges and realising the benefits of adopting GDS.

Ms Lindsay Dickson from Teys Australia highlighted the following key challenges of adopting GDS: application of GDS through manual processes, requirement for conducting a series of manual queries to get the complete supply chain overview, usage of manual-based visibility system and limited EDI capabilities. Ms Dickson reported that adding the web portals functionality of GDS has provided supply chain visibility to interested parties with ease. GDS incorporation also allowed the same data to be uploaded to several different web portals to provide advice on load (visibility) and provide authorities with regulatory information such as E-Cert quarantine, security and food safety. The Meat Messaging Web portal project has provided visibility of supply chain, facilitated clearing of goods at import and at the same time provided information to customers down to carton level of load.

Moving forward, Ms Dickson provided several key suggestions which include recognising GDS in regulatory framework, to use uploaded information to verify supply chain integrity, to use information to focus regulatory efforts on exceptions in the supply chains, and to use barcodes / Serial Shipping Container Code (SSCC) as load identifiers in lieu of ship marks.

Dato' Paul Mak from the Malaysia Durian Exporters reported positive results from the GDS Durian Pilot which include the following:

- Overall supply chain visibility improved from 40% to 100%.
- Time spent on tracking the goods' position reduced by 98% compared to previous manual tracking.
- Serialisation combined with supply chain visibility ensured improved anti-counterfeiting mechanism.

For the next steps, Dato' Mak suggested the following actions: (1) for APEC to develop guidance on the use of GDS by competent authorities at the border, as part of addressing the APEC supply chain improvements; (2) further guidance on simplification of processes at the border including migration to paperless trade.

Mr Marco Sanchez from Pernod Ricard Mexico, reported the activities of the GDS Tequila Pilot which involved putting radio frequency tags on tequila products in order to trace them all along the logistic flow. Additionally, detection devices were also installed in the logistic-flow sites, including production and distribution warehouses, and highways and customs.

Mr Sanchez explained the following impact of GDS application in the Tequila pilot (among others):

- Process improvement: opportunities for reduced paperwork at Customs in US.
- Transit time diminution: 5-day decrease in transit time.
- Complete visibility on alcoholic beverages trade: visibility in imports, exports, sales, taxation, etc.
- Public health: assuring the consumption of authentic products that comply with each market regulation.
- Consumer information: providing on-premise level of consumption information and product information at the retail level.

Ms Mary Wong from GS1 Peru explained about the GDS Peruvian pilot project results and the next steps to be taken. The GDS Asparagus Pilot in Peru has managed to address the following key issues: Traceability/Visibility Data Definition for Risk Management Purposes; Data Mapping Guidelines and Standard Methodology; and Implementation. Moving forward, Ms Wong highlighted the following key findings:

- Visibility is of huge interest for both the private sector and the government in order to avoid duplicative processes.
- Interest from Peruvian government to build a unique Integrated Risk Management System based on visibility and GDS, with the active participation of main government agencies including sanitary, agricultural and taxes (electronic invoice), within the Peruvian single window initiative.
- Interest in APEC to continue efforts in using GDS to improve Supply Chain Connectivity by having more detailed pilots.

3. Case Sharing on Facilitation and Global Data Standards

In this session, Ms Allex Evans from New Zealand Customs Service introduced two Australia/New Zealand trials, namely "e-Commerce Green Lane" and "Secure Trade Lane" which adopt GDS to facilitate e-commerce and customs clearance. Ms Evans explained that Trade Single Window (TSW) in New Zealand is currently progressing in a Joint Customs/MPI project that uses WCO3 data model, aiming to improve the risk and intelligence capacity, and provide the basis for new business models in the future. Ms Evans shared the New Zealand's experience in implementing the e-Commerce Green Lane Trial and the Secure Trade Lane Trial. The Green Lane trial involved both New Zealand (Customs, MPI, NZ Post) and Australia (Border Force, DAFF, Australia Post) stakeholders who test processes that allow the seamless movement of low-risk goods while enabling resources to be re-directed towards high-risk goods.

Ms Evans also explained the future state of Secure Trade Lane which may involve a joint clearance where the export entry becomes the import entry; the requirement for industry to submit each piece of information to agencies only once; and for the industry to provide information at the earliest possible point in the supply chain.

4. Panel Discussion on Next Steps to Promote Wider Adoption of GDS

This session aimed to exchange views or ideas on how to further promote the adoption of GDS in the APEC region. Ms Maria Lucana from the Trade Facilitation Department, Ministry of Foreign Trade and Tourism, Peru, highlighted Peru's plan for the next steps for GDS which consist of the following:

1. To share the results of the APEC pilots with trade associations, logistic operators, public sector and other stakeholders, and to promote best practices on the application of GDS.
2. To coordinate at inter-sectoral level the scope of the project in the application of GDS.
3. To evaluate the incorporation of a visibility tool into the Foreign Trade Single Window.
4. To consider the use of electronic seals in the project along the supply chain.

This session also discussed the possibility of having certain incentives to encourage the application of GDS.

ABBREVIATIONS AND GLOSSARY

3PL	Third-Party Logistics refers to a firm that provides outsourced logistics (and supply chain) services to shippers/suppliers.
AEO	Authorised Economic Operator is a party involved in the international movement of goods, in whatever function, that has been approved by, or on behalf of, a national Customs administration as complying with certain supply chain security standards (adapted from World Customs Organisation definition).
AQSIQ	General Administration of Quality Supervision, Inspection and Quarantine of China.
CBP	US Customs and Border Protection.
EDI	Electronic Data Interchange is the transfer of data from one computer system to another by standardised message formatting, without the need for human intervention. EDI permits multiple firms - possibly in different economies - to exchange documents electronically.
EPCIS	Electronic Product Code Information Services is a standard developed by GS1 to capture and report event-based traceability data. EPCIS helps to capture visibility event data along the supply chain. Visibility event data details about physical or digital activity in the supply chain of products and other assets, identified by keys, detailing where the objects are in time, and why; not just within an organisation, but across organisations.
FOB	"Free on Board" terms of trade. The cost of export clearances and transport to the export port terminal are borne by the supplier. Once the goods have crossed the ship rail and are effectively "on board" the vessel at the export port, the goods transfer ownership to the importer.
FMCG	Fast Moving Consumer Goods refer to products that sell relatively quickly at low cost.
GDS	Global Data Standards.
GIAI	Global Individual Asset Identifier captures information about the asset used in the supply chain.
GLN	Global Location Number identifies the location of the event and the stakeholder involved.
GMP	Good Manufacturing Practice is a system ensuring quality standards in the production of goods.
GS1	GS1 is a neutral, not-for-profit, international organisation that develops and maintains open, global standards for supply and demand chains across multiple sectors.
GSIN	Global Shipment Identification Number contains information on the whole shipment.
GTC	Global Traceability Conformance is a programme that supports the implementation of traceability.

GTIN	Global Trade Item Number is a GS1 identification key used to globally identify tradeable items.
HACCP	Hazard Analysis and Critical Control Points are a systematic approach towards food security, aimed at protecting food from biological, chemical and physical hazards during its production.
JBMS	Joint Border Management System.
KPI	Key Performance Indicator.
LSIF	APEC Life Sciences Innovation Forum.
M2M	Machine to Machine.
MIMOS	A private agency under the Ministry of Science, Technology and Innovation of Malaysia.
MRA	Mutual Recognition Agreement is an agreement between two or more economies to recognise each other's conformity assessments.
MRT	APEC Ministers Responsible for Trade.
MyGAP	Malaysian Good Agricultural Practices.
PTI	Product Traceability Initiative is an industry-led initiative to improve traceability throughout the supply chain.
RFID	Radio Frequency Identification is a means of storing and retrieving data through electromagnetic transmission to a radio frequency compatible integrated circuit. The technology uses small radio transponders, called "tags," that are attached to the objects being tracked. The tags communicate with a reader (or antenna) when a tag is within range of the reader. The reader then passes information about the object to a host computer that processes the information and, in turn, passes the information over internal networks and the internet. Thus, as the tagged objects move in the supply chain, the movements can become visible through a web-interface. The tags can be programmed to hold a substantial amount of information describing the contents of the container, its shipment origin, destination, etc. They can also be used to detect tampering or other security breaches (see Johnson 2007). RFID tags can be passive, requiring an RFID reader; or active, with the tag able to independently transmit.
SALM	Good Farm Practice Scheme Malaysia.
SC	Supply Chain refers to a system of people, organisations, processes and information involved in sending goods or services from the supplier to the customer.
SCV	Supply Chain Visibility is the ability to track the movement of goods from the supplier to the customer.
SGTIN	Serial Global Trade Item Number is a unique number allocated to a single product item and then combined with the GTIN to provide a unique identification for the package.
SKU	A Stock Keeping Unit is an identification code in the form of a machine-readable bar code that enables tracking of a product or service for inventory.

SOP	Standard Operating Procedures.
SSCC	Serial Shipping Container Code is the GS1 identification key used by firms to identify a logistic unit, which can be any combination of trade items packaged together for storage and/or transport purposes, for example a case, pallet or parcel.
SUNAT	Peru's Customs and Tax Administration.
TFA	Trade Facilitation Agreement.
TSW	Trade Single Window is a system facilitating easier cross-border trade by collecting regulatory documents at a single location.
ULD	Unit Load Devices are containers or pallets used to load freight onto aircrafts.

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