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Advancing Free Trade
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Study on the Application of Global Data Standards for APEC Supply Chain Connectivity (Phase 1)

APEC Policy Support Unit
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1. EXECUTIVE SUMMARY

Adoption of global data standards (GDS) in supply chains enables relevant stakeholders to send and receive messages to and from each other in a globally consistent language, hence assist them in monitoring freight, transport assets such as containers and trucks, storage and delivery locations and reporting events throughout the shipment, such as traffic congestion, accidents and port delays. By adopting common identifiers for goods, transport equipment, places and events, activities in the supply chain can be viewed from supplier to customer.

In order to demonstrate this capability, two pilots were conducted to test the utilisation of GDS in supply chain connectivity. These pilots involved cross-border shipments of wine and beef between APEC members, including Australia; the United States; and Hong Kong, China.

Identified Costs and Benefits

The pilots aimed to discover more about how GDS can enable improved supply chain connectivity across borders and the respective benefits and costs related to achieving connectivity. Benefits were measured across the variables of efficiency, integrity, visibility and innovation. Costs were assessed across the variables of preparation, development and implementation of global data standards.

Adoption of GDS into a business effectively builds a capability which can be leveraged to create connectivity and visibility in each supply chain. The pilots were able to demonstrate that this capability can be achieved; however the realised benefits are not fully evident at this stage without further assessments over a longer period of time.

For the Wine Pilot, quantifiable benefits achieved through utilising GDS for traceability were associated with eliminating inefficiencies and delivery in full on time (DIFOT) failures from the baseline survey. These inefficiencies were estimated at 1.00 percent of the value of this supply chain. The annual shipments are low volume and the trading relationship is mature with well-established "workarounds" for shipment failures. However, in the high volume domestic trade for this product, higher visibility would deliver more substantial business value.

For the Beef Pilot, benefits quantified were associated with savings in manual data entry, container demurrage and detention and amelioration of the impact of missing or damaged port shipping marks. The benefits derived from adopting and applying GDS accounted for 0.67 percent of the value of this supply chain. The shipments are high volume and high value, so the benefits are significant for this trade and can be extrapolated to more benefits for the Australian meat export industry.

The costs of adopting GDS within each supply chain can be variable. They depend on the levels of automation and accessibility all participants wish to achieve. The full costs of implementation were not experienced through the pilot, as a pilot platform was provided to participants for uploading and querying data. Factors such as staff training and development of new messaging interfaces were not fully operationalised to enable evaluation of actual costs. For a small or medium sized business, the cost to achieve GDS-compliant messaging is estimated at a minimum of USD 11,000, in addition to membership fees of the standards issuing body and the transactional costs based on the number of messages and interfaces required (similar to a telephone or internet plan) with a service provider. The recurrent costs range between USD 1,092 and USD 12,325, depending on turnover, level of integration with enterprise resource programs and the volume of messages. For larger enterprises, full integration with business systems is the most efficient approach, with initial integrations being able to be repeated with suppliers and customers at a much lower cost once EDI XML interfaces are programmed for the various messages.

At the conclusion of the pilot assessment, it was not possible to accurately determine a cost-benefit ratio for the pilots given their nascent state. Each pilot was able to demonstrate benefits and identify costs. However, the precise value of both remains subject to further realisation beyond the timeframe of the current study. For example, having data available which is harvested from supply chain events can lead to improved business reporting and decision-making and to the development of innovative applications. However, such developments have not yet emerged from these pilots due to the small number of shipments conducted in the timeframe of the study.

Key Impact of GDS

For the businesses, the main issue targeted by the use of GDS in the wine and boxed beef pilots was limited visibility in the supply chain. GS1 Hong Kong, China, a not-for-profit standards organisation, made available a data platform to upload data on each shipment event, to be shared between businesses. This platform (EzTrack), combined with the application of GDS in each business, enabled real time connection and visibility for participants along the supply chain of both pilots.

Baseline surveys were conducted to determine the performance of each supply chain prior to the commencement of the pilots (i.e. without the use of GDS). Based on completed surveys, interviews and conferencing with each business, it was established that the communications among stakeholders are still largely manual processes to report events in the supply chain, with large components of the physical process effectively a “black hole” invisible even to the party with current custody of the goods.

Of the 28 percent of the businesses in the pilots interacting via a web portal, in the majority of cases the data was entered manually. Automated messaging was used in only 14 percent of these businesses, which included manufacturers, processors, warehouse and storage, port

terminals, transport and customers. Few businesses exchanged data with more than the "one up; one down" participants in the supply chain.

In the pilots, as a result of adopting GDS and using them to share event messaging, visibility was found to have increased from 35 to 73 percent of supply chain events for the wine pilot and from 43 to 93 percent for the boxed beef pilot. Improved data tracking reduced the delivery in full on time (DIFOT) failures in both pilots (by 5 and 1 percentage points, respectively).

APEC GDS Survey

APEC economies were surveyed in relation to the levels of adoption of GDS and the anticipated benefits that might accrue in the private and public realms from standardisation of supply chain data. Sensitive products such as pharmaceuticals and food products traded cross-border were identified as a priority for traceability and supply chain visibility enabled through the standards. Levels of adoption within traded goods sectors varied considerably across APEC economies, with 50 percent of respondents having none or limited adoption of GDS in their jurisdiction.

In member economies where standards are being utilised, systems for track and trace are implemented in pharmaceuticals, food and beverage, healthcare, retail, communications, building products and construction industries. In these economies, the private sector has voluntarily adopted GDS to enable improved communication with domestic and international trade partners.

Manufacturers and their logistics service providers are expected to be engaged in adoption of these standards in their supply chains. In the public sector, APEC member economies could envisage GDS being intrinsic to assurance and compliance verification by trade agencies such as Customs and food safety/biosecurity inspection agencies.

Anticipated benefits from adoption of GDS within APEC economies were efficiency, visibility, and traceability, with an expectation that they would support lowering cost in goods distribution.

Key challenges envisaged in adoption of GDS across APEC economies were changes required to achieve harmonised legal and regulatory frameworks if the standards are mandated; the need for broad private and public sector awareness of the benefits of GDS; and whether micro, small and medium sized businesses would have the capacity to invest in this capability.

Contribution of GDS to SCFAP

In relation to the APEC Supply Chain Connectivity Framework Action Plan (SCFAP), the pilots indicated that the adoption of GDS can contribute to amelioration of a number of chokepoints, for example lack of awareness and coordination among government agencies on policies affecting logistics; burdensome customs documentation and other procedures; and variations in cross-border standards and regulations for movement of goods. Two examples of this capability shown in the pilots were in the use of barcode data to replace missing or damaged

shipping marks on boxes of beef that would normally be rejected by the regulator for clearance and the ability of the port authority to automatically notify approved wharf cartage operators of container availability, expediting port clearances.

Challenges and opportunities arise in relation to relieving the chokepoints. These were identified in relation to:

- Use of industry system data to manage supply chain risk;
- Coordination of regulatory agencies;
- Application of GDS in trusted trader programs;
- Cargo security applications; and
- Interfaces with port community systems.

Enablers and Challenges

Data is the fundamental requirement for border clearance from the outset of a shipment. The lack of electronic data interchange (EDI)-enabled interfaces with border and trade regulatory agencies in each pilot means that data identifying each item/transport asset/party must be uploaded manually, making it then prone to human error. Manifest data could be improved by using GDS to more accurately label and record tradable goods. This would improve Customs tariff collection and monitoring of sensitive products.

Companies enabled with GDS experience frustration as they are unable to take advantage of automated clearance processes. The gap between industry and government systems will widen as digital business grows. Companies that are participants in trusted/preferred trader programs are expected to develop greater visibility of shipments using GDS, as is the case in the beef pilot. Shippers and border agencies could share the benefits of this capability.

The pilots demonstrated the “knock-on” impacts of manual errors which extend throughout the supply chain and affect the competitiveness of each business. Particularly in the beef pilot, the process of replacement/re-issuance of USDA Food Safety Inspection Service documents such as phytosanitary certificates often outweighs or erodes the value of the shipment, so food wastage results. Acceptance of barcode data on meat shipments, which carry up to 40 attributes of the product contained in the box, can replace manual stamps/shipping marks and result in elimination of error and reduction in the cost of rejected and delayed shipments.

Border agencies will need to further analyse the potential to access and use data from visibility platforms to verify compliance or to remove duplication for shippers entering information onto Customs or biosecurity web platforms. The pilot showed that data from a shipment covering the entire import/export path can be available to participants in the supply chain. How a border agency may access and utilise this industry data is unresolved.

Progressing GDS adoption in APEC

In order to encourage the adoption of GDS as a generic capability within APEC supply chains, further pilots and monitoring of results over a longer period of time is recommended. Firms that proceed to full development and integration of supply chain messaging, including transport instruction, transport status and event tracking; to complement existing commercial transaction messaging, will take some time to recognise and implement dashboard systems to assist decision-making and to provide customers with full transparency of freight movement.

Regulators are in a position to encourage the adoption of standards to enable visibility in sensitive supply chains such as pharmaceuticals and certain categories of food for animal and human consumption, where supply chain visibility is critical to product safety and managing risk. However, introduction of a mandatory GDS in these supply chains will require harmonisation across APEC economies and this represents one of the largest challenges identified by APEC members.

It emerges that governments might consider two streams of activity in relation to the adoption of GDS to facilitate trade:

- Supporting industry understanding and uptake by working with trade and logistics peak bodies and the standards-providers; and
- Conducting analysis on how GDS might be utilised in gathering data to improve the efficiency of trade regulation activities.

A multi-pronged strategy is advised to facilitate the adoption of global data standards across APEC supply chains, led by industry and supported by governments. Industry facilitation needs to be supported through initiatives with manufacturers and logistics service providers such as establishing a global data standards certification system and linking micro, small and medium enterprises (MSMEs) to standards-compliant suppliers.

The role of industry peak bodies is recognised as an effective conduit with manufacturers and transport and logistics suppliers. These industry bodies are in an ideal position to educate their members on the benefits of global data standards and to encourage members to move to certification in the standards and automation of messaging.

These strategies may include:

- Promotion of the benefits of using GDS in collaboration with domestic industry peak bodies (freight forwarders; logistics associations; chambers of commerce and trade associations);
- Establishment of a certification system with the standards provider. In September 2015, the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC) endorsed the GS1 Electronic Product Code Information Services (EPCIS) event-tracking standard and the GS1 Core Business

Vocabulary. ICT system providers, such as SAP, can now derive business value from marketing their compliance with this standard, as can suppliers such as transport firms;[1]

- Development of Communities of Practice for micro and small businesses, to link them to ICT integration suppliers who are certified as GDS-compliant;
- Supporting domestic and APEC regional initiatives, such as the APEC GDS pilots;
- Advancing the ability of industry to utilise data from visibility platforms in compliance activity; and
- Implementing GDS in existing domestic compliance systems related to freight operations, such as mass management, driver fatigue, electronic work diaries, and vehicle booking systems.

The two pilots have shown the time, resources and commitment required of firms to progress the adoption of global data standards from simply a "dictionary" of supply chain standards to a useful business tool to enhance supply chain connectivity. As firms progress in the digital economy, new interactions between traders and regulatory agencies which take advantage of the automated event data should be considered in the armoury of tools at each government's disposal to fight counterfeiting and to verify economy-of-origin, authenticity and pedigree of products. This will potentially extend the firm-level benefits identified in the pilots.

[1] GS1, 2015, "ISO/IEC approves GS1 EPCIS standard for improving traceability and anti-counterfeiting" media release, http://www.gs1.org/sites/default/files/docs/epc/ISO_EPCIS_Release_9.15.15.pdf

2. INTRODUCTION

Economic integration among the APEC member economies has continued strongly over the past several decades. This has been influenced by income and population growth, particularly among the developing member economies, and domestic and regional trade policy reforms in the region. At the same time there has been rapid advancement in information and communication technologies, including digital technologies. Given this background, efforts to improve supply chain connectivity and to further strengthen regional economic integration, have become one of APEC's core activities.

Global Data Standards and APEC

Global Data Standards (GDS) provides a common language to identify, capture and share supply chain data. Through the application of a broad range of coding and data sharing systems, GDS provide a unique identification for all products, business locations, traders and automatic sharing of relevant information, thus enhancing supply chain visibility by knowing 'what', 'where', 'when' and 'why' of an event.

GDS also enhances traceability (defined by the International Organization for Standardization (ISO) as 'the ability to identify and trace the history, distribution, location, and application of products, parts, and materials'[2]) along supply chains in an effective and efficient manner. Increasingly GDS-enabled traceability systems are needed as products, parts, and materials move from suppliers, are processed at another location and are ultimately distributed as end products. Such traceability systems provide information on the components of products, parts, and materials as well as information on transformations throughout the value chain. Traceability ensures the accuracy of this information, such as product quality, safety and labelling (see United Nations Global Compact and BSR, 2014).

APEC has recognised the potential benefits of GDS for real-time tracking of products from the source to their final destination across APEC member economies and beyond:

- 2010: Ministers made a commitment to an APEC-wide target of a 10 percent improvement in supply chain performance by 2015, in terms of reduction of time, cost and uncertainty, taking into consideration individual member economies' circumstances; (APEC Leaders' Declaration, Yokohama, 2010)
- 2013: Ministers recognised the contribution that GDS could make to enhancing supply chain efficiency, and encouraged to explore what more could be done to facilitate mutual compatibility amongst data standards frameworks, and the compatibility of

[2] Praxiom Research Group Limited (2013), ISO Definition of Traceability, http://www.praxiom.com/iso-definition.htm#Traceability.

economies' frameworks with the use of GDS; (APEC Ministerial Meeting, Bali, 2013) and

- 2014: Ministers directed further advance work on GDS, including developing pilot projects, conducting studies and establishing a set of policy-based principles and recommendations for future GDS initiatives. Leaders also encouraged APEC member economies to work with the private sector to promote further cooperation on GDS and their wider use by developing pilot projects. (APEC Ministerial Meeting, Beijing, 2014)

Production processes that cut across multiple member economies are prevalent in the APEC region, making GDS particularly important for effective and efficient border management and supply chain performance. One example is the Hong Kong Intra-Asia Visibility Pilot among China; Hong Kong, China; and Chinese Taipei, which has started to streamline data standards for customs management in the APEC region (see http://www.apec.org/Press/News-Releases/2014/0512_standards.aspx).

There are several other current or planned GDS initiatives in the APEC region. Malaysia has initiated a process using GDS in their frozen durian export trade aimed at ensuring traceability (and potential recall) of the products to address common interest issues such as uplifting product branding and maintaining consumer trust in relation to authenticating product brand. Other pilots demonstrating the use of GDS in product supply chains, in Malaysia, Mexico and Peru, were recently announced.

In Australia, pilots implementing GDS across multimodal supply chains are underway, including the distribution of imported retail goods and domestic agri-food products.

The *APEC Statement on Promoting the Use of Interoperable GDS (2014)* notes that the wider use of GDS can have the following benefits across the APEC economies:

- Efficiency: GDS can improve the efficiency of supply chains by eliminating unnecessary transactions, and enabling better informed and more accurate risk assessments;
- Integrity: GDS can be used to verify the integrity of a product throughout the supply chain;
- Visibility: GDS can increase the visibility and transparency of supply chain processes; and
- Innovation: GDS can provide a platform for innovation by enabling new ways to utilise information through 'smart' supply chain processes.

Global Value Chains and GDS

Global Value Chains (GVCs) cover the full range of activities involved in bringing a product/good or service from its conception to its end use and beyond, including design, production, marketing, distribution and support to the final consumer across multiple geographic areas. GVCs have become a dominant feature of the global economy including the APEC region. APEC is looking to move beyond reducing transaction costs, as outlined in the

Trade Facilitation Action Plans (TFAPs), and expand its trade facilitation work to cover other associated transport, communication and related regulatory 'behind the border' costs. GDS will be instrumental in achieving these higher level objectives.

APEC Supply Chain Connectivity Framework and GDS

Improving trade logistics through enhanced supply-chain connectivity has emerged as a significant factor contributing towards increased trade facilitation. The APEC Supply Chain Connectivity Framework (CTI Report to Ministers 2014) reinforces the need for approaching supply chain connectivity holistically and conducting 'cross-cutting' work on trade facilitation across APEC fora and sub-fora. Identifying the 'chokepoints' (trade-impeding bottlenecks) in the existing supply chain networks and focussing on work streams that would address these chokepoints are integral to enhancing supply chain connectivity.

The APEC Supply Chain Connectivity Framework has set down eight chokepoints affecting the smooth flow of goods, services and business travellers throughout the APEC region:

1. Lack of transparency/awareness of the full scope of regulatory issues affecting logistics; lack of awareness and coordination among government agencies on policies affecting logistics sector; and an absence of single contact point or champion agency on logistics matters.
2. Inefficient or inadequate transport infrastructure; lack of cross-border physical linkages (e.g., roads, bridges).
3. Lack of capacity of local/regional logistics sub-providers.
4. Inefficient clearance of goods at customs; and lack of coordination among border agencies, especially relating to clearance of regulated goods 'at the border'.
5. Burdensome customs documentation and other procedures (including for preferential trade).
6. Underdeveloped multi-modal transport capabilities; inefficient air, land, and multimodal connectivity.
7. Variations in cross-border standards and regulations for movement of goods, services and business travellers.
8. Lack of regional cross-border customs-transit arrangements.

It is anticipated that widespread use of GDS in various supply chains in the APEC region (and beyond) will help overcome variations in cross-border standards and regulations for movement of goods (as per Chokepoint 7 in the APEC Supply Chain Connectivity Framework Action Plan (SCFAP) (CTI Report to Ministers, 2014) of the APEC members.

Furthermore, it could be argued that the use of GDS also helps to address other chokepoints, particularly chokepoint 1 (lack of awareness and coordination among government agencies on policies affecting logistics), chokepoint 4 (the inefficient clearance of goods at customs), chokepoint 5 (the burdensome customs documentation and other procedures), and chokepoint 8 (the lack of regional cross-border customs-transit arrangements).

The current study

In response to the developments described above, the APEC Committee on Trade and Investment (CTI) commissioned the study described in this report on two GDS pilot projects. As the wider use of GDS is likely to have beneficial impacts on stakeholders along the supply chains, such as producers, logistics providers and consumers of tradable goods in the region, the aim of the study was to assess the benefits as well as the associated costs of the implementation of GDS in these supply chains. The study outcomes will assist APEC to map future activities on GDS.

3. STUDY OBJECTIVES AND METHODS

Objectives

The major objectives of the pilot projects were to:

1. Track the progress and conduct a proof of concept and cost-benefit analysis on the application of particular GDS at product level, with a particular aim of enhancing supply chain visibility as related to traceability and expedited product admission (coping with existing customs clearance system and future single window platform), specifically:
    - to demonstrate whether and how GDS will enhance supply chain performance and contribute to better compliance;
    - to identify enablers, challenges and mitigation policies; and
    - to determine if it is cost-effective to adopt GDS in supply chains for relevant stakeholders (e.g., traders, logistics service providers, border agencies, etc.);

2. Propose recommendations on possible future actions to enhance supply chain performance through the application of GDS, taking into account the challenges that member economies may face. This may include policy recommendations to facilitate compatibility among member economies' frameworks with the use of GDS. These recommendations will help to identify the next steps to implement the commitments by Ministers and Leaders on this issue, building upon the existing APEC and APEC Business Advisory Council (ABAC) work.

3. Illustrate the current implementation of certain GDS by APEC member economies used for the trans-boundary movement of goods and address the related chokepoints identified under the APEC Supply Chain Connectivity Framework Action Plan (SCFAP).

The aim of the analysis phase of the study was to develop quantitative metrics in the form of a proof of concept that can measure what and where benefit streams flow from adoption of GDS, including elucidating the less tangible benefits to supply chain partners, through documentation of the pilot studies.

The study included investigation of and recommendations for the treatment of key issues and the benefits and costs associated with adoption of the GDS.

The GDS pilots

The two pilot supply chains chosen for the study were:

- Wine exported from Australia and imported to Hong Kong, China (the 'Wine Pilot');
- Boxed beef exported from Australia and imported to the USA (the 'Beef Pilot').

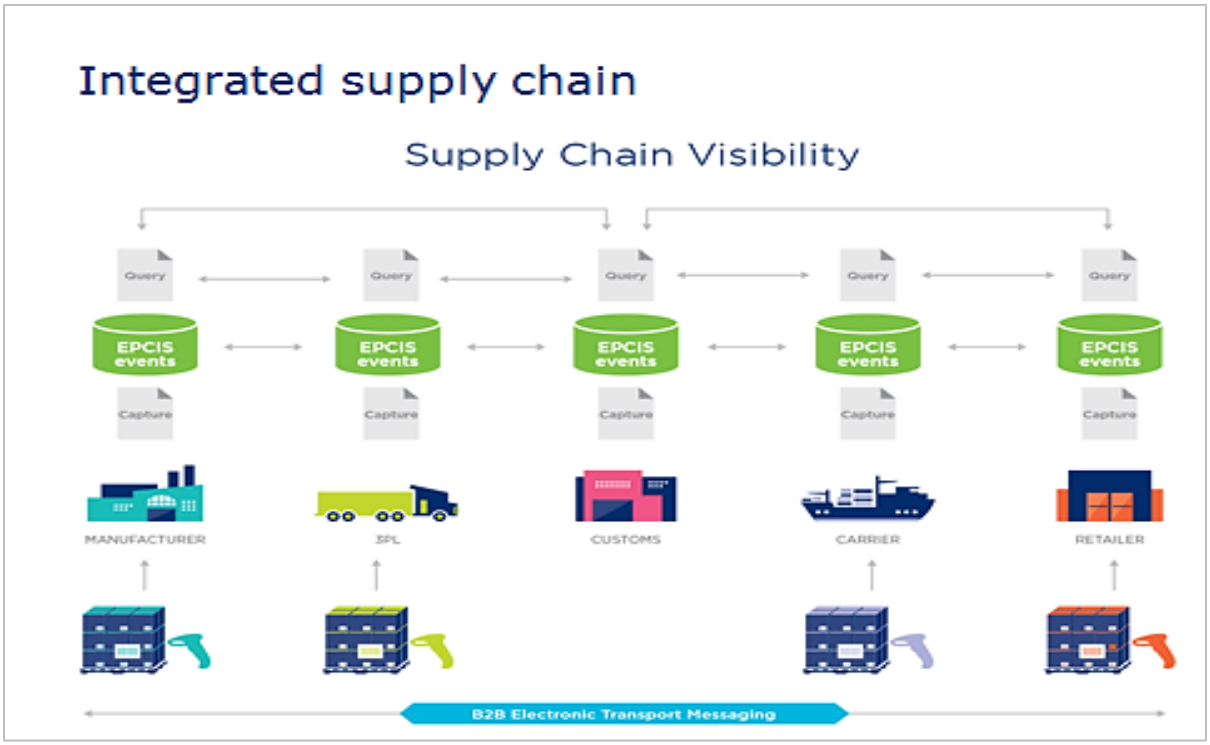
These supply chains had a mix of current capabilities in electronic messaging, were trialling the use of GDS in existing electronic interfaces, and were introducing the GS1 Electronic Product Code Information Service (EPCIS) standard (used to associate a cargo item with a transport asset such as a pallet, container, ship, or truck) in a supply chain event (e.g., vessel arrival, truck loading) in real time. Detailed flow charts showing the supply chain processes and the messages associated with each 'event' in each of these supply chains are shown in Appendix 1.

Before the GDS pilots commenced, it was apparent that there was limited visibility in the supply chains, either through email communication or through electronic data interchange (EDI) interfaces that transmit messages to activate business processes, mostly around commercial milestones such as submission of a purchase order or an invoice. Most of the messages reporting on the status of cargo were sent hours, sometimes days, after that event, so decision-making and monitoring is delayed, thus creating cost, reducing opportunity, and elevating risk.

The GDS pilots aimed to supplement this existing transactional data with transport event messages and transport instruction interface using GS1 standards. The Electronic Product Code Information Services (EPCIS) EzTrack integrated supply chain test environment (a portal for messages between all parties without the need for full system integration) was used to enable additional messages and real-time visibility for all participants. This was the first step towards implementation of GDS at product level.

Figure 1 illustrates how GDS is used to enhance supply chain visibility in the form of business-to-business (B2B) electronic transport messaging.

Figure 1: Use of GS1 in electronic transport messaging



Source: GS1 Australia

Messages and global standards

The event reporting for both pilots used GS1 EPCIS standards:

- EPCIS 1.1 Specification
- Core Business Vocabulary (CBV) 1.1
- EPCIS and CBV Implementation Guideline
- EPC Tag Data Standard v1.9

Barcode labelling of freight:

- Both trials used the existing labels on the cases of wine and cartons of beef, which use GS1 numbering and barcoding
- The Wine Pilot also used the existing barcode labelling of pallets

The 'Meat Messaging' system is based on the GS1 standards for numbering and bar coding of meat products and the GS1 EANCOM electronic message standard (see http://www.meatmessaging.com/docs.asp, FAQs)

Methodological framework

The methodological framework used to capture data related to costs and benefits in each supply chain comprised three tasks:

- Completion of a baseline survey to determine the use of GDS in each supply chain prior to the pilots commencing;
- Establishing the key performance indicators associated with efficiency, integrity, visibility and innovation relevant to each pilot; and
- Identifying impacts experienced or anticipated in each supply chain in implementing the GDS through the pilots.

APEC member economies were also invited to complete a survey in relation to their assessment of progress on adoption of GDS in their trade activities. This survey was done by the APEC Policy Support Unit.

The following steps were undertaken to complete the study tasks:

- Formal engagement with the key stakeholders;
- Developing a questionnaire and conducting a GDS pilot baseline survey;
- Developing a GDS pilot benefits/key performance indicator (KPI) matrix and applying it to each supply chain; and
- Qualitative and quantitative assessment of likely costs and benefits of using GDS.

The GDS pilot baseline survey questionnaire (Appendix 2) was designed to collect relevant data available from the firms and stakeholders in each supply chain. The data available was influenced by several factors including the key relationships with each firm in the pilot supply chain, ICT suppliers and managers, GS1 project staff and the APEC Secretariat.

The questionnaire was developed in close consultation with the key stakeholders. Feedback and responses to the survey were used to form qualitative and quantitative assessments of the costs and benefits of improving supply chain visibility using the GDS. The data collected at baseline represent conditions prior to the application of GDS and the data available to measure the KPIs and other benefits.

Responses from stakeholders for post-pilot assessments were sought following the boxed beef and wine shipments using the relevant GDS. Three boxed beef shipments and four wine shipments were included in the pilots described in this report.

It should be noted that the pilots are by their nature a preliminary ‘discovery’ phase in adopting the wider use of GDS. As such the benefits for each supply chain were measured at an early stage of implementation. As full implementation occurs, it is likely that additional commercial benefits will emerge and further applications built on the GDS will come into use, as has been the case in other GDS pilots.

The process of assessing the benefits of GDS involved raising awareness and collaboration with the key stakeholders, including:

Beef Pilot:

- GS1 Australia and US
- Meat processing firm in Australia
- Customer in USA
- Australian and USA Customs and Border Protection Services
- Wharf transportation
- Shipping line
- US Department of Agriculture Food Safety and Inspection Service
- Biosecurity Australia (Department of Agriculture and Water Resources)
- Meat Clearance Centre, Port of Philadelphia
- 3rd party logistics (3PL) cold storage
- Meat and Livestock Australia.

Wine Pilot:

- GS1 Hong Kong and Australia
- Wine supply firm in Australia
- 3PL wine warehouse
- Stevedore
- Import customer (Hong Kong, China).

Agreement was sought on selected KPIs to be measured at baseline and then again on completion of the pilots. Data collection involved the GDS pilot baseline survey questionnaire and the GDS pilot benefits/KPI matrix. This was supplemented with face-to-face and telephone discussions with the stakeholders.

Assessment of the benefits of GDS was dependent on the business tools at the disposal of firms to generate meaningful actions to enhance efficiency. While the standards enable whole-of-supply-chain, real-time data capture and exchange, it is up to the participants in each supply chain to utilise the data to effect decisions and activities that benefit the traders, regulators and each business in the chain. The documented examples in this report of how participants created benefits by using GDS were therefore limited by the tools used in each pilot supply chain.

The benefit assessment focused on four potential benefit streams:

- Efficiency: defined around standard 'Delivery in Full on Time (DIFOT)' measures and focused on time and cost savings.
- Integrity: defined around protection of product authenticity, management of defined risks and product quality. For the Beef Pilot, the metrics included a key focus area around compliance, including time and cost impacts associated with border clearance procedures and the potential benefits associated with traceability and attaining Trusted Trader status.
- Visibility: defined around improved planning and management of variables within the supply chain.
- Innovation: the ability to create new value from the use of data analytics and to utilise supply chain visibility to lift customer service.

Prior to the pilot commencing, the companies in each supply chain were asked to rank the anticipated benefits. The responses from eight of the companies involved in the pilots (three in the Wine Pilot and five in the Beef Pilot) were scored. Improved cost control, cost savings from automation of business processes, improved data quality and labour efficiencies were foremost in the expectations of these businesses (Table 2).

Table 2: Anticipated benefits of GDS by pilot companies

Expected benefit to my business	**Ranked score of responses**
Improved cost control, especially when things go wrong	15
Reduced manual processes e.g., labelling, data entry	11
Improved data quality going into business systems	10
More efficient use of labour (improved work flows)	9
Reduced time and cost to comply with border agencies	8
Earlier notification of transport schedules	8
Improved customer reporting	7
Improved exceptions management	7
Better matching supply to demand	7
Improved ability to identify trends	5
More predictable operations	5
Avoidance of stock run outs	3
Improved inventory control	3
Improved collaboration between supply chain partners	2

Source: Victoria University, Institute for Supply Chain and Logistics (VU ISCL) APEC GDS Pilot Baseline Survey, 2015

4. BENEFITS OF ADOPTING GDS

The Wine Pilot (Australia to Hong Kong, China)

During the pilot, one container of wine was exported to the customer every two to three months. While the product was shipped in much higher volumes on the domestic market, the amount exported in the pilot was thought to be typical for a smaller Australian exporter.

The pilot commenced in October 2015 when the first shipment was completed. Since then, three further shipments were completed, making it four shipments in total. Being a small volume shipment with potential for pallet level aggregation, it was decided to utilise the product identification at the carton level, which could be identified on a pallet and subsequently, a container.

Thirteen events were recorded across this supply chain utilising the Electronic Product Code Information Services (EPCIS) GDS (see Appendix 1). The terms of trade for the Wine Pilot were 'Free On Board (FOB)', so the customer assumed custody of the product from the time it was loaded on the outgoing vessel from Australia.

The process from the point at which the customer placed the order to the point of shipping the wine is outlined below:

- Orders were received via email from the customer in Hong Kong, China via an Asia-wide sales team working for the supplier firm and located in China. The information was then manually entered as a purchase order and entered into the Enterprise Resource Planning (ERP) system.
- The supplier coordinated transport of the product from several vineyards to a consolidation centre operated by a third-party logistics (3PL) company. The supplier had an existing electronic data interchange (EDI) interface with the 3PL Warehouse Management System (WMS), so was aware of what stock was being held at the facility. A Customer Sales Order was the first message to the 3PL from the supplier to activate a shipment.
- A pick list was prepared within the 3PL to optimise container loading (this is particularly useful if the shipment happens in a less-than-container-load (LCL) consignment.
- The 3PL also organised all clearances for the shipment including an electronic interface with the Australian Customs and Border Protection Service Integrated Cargo System to receive a cleared Export Declaration Number (EDN) for the shipment. Export shipments of over 100 litres of wine require the exporter to have a licence for export,

product registration and an export permit.[3] The Export Permit Number, issued by Wine Australia, is required before receiving an EDN from Australian Customs. At this stage, data entry was required to populate the clearance system to enable electronic transactions with Wine Australia's website and the Australian Customs Integrated Cargo System.

- The supplier was notified of the vessel and voyage details by the customer/importer, who booked the shipping of the product to Hong Kong, China.
- The selected shipping line supplied empty containers to the 3PL to pack the shipment. Once the shipment was packed and all clearances were complete, the 3PL placed the full container on a grid and the stevedore was notified to transport the container a short distance to a loading slot in the port terminal.
- The 3PL notified the supplier that the goods were dispatched and the shipping line in turn notified the customer/importer that the container had been loaded on the vessel and the voyage had commenced.

Observed and potential automated messaging across the Wine Pilot supply chain

At the baseline survey, it was indicated that three key EDI messages that record 'milestone' events and facilitate invoicing within the supplier and the 3PL were automated. Only one of these messages was a time-stamped EDI message from the 3PL to the supplier confirming the packing was complete. The remainder of the process was manual, mainly due to the low volumes and specific requirements of the product.

It was not possible to trace a carton of wine from the vineyard through to the customer. Although the 3PL's WMS was capable of capturing this data and making it visible to the supplier or customer, this functionality had not been activated. Global Trade Item Numbers (GTINs) were not recorded and thus there was no itemising of GTINs against a Serial Shipping Container Code (SSCC) that related to the pallet, so tracing a carton of wine beyond the packing list associated with the container was not active.

The 3PL used a manual process to assess whether all stock had arrived ready for packing and the batching of the stock onto pallets. This function could be automated within the WMS based on GTIN data but the impetus to do so would depend on customer demand and volume.

At the Hong Kong, China leg of this supply chain, the customer/importer organised wharf cartage from the port terminal to a storage and distribution facility. The Customer Order was transmitted as a PDF document by email to the Australian supplier and a PDF of the invoice

[3] Wine Australia Compliance Guide, December 2015.
http://www.wineaustralia.com/en/Production%20and%20Exporting/Exporting%20Wine/~/media/0000Industry%20Site/Documents/Production%20and%20Exporting/Exporting%20Wine/Wine%20Australia%20Compliance%20Guide%20December%202015.ashx

for the goods was also sent via email. A forwarder was used to organise shipping from Australia via email or telephone.

The elapsed time for a Full Container Load (FCL) shipment, from the time the customer placed the order to receiving the order and placing it in storage after unpacking was 14 days.

Benefits of GDS in the Wine Pilot

Efficiency

The main efficiency issue for the Wine Pilot was delivery in full on time (DIFOT) failures related to:

- Delays in loading/unloading containers at port due to weather/disruption.
- Incorrect entry of data, e.g. coding of the Purchase Order from the customer.
- Errors in loading a mixed order on a pallet for shipment.

In the case of shipment failure due to missing stock (DIFOT, Table 3), the stock would be re-ordered to go out with the next shipment due to the cost associated with small volume shipment. Elapsed time to include the missing stock in the next shipment was 14 days for re-shipment plus additional time and cost to resolve the shipment failure. Who bears the cost of the missing stock is an issue to be resolved between the supplier, the customer and the insurance firm, but as Table 3 shows, the costs can be considerable.

The expected benefit of GDS relates to improved customer reporting and avoidance of stock run-outs.

Table 3: Impact of DIFOT Failures on Wine Pilot

Stakeholders/Parties Involved	Additional time per occurrence (hours)	Cost per occurrence (USD)
Supplier • Receive message regarding missing stock • Reorder missing stock for next consignment • Issue credit note to customer	4.00	230.00
3PL • Amend inventory • Pack missing stock	2.50	143.00
Customer • Inform the supplier and re-book the order • Arrange new shipment • Receive release order and arrange truck pick up • Product devanning • Product storage	10.50	273.00
TOTAL	17.00	646.00

Source: VU ISCL APEC GDS Pilot Baseline Survey, 2016.

In the baseline survey, an estimate of the annual cost of failed shipments is USD 15,000. This cost is not inclusive of the foregone 14 days of potential sales that the customer experienced, which no doubt would have an impact on profit and customer satisfaction.

Prior to the GDS pilot, data relating to the carton (or pallet) was scanned once the product left the Australian 3PL warehouse and was not readily available again until the wine was received and put away at the importer's warehouse in Hong Kong, China. Therefore, it could not be verified as to whether the pallet, container, vessel or truck actually contained the order of cartons or individual bottles at any point along the chain, making it difficult for the supplier to correct any errors that may occur along the way.

During the pilot, enabling GDS at the carton level eliminated this wastage, allowing the supplier, the 3PL and the customer to know precisely what had been shipped as carton level data was available at every point of the shipment. The use of GDS completely eliminated errors from the point of packing to the receipt and storage of the shipment and improved cost control, especially when there were shipment failures. GDS provided improved ability to pinpoint the event, location, date, time and custodian of the cargo related to the shipment error and improved the DIFOT measure by five percent.

Visibility

The capacity to provide earlier notification of transport schedules is another benefit of GDS. The shipment schedules provided by the shipping line and transport suppliers are usually

tentative. Using the EzTrack platform, the importer could view the actual departure and arrival of the vessel, improving receival planning such as warehouse preparation.

The customer/wine importer in Hong Kong, China identified GDS enabled improvement in the ability to identify trends as another business benefit. With the adoption of GDS, data can be captured precisely and linked efficiently to internal planning and report cycles, to identify trends in supply which can be addressed in a systematic way. Within a firm, various reports rely on the accuracy of data from work sites. Inconsistency of data can result in time wastage, which adds to the cost.

Innovation

The ability to track a consignment at the carton level was identified as a capability which would enable the customer to move towards a more "pull" or demand-driven supply chain model. This model would enable better matching of supply and demand and elimination of surplus inventory, as the customer's sales data related to the supplier's stock could be made available immediately, allowing the supplier to plan for replenishment, all without the intervention of manual processes. In the instance of infrequent shipments, this can be a vital efficiency gain, avoiding the need to keep buffer stocks at the customer end and allowing the supplier to redeploy surplus stock and ensure supply is prepared well in advance of a shipment. In a mature trading relationship, as is the case for the Wine Pilot, this benefit became evident to the customer.

The Beef Pilot (Australia to USA)

Australian beef sales to the USA totalled over 416,000 tonnes in 2015, the equivalent of more than 23,000 FCL shipments. As a major meat exporter in this trade, the volume of FCL beef shipments was significant, thus magnifying small cost and time savings into large absolute gains. For the Beef Pilot, the supply chain involved transporting product from the processor in Queensland, Australia, through the Port of Brisbane to the Port of Philadelphia, USA, then on to a storage facility for distribution to retailers by the customer. The supplier and the customer were subsidiaries of one international firm.

GDS was used for all 15 events in this supply chain pilot (see Appendix 1), including EDI messages between ERP systems, event notifications and transport instructions. Three pilot shipments were completed using GDS.

The process from the ordering of the beef to delivery to the customer is outlined below:

- Orders for boxed beef were placed through EDI messaging to the meat processing plant (supplier). Both the customer and supplier systems were automatically populated with 30 to 40 attributes of the product.
- Full container loads of boxed beef were packed at the meat processing plant. The supplier managed freight forwarding internally.
- Wharf cartage was outsourced to a transport firm and shipping was booked directly with the shipping line.
- Shipped from Australia to the USA via New Zealand.
- On arrival at the Port of Philadelphia, the customer liaised with the meat clearance centre and organised transport to 3PL cold storage in New Jersey and delivery to customers.

Through the use of GDS, the Beef Pilot was able to identify in real time the movement of the beef product from the processor to loading at the Australian port, trans-shipment via New Zealand on the shipping schedule, arrival at the US port and discharge to the Meat Clearance Centre. The product was then transported to the cold storage facility where grading, inspection by the United States Department of Agriculture Food Safety Inspection Service and product storage took place prior to distribution.

Benefits of GDS in the Beef Pilot

Efficiency

DIFOT failures in the Beef Pilot were related to:

- Incomplete or missing ship marks;
- Incorrect entry of data e.g., Export Clearance Number (ECN);
- Refused entry based on missing phytosanitary originals;
- Knock-on impacts of shipping and port clearance delays/surge events;
- Failure to return empty containers to the shipping line;
- Expiration of free days storage at port terminals.

The DIFOT baseline measure was 98 percent for the meat shipments, although a single failure generally impacts the entire consignment on that Bill of Lading. In the Pilot, the DIFOT measure was 99 percent. This improvement in efficiency was due to the elimination of DIFOT failures related to incomplete or missing ship marks.

Transport management

At baseline, daily manual entry of up to a dozen ECNs into the Transport Management System was required to activate an EDI notification. In one year, this equates to thousands of entries. At an hourly rate of USD 55[4], the savings for this specific supply chain in automating this one process is USD 57,000 per annum and in excess of 1,000 hours of manual labour. Avoidance of this cost through the pilot generated what at first appeared to be a marginal benefit. However, in the context of the entire business of the outbound wharf cartage transport firm, this benefit can be extrapolated into significant savings.

Based on the identification of this benefit during the pilot, the company proceeded to implementation of this automated message. There were further benefits from this one change in better meeting customer needs and eliminating manual data entry errors. Given the sophisticated systems available in the business, only a modest effort was required to integrate the automated messages around transport instructions with the supplier/Customs systems.

Container demurrage and detention

Another efficiency benefit identified in the pilot was reduction in costs associated with container demurrage and detention. By being able to track equipment (containers) and improve the speed of return of empty containers from the importer, the shipping line could potentially reduce container detention costs. Detention costs on return of empty reefer containers between nine and 17 days late were on average USD 120 per twenty-foot equivalent unit (TEU) and USD 210 per forty-foot equivalent unit (FEU), rising to USD 255 and USD 440, respectively,

[4] This figure includes wages, company overheads and outsourced programming support.

after 25 days. The incidence of container demurrage at port terminals and container detention due to expiry of equipment 'free days' was estimated at one container per 200 shipped at baseline. Use of the GDS was able to eliminate this cost during the pilot.

Automation of ship discharge notices to the transport and 3PL suppliers concurrent with notification to the importer and/or the importer's customs broker can substantially reduce the costs of container demurrage and detention. The shipping line in the pilot indicated the likelihood that this could be a significant benefit if it saved a day lost in notification and booking of timeslots to deliver or collect the container at the port terminal. There are limitations on 'free days' at busy port terminals with usually four days on the wharf and four extra days to collect, transport, unpack and return the container to the shipping line.

This issue has been the subject of a US Federal Maritime Commission inquiry held in 2014, mainly in response to the escalating cost of demurrage and detention charges resulting from port congestion[5]. The ability to minimise these costs through early notification of container availability at port and importer notification can make a significant reduction in costs, given the volume of containers of meat shipped into US ports.

Integrity

The shipping line was able to supply location data to the EzTrack portal during each shipment, at trans-shipment and at regular intervals during the shipment, enabling improved traceability for the shipper and customer. The shipping line identified that attaching temperature logging monitors to the containers to measure the interior temperature of the container in real time was a potential customer care assurance that could be added.

Innovation

The Australian Meat Messaging Portal is an innovation in meat export utilising the GDS. One particular application is in enabling verification of the port shipping mark on each box of beef imported to the US. It is currently in trial for replacement of damaged or missing shipping marks.

Verification of the shipping mark is a pivotal step in meat importation to the United States as clearance of a consignment of meat relies heavily on this mark, which contains details of the contents of the carton. Once the submitted consignment data has been verified, the meat has the status of a domestic product and is able to be distributed. Currently, the GDS-compliant barcode is recognised as a 'back-up' mechanism to the manual verification process used by the Australian and US regulators. By working with the regulators and co-investing in the

[5] US Federal Maritime Commission, (2015), Rules, Rates, and Practices Relating to Detention, Demurrage, and Free Time for Containerized Imports and Exports Moving Through Selected United States Ports, April 3, 2015.

development of this capability, the industry anticipates the barcode using GDS will be a fully automated process.

This is a major advancement which would deliver benefits for trade, reducing administrative time and cost and inevitable human error from the meat clearance process. The Australian boxed meat exports to the US in 2013 of 279,762 tonnes lost AUD 14.5 million due to missing or damaged port shipping marks, indicating a significant trade restricting effect.[6] The supplier estimated that one percent of its meat shipments into the US were rejected due to missing or damaged port shipping marks. As this firm is acknowledged as a high performer in implementing quality control over port shipping stamps at the processing plant, it is likely that other suppliers would have a higher rate of missing or damaged shipping marks on meat cartons.

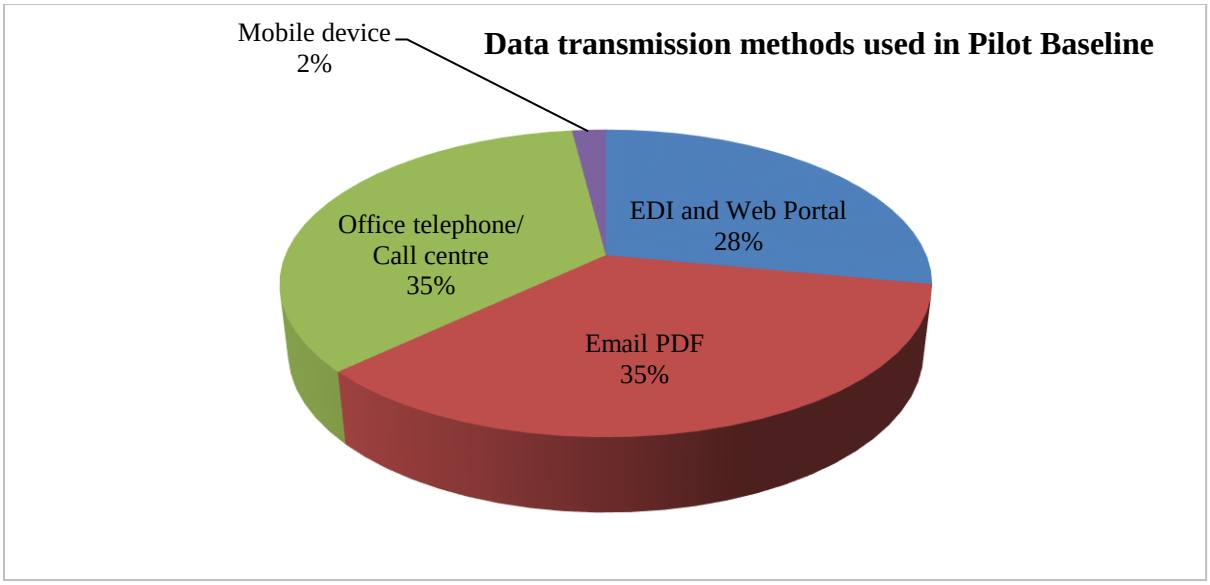
Demonstrated benefits in the pilot GDS implementation

Based on completed surveys and interviews, it was established that the communications among stakeholders to report events in the supply chain were still largely manual processes, with large components of the physical process effectively a 'black hole', invisible even to the party with current custody of the goods.

Both pilots contained businesses with some EDI messaging or capability, although in some instances, this capability was latent. Of the 28 percent interacting via a web portal, in the majority of cases the data was entered manually (see Figure 3). EDI was used by 14 percent of participants.

[6] D.N. Harris and Associates, 2013, Comparative Evaluation of Technical Barriers to Trade for Australian Red Meat, MLA and AMIC

Figure 3: Data transmission methods used in pilot baseline survey



Source: VU ISCL APEC GDS Pilot Baseline Survey, 2016

Emailed PDF document formats were commonly used to transmit key data that activated internal business processes, generating event data which was usually a by-product of a commercial transactional milestone, for example a time and date stamp for a completed process such as goods receival. The EDI systems were not focused on cargo status or transport events per se.

In each pilot supply chain, participants identified automated notices that were available from their existing systems but were not activated. In both instances (warehouse and transport), there was a lack of recognition that other parties could benefit from this information. This may be due to the fact that the supplier considered it not cost effective to activate due to the low volume of trade in this supply chain. With minimal effort, some event data was able to be supplied to the whole supply chain. These are opportunities that were not core to the pilot but that could be exploited to provide greater benefits (with larger customers).

In the baseline survey, few respondents had interaction with more than the ‘one up’ or ‘one down’ participants in the supply chain. This may be due to the terms of trade of both pilots, where the FOB shipment meant less interaction between the supplier and the foreign participants. Interaction may increase due to an investigation of a failure, when the supplier queries successive contractors. However, this does not involve parties such as the port terminal where delays may have occurred.

The Beef Pilot had the most advanced interfaces, largely due to the supplier and customer having compatible systems that populated data based on GDS-compliant barcoded cartons scanned and uploaded in the customer system and shared with the supplier through EDI.

Efficiency

Avoidance of DIFOT failures

In the pilot supply chains, DIFOT failures represented two percent (beef) and five percent (wine) of shipments at baseline. With accurate capture of data, the pilots demonstrated that DIFOT failures could be largely eliminated. Improved tracking of the freight and attachment of monitoring applications to measure compliance to regulator and customer specifications, such as temperature monitoring can virtually eliminate DIFOT failure.

Investigation of DIFOT failures

The pilot businesses identified that the increased supply chain visibility through the use of GDS would result in time and cost savings associated with forensic investigations into the causes of and the party responsible for DIFOT failures (such as missing freight, tampering with goods, product integrity failures, delays that result in additional fees such as container detention or demurrage at ports and terminals). Using the EPCIS event-tracking portal, GS1 allowed suppliers, logistics operators and customers to capture real-time data to help circumvent any time-consuming investigations.

Supply chain planning

Improved planning for shipment receival and collection of cargo from port terminals were identified as potential benefits. Port systems utilising GDS for interoperability are able to provide 'push' notifications to cargo owners and forwarders when a vessel has discharged cargo. With reduced dwell times in port terminals, an additional day's notice can potentially save demurrage costs and allow more time for cargo owners to unpack goods and avoid container detention.

Use of GDS to enable system interoperability can also help distribution logistics, so labour can be better matched to arrival of goods. Distribution centre managers can better coordinate pack/unpack and storage processes and merging of domestic deliveries with import products for loading or repacking for retail delivery. Pre-pilot, schedules were tentative. Lack of certainty has a significant cost in logistics, where an entire shift of workers may be underutilised due to inability to match events to labour. During the pilot, availability of event data was able to support improved shipment planning.

The EPCIS portal data on supply chain events can interface directly with warehouse management systems to optimise activity.

Identifying trends and analytics

Improving the quality of the data through the addition of event data to the enterprise resource planning (ERP) system can help the customer to identify trends in real time. With unique identifiers for each product, freight unit and event, a search can be immediately undertaken to

locate all activities associated with the item, carton or pallet. Improved supply chain analytics can assist with decision-making around distribution strategies and address recurring problems.

Removal of processing errors

Participants in both pilots agree that elimination of manual data entry would be beneficial. Although this was not seen as an onerous process in these pilot supply chains given existing EDI messaging, the cumulative savings in manual data entry time and human error adjustments could be significant.

Integrity

A shared terminology

One of the benefits of GDS is the improved clarity around shipment information and the avoidance of confusion between parties. The GDS relies on a shared understanding of the 'who, what, where, when and why' and provides clear definitions.

Data integrity

Application of GDS to the EDI messaging, transport instructions, transport status and EPCIS event monitoring creates greater standardisation, resulting in better data quality. This in turn generates improved reporting against business KPIs and can save significant amounts of time on internal reporting, where inconsistent data plagues business metrics. Cleaning data is often needed when GDS are introduced. For example, one business found six addresses for one customer in its system, now replaced by the one unique global location number (GLN).

Product integrity

GDS creates the language and 'grammar' for messages to be transmitted across disparate data systems. Applications using GDS have the capacity to identify, capture and share a range of attributes such as economy/region of origin, temperature, humidity, product pedigree, as well as data that attaches to the product and cargo unit, at the individual item, carton, pallet, truck, vessel or container level, for supply chain purposes. Concerns regarding product inputs, the conditions of production, compliance with product assurance and quality systems, tampering and biosecurity risks can therefore be monitored across borders, transport modes and supply chain events using GDS.

The shipping lines have identified the potential to enhance customer care by being able to monitor temperature during transit. This is not only an assurance for suppliers and customers but allows a spike in temperature to be managed, so that the 'use by/best before' dates can be adjusted accordingly as well as the warehousing and distribution instructions.

Visibility

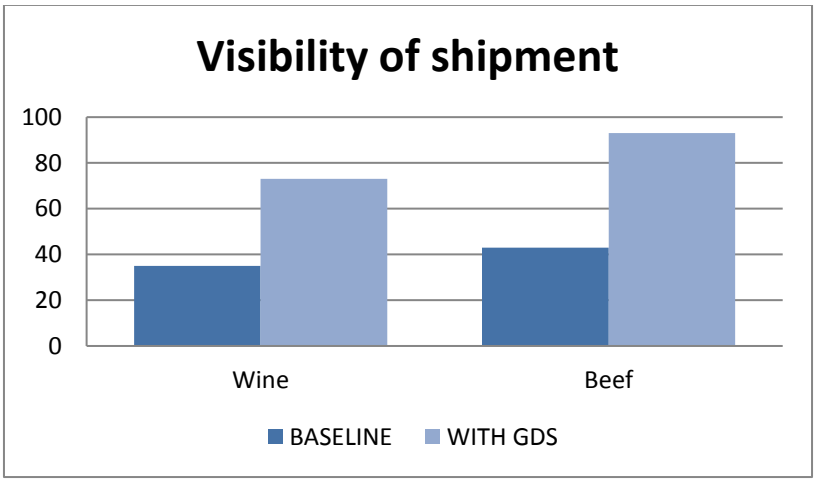
Traceability

Both pilots showed marked improvements in traceability through the use of GDS (Figure 4). In the Wine Pilot, the benefit of having the capacity to identify product across split loads in the transport task was evident. Containers containing a blended load coming from several suppliers make transport cheaper but there is an additional level of risk in losing track of the product through the supply chain. GDS allows the relevant parties to trace individual cartons at each stage of the shipment.

In the Wine Pilot, visibility at baseline was via EDI messaging or emailed PDF documents. No event status information was available in real time and it was not automated. These messages covered 35 percent of events during the shipment, while the remaining 65 percent of events were invisible to participants other than those executing the particular task. During the pilot, automating event reporting using the GDS GS1 EPCIS during shipment resulted in 73 percent of events being visible by all parties.

In the Beef Pilot, visibility (not in real time) covered 43 percent of the shipment events at baseline. The use of GDS in the pilot improved visibility to 93 percent of events.

Figure 4: Visibility of Shipment Levels Pre and Post Pilot



Source: VU ISCL APEC GDS Pilots, 2016.

Innovation

New methods to demonstrate compliance with regulators

A key expectation from the Beef Pilot was using GDS to engage with the Meat Messaging Portal and to automate the Port Shipping Mark process. This application, built on GDS, is an example of the capacity within industry to innovate and create real value for traders.

Less tangible benefits

There were a number of less tangible benefits identified during the pilots that are more difficult to measure. These were either outside the available service offering or outside the scope of the supply chain analysis. They include:

- *Customer service/assurance using readings from temperature loggers during the voyage*. As the beef is trans-shipped via New Zealand, this is a material concern for the supplier and customer. By recording temperature in real time, any variations can be managed by either discarding product or bringing forward its 'use-by' date. For some products, missed sales promotions could have a significant impact on the supply chain.
- *End customer satisfaction*. The analysis only covered the supply chain from the exporter/supplier to the importer/customer's storage facility. However, the end customers are also affected by DIFOT failure. This has a range of effects; some are measurable while others are difficult to assess, such as the levels of trust and contract risk to the end customer. Some penalties were assessed indicating that the price the end customer is willing to pay for the product if there are issues with clearances can reduce the value of the product by two thirds.

- *Foregone sales for the importer*. Although not included in the analysis, there are known costs to the supplier through investigations into missing stock and lost sales, and impacts on the end customer through limited availability of stock.

5. COSTS OF IMPLEMENTING GDS

The cost variables include preparation, development, and implementation of GDS. Estimates of costs were based on an average of USD 55 per hour for each activity. The costs did not include hardware purchases as it was assumed that companies adopting GDS have existing computers. Additional investment in radio frequency identification or RFID (a form of electronic tagging) equipment including sensors, barcode readers or hand-held devices may be needed at receival and dispatch points.

Preparation

Prior to embarking on system integration, a key task in making GDS useful is the need for clean data, which can then be shared by supply chain stakeholders. For example, one business found that it had coded multiple location data for one site, so that GDS-compliant transport instructions needed to be made consistent with global location numbers. It was estimated that collating and cleaning up master data would take about 20 hours.

In preparing for adoption of the GDS, the business must understand the GDS system and the associated new data formats and review data fields on business forms to accommodate the system. This task was estimated to take 40 hours.

Total time: 60 hours = USD 3,300

Development

Development of the GDS system involves programming messages in a format, e.g., Javascript, that can be transmitted and received in a portal repository shared by supply chain participants, or transmitted direct to relevant parties through electronic data interchange (EDI). Developing messages for the Electronic Product Code Information Services (EPCIS) and stored procedures was estimated to take 80 hours.

EPCIS queries also need to be programmed so that each participant can retrieve the required data from the portal or another party using the GDS. This process could take up to 20 hours.

Limited development was required in the pilots as the pilot businesses had the advantage of using the GS1 EzTrack test environment, which acts as a collaborative portal through which participants can lodge data and query the supply chain event data in addition to their own EDI-transmitted data.

Total time: 100 hours = USD 5,500

Implementation

System integration for the full automation of messages and implementation of supply chain visibility requires construction of interfaces between the supply chain partner systems, including:

- supplier enterprise resource planning (ERP);
- transport firm's transport management system (TMS);
- third-party logistics (3PL)'s warehouse management system (WMS);
- shipping line portal;
- port community system;
- freight forwarder's system; and
- customer's ERP.

Implementation requires time, resources and ICT development work. Those more advanced in implementation of supply chain event visibility generally spend around two months on the task using both internal staff and ICT consultants.

Work practices often rely on individual knowledge and 'workabouts' developed in the workplace to overcome recurring problems. While automated interfaces eliminate manual processes, change requires the support of staff to utilise the technology correctly to record and collate correct data. This requires leadership and cooperation of management and staff. Adequate training and awareness is a cost to the business but it can be balanced by the benefits of process automation and data harvesting. Staff training can take about 40 hours in total within a small business with less than 20 employees.

In addition to time costs, there are costs associated with hosting or setting up the platforms for the GDS system. For a small business to implement a basic EDI and EPCIS messaging capability, there are two options:

Option 1: Basic, non-integrated, using web forms

This may be a fixed-cost deal available with no set-up, similar to a mobile phone plan. The basic service fee is estimated at USD 38 per month, based on volume with unlimited messaging, or increments of USD 15 per month for each new customer on-boarded.

Option 2: Integrated set-up

This can be either a hosted service or built in-house (costing between USD 1,000 and USD 10,000 to build). Charges are based on message types (data used) and there may also be a charge per customer/trading partner.

To operate this automated messaging capability, the ongoing cost is around USD 100 per month, again depending on the number of messages and trading partners messaged. For firms

with EDI messaging capability, EPCIS messages will cost a similar amount to EDI XML messages.

Membership of standards body

The anticipated cost of membership of GS1, the GDS body that issues unique identifiers for the company, goods, transport equipment, etc., are as follows:

	Less than USD 1 million turnover	USD 1-10 million turnover
Year 1	USD 760	USD 1,125
Per year thereafter	USD 456	USD 661

Note: Fees may vary depending on the messaging capability required versus turnover

It should be noted that internal and external activities associated with gaining GS1 GDS ISO certification, such as assessing internal processes, training employees and implementing new systems, are tax deductible in some APEC jurisdictions[7], so these costs are likely to be claimable by the business.

The costs to a small business to implement GDS and to utilise them in creating supply chain visibility are likely to involve a cost of USD 12,000 to USD 30,000 to achieve GDS-compliant interfaces with their supply chain partners.[8]

For a larger business, standardisation of messaging is likely to complement existing enterprise level systems, such as transport management, warehouse management, or ERP. The scale of integration and customer/supplier engagement is also likely to be more extensive and time-consuming. Full integration with EDI XML messaging to enhance visibility is most likely to be undertaken by enterprise level businesses with existing EDI messaging capability.

Each business will need to prepare a specific business case to assess the business value.

Retention of alternative standards

Businesses that utilise their own standards will face interoperability issues when they need to integrate outside their environments. They can deal with this through overlaying GDS-based elements to their current data structures/information systems, thereby reducing costs and the effort required to integrate systems.

GS1 standards are the most widely used supply chain standards in the world, with a user base of around 2 million companies across 150+ economies. Encouraging a trading partner to use the GS1 standards as the integration layer will therefore be more efficient. The GS1 standards are technology and industry neutral. This means that companies operating across multiple

[7] US Internal Revenue Ruling 2000-4; Standards Malaysia ISO/IEC 17021

[8] This figure is based on survey of the actual costs experienced by companies having implemented GDS capability.

sectors will find that the GS1 standards offer more leverage as they apply across sectors and are independent of the technology platform or vendor, with a myriad of technology providers able to support the GS1 data structures natively with off-the-shelf solutions, again keeping technology and implementation costs down.

As a messaging standard, EPCIS has little value until it is directed to a business intelligence layer that can utilise the data. Many systems presently gather their data from multiple sources with the problems that they are often inconsistent and come from error prone sources such as spreadsheets or other un-integrated systems. Outputs from these systems are therefore largely inaccurate and not timely, often coming hours or days after the events have taken place, resulting in decisions being made on unreliable, inaccurate and often poor data. Through standard messaging formats, EPCIS can greatly improve the quality of data in business systems, thereby presenting information that can be trusted to be accurate, consistent and timely to the user.

6. ENABLERS AND CHALLENGES

Transport and logistics, and related communication along the supply chains, are key aspects of trade facilitation in the APEC region and beyond. Poor visibility and traceability of goods moving along the supply chains are counter to the APEC Principles of Trade Facilitation (i.e. transparency, communications, consultations and cooperation; simplification, practicability and efficiency; non-discrimination, consistency, predictability and due process; harmonisation, standardisation and mutual recognition; and modernisation and the use of new technology). Wider use of GDS can play a crucial role in managing supply chain risks associated with lack of visibility and poor traceability of goods that move along the supply chains. This is crucial to enhancing trade facilitation in the APEC region, particularly for dealing with customs and border control agencies across different trading economies.

This chapter discusses the potential enablers and challenges associated with the adoption of GDS in the context of the two pilot studies undertaken.

Enabling APEC supply chain connectivity goals

The APEC Supply Chain Connectivity Framework Action Plan (SCFAP) chokepoints that may be addressed with the use of GDS in global value chains include:

- Chokepoint 1: Lack of transparency/awareness of the full scope of regulatory issues affecting logistics;
- Chokepoint 4: Inefficient clearance of goods at customs; lack of coordination among border agencies, especially relating to clearance of regulated goods ‘at the border’;
- Chokepoint 5: Burdensome customs documentation and other procedures (including for preferential trade);
- Chokepoint 7: Variations in cross-border standards and regulations for movement of goods, services and business travellers; and
- Chokepoint 8: Lack of regional cross-border customs-transit arrangements.

Some specific opportunities and challenges that relate to the APEC goals on connectivity, global value chains, SCFAP and Bogor Goals have been highlighted in the GDS pilots as follows.

Availability of industry system data to automate entry of trade data and to verify compliance

One of the largest barriers to efficiency from the industry perspective is the inability to leverage commercial system data for regulatory purposes. Data is the fundamental requirement for border clearance from the outset of a shipment.

The lack of electronic data interchange (EDI)-enabled interfaces with border and trade regulatory agencies in each pilot meant that data identifying each item/transport asset/party

generated through GDS applications must be uploaded manually; exposing it to human error and also adding to the burdensome documentation and procedure.

Compliance can be demonstrated using existing industry quality assurance (QA) systems applied to suppliers and along supply chains, often in near-time through existing EDI messages between supply chain partners. There is some frustration from major suppliers and their customers that this data is not recognised as of sufficient evidentiary level for the purposes of cargo clearance.

Companies enabled with GDS will experience added frustration as they are unable to take advantage of automated data exchange formats to provide information to regulators for clearance processes. This is because governments may refuse to accept automated data, or are unable to as their own regulatory systems and industry portals are themselves non-GDS compliant. The gap between industry and government systems will widen as digital business grows.

The pilots demonstrated the 'knock-on' impacts of manual errors which extended throughout the supply chains and affected the competitiveness of the business. The effects were clear in the Beef Pilot where replacement of clearance documents such as phytosanitary certificates could outweigh or erode the value of the shipment, resulting in food wastage and loss of customer confidence. Acceptance of barcode data on meat shipments, which carry up to 40 attributes of the product contained in the box (e.g. provenance, quality grading), can replace manual stamps/shipping marks and result in elimination of error and reduction in cost of rejected and delayed shipments.

It is unlikely in the foreseeable future that regulatory agencies could contemplate full integration of industry supply chain portals with the main systems of the regulator, e.g., Customs Integrated Cargo Systems. It is more realistic to conceive of the regulator having access to the industry portals enabling visibility, in support of their own decision-making frameworks and systems.

It is anticipated that by having access to the raw data from a visibility platform, a regulator could query events using the GS1 Electronic Product Code Information Services (EPCIS) data to reduce clearance times, burdensome documentation and enhance risk management. Having access to item level data on the shipment can provide a higher level of confidence for regulators and enhance supply chain security.

Coordination of regulatory agencies

In both the pilot supply chains, a number of regulators must clear the product for export and import trade. In the case of the wine trade, they are: Wine Australia and the Australian Customs and Border Protection Service; and for the boxed meat trade, they are: the Australian and US Customs and Border Protection Services; the Australian Department of Agriculture and Water Resources (Biosecurity Australia) and the US Department of Agriculture (Food Safety Inspection Services).

The ideal would be to have one window to submit data required for compliance, enabling each agency to draw data relevant to their purposes. The reality is that in a number of APEC jurisdictions, these interfaces are manual and require duplicated information from the applicant. This complication applies to many products for human or animal consumption, and strongly influences clearance times.

The potential for GDS to enable a streamlined clearance process depends on coordination between regulatory agencies and the ability of each agency to interface with not only the traders but with each other. Simultaneous clearances between exporting and importing economies could be envisaged in an environment where GDS enables detailed information to accompany relevant documentation such as export declarations.

A number of APEC jurisdictions are progressing with Single-Stop:Single Window Inspection and Coordinated Border Management models. GDS-enabled visibility into containers and vehicles through scanning barcodes will create a higher level of assurance and could eliminate the need for unpacking on a regular basis, allowing inspection to focus on high-risk cargoes.

In this environment, security of information becomes an issue since there will be a need to protect clearance advice to the shipper from inappropriate usage via a shared event visibility portal. A customs officer gave an example of a shipment which could be cleared for import prior to a final port of call, but illegal intervention may occur at that transit port, thus placing the importing economy at risk.

Manifest data could also be improved by using GDS to more accurately label and record tradable goods. This would improve customs tariff collection and monitoring of sensitive products.

Trusted Trader Program/Authorised Economic Operator Program

Within the World Customs Organisation's SAFE Framework[9] which aims to enhance global security and facilitate global trade, the application of GDS to the Authorised Economic Operator (AEO) program in product identification (Global Trade Item Number (GTIN), Serial Shipping Container Code (SSCC)), global location number (GLN), and supply chain event notices (Electronic Product Code Information Services (EPCIS)) would support APEC customs-to-customs and customs-to-business interactions and mutual recognition.

Within APEC, the Action Plan on the Development of AEO Programs and the AEO Compendium for all APEC Economies help members to establish the AEO programs and mutual recognition. Operators can be accredited by customs as an AEO when they prove to have high-quality internal processes that prevent goods in international transport from being tampered with. This helps speedy customs inspections for low-risk operators.

[9] World Customs Organisation, SAFE Framework of Standards to secure and facilitate global trade, June 2015

Companies that are participants in trusted/preferred trader programs are expected to develop greater visibility and transparency of shipments using GDS, as is the case in the Beef Pilot. Shippers and border agencies could share the benefits of this capability.

Companies participating in the Trusted Trader/AEO Programs could enable greater visibility of goods in shipment to customs and biosecurity agencies, in order to reinforce the clearance decision. Not only could data populate declaration documentation, real time information on the events in the supply chain relating to product custody would be available. This is at a level of granularity exceeding current Australian Harmonized Export Commodity Classification (AHECC) data.

Benefits for border agencies would include the ability to allocate resources from trusted traders to higher risk shippers. Inspection could be targeted to exceptions, such as shipments recording an unusually long elapsed shipment time. This more targeted inspection mode by the regulator would operate through exceptions being 'flagged' in the system. An industry portal enabling the regulatory agency to query supply chain events can also provide the product custody data, detailing who touched the cargo and when this occurred. This is an additional risk management capability which regulatory agencies will need to explore in terms of how it could be accessed and used.

GS1 cites several examples of cross-border regulatory clearances facilitated using GDS. One example is the introduction in December 2013 and adoption in 2014 of the Integrated Import Declaration for the trade between Canada and the United States, based on the Global Trade Item Number (GTIN) identifier for all products entering Canada. This data populates the systems of nine agencies regulating commercial imports.

The New Zealand Single Trade Window is using GDS for its import trusted trader program, implementing the Joint Border Management System based on the 'light touch-high assurance' model. It is anticipated that this model will be expanded to exports.

Similar initiatives are afoot in Malaysia (uCustoms). In the Netherlands, progress on phytosanitary records using Global Location Numbers (Frug I Com) can trace the region of origin, growing location, packing location, and cold storage location using this data.

Cargo security

The GS1 EPCIS global interface standard is compatible with radio frequency identification (RFID) devices as well as barcoding. Regulatory agencies are still reviewing the potential capability of data from container seals in terms of real-time cargo security management.

Use of GDS in RFID tracking devices, linked through the event platform, would enable more effective industry adoption.

The use of GDS to improve supply chain visibility and in turn enabling access by regulators will require a full proof of concept. The APEC GDS pilots represent a great opportunity for

regulators to explore what might be possible in the context of reducing the regulatory burden on traders and improving the effectiveness of regulatory activities.

An opportunity is available to analyse the benefits through the work of the APEC Life Sciences Innovation Forum (APEC LSIF), which, since 2009 has been developing supply chain standards for pharmaceutical products. The APEC LSIF work has resulted in the development of guidelines by APEC economies to address product counterfeiting and traceability and industry pilots on pharmaceutical and biomedical product traceability being conducted.[10]

Interface with port community systems

Current port community systems are used largely to interface with regulators or operational partners such as terminals and shipping lines. An example is the terminal vehicle booking system.

There is significant potential to tailor port event-related messages for EPCIS applications. The ship/terminal/land transport interface is an important event site for both exporter and importer. Typically, the shipping line and cargo operator interface with messages on the status of cargo; however, those tasked with the transport operations are not commonly involved.

In 2014, Port Klang Malaysia adopted GDS to identify all operators and businesses associated with the port gateway. The system can now integrate vessel data, Customs Information System data and provide arrival, departure, berthing and cargo information in real time through Port Klang Net.

Other opportunities and challenges

Promulgation within industry

The pilots demonstrated two key issues related to the uptake of GDS in automating messages such as transport instructions and improving supply chain visibility through event notifications. The first is the surprising lack of EDI usage in these supply chains (14%); and the second is the current poor capability of end customer firms and supply chain participants to grasp the benefits of GDS in various business applications.

Some industries have traditional business operation models that rely on the detailed knowledge and expertise of individuals and their deployment of ‘workarounds’ based on relationships within a supply chain. This model, which has served industries such as the meat industry well in the past, is now becoming less effective as experienced personnel exit the industry through retirement.

[10] APEC, 2015 CTI Report to Ministers, Appendix 15, LSIF Letter to Ministers and Leaders, publications.apec.org/publication-detail.php?pub_id=1683

The generational change is both a challenge and an opportunity to replace those manual and personal 'systems' with automation.

On-boarding of partners in supply chains

Integration with supply chain partner systems to enable access to data from multiple supply chain participants requires dedicated resources in the form of programming time. During the pilot, the EPCIS EzTrack event-tracking portal developed by GS1 Hong Kong, China was used. In a real implementation or production mode, the in-kind contribution of this facility would be replaced with integrated interfaces between supply chain participants to enable direct messages to be passed between participants or shared via a portal. Internal business cases will need to be developed in order for companies to set aside resources and establish the specific cost-benefit ratios and return on investment.

Collaboration within a supply chain

Establishing and maintaining collaborative arrangements between stable partners willing to invest in the capacity to create visibility is perhaps the greatest challenge. Customers and suppliers need to share the commitment to enabling this, bringing logistics suppliers into this collaborative space, driven by the need to differentiate their product and provide customer service.

Data security and data storage capacity

A secure environment and data storage capacity is relevant to the rollout of GDS capability within an industry. Depending on the applications used, data generated through supply chain events could be amplified by 'Internet of Things' (IoT) data from device, vehicle or infrastructure sensor readings, for example 'time in-time out' from dock sensors at warehouses and terminal/distribution centre gates, and Verified Gross Mass container readings from port terminal straddles and weighbridges. The issue of data security and protection was raised by APEC member economies surveyed.

Although data security was an issue of concern to those surveyed, it should be noted that the risk from the use or storage of GS1 EPCIS data is no greater than that for any other data exchange format. The realities of digital business demand data security and data storage capacity which are now part of general business activities.

7. IMPACT ON APEC MEMBER ECONOMIES

The APEC Policy Support Unit (PSU) distributed a survey to gain a more detailed understanding of the response of APEC member economies (including private sector) to the utilisation of global data standards (GDS), the sectors that are adopting GDS, and the benefits that might accrue to the private and public realms.

The GDS Survey 2016 garnered 16 responses from the following: Brunei Darussalam; Chile; Hong Kong, China (Committee on Trade and Investment – CTI, Sub-Committee on Customs Procedures – SCCP); Japan; Korea; Malaysia; Mexico (Committee on Trade and Investment - CTI and Electronic Commerce Steering Group - ECSG); New Zealand; Peru; Russia; Chinese Taipei (APEC Alliance for Supply Chain Connectivity - A2C2, Sub-Committee on Customs Procedures - SCCP and Sub-Committee on Standards and Conformance - SCSC); Thailand and Philip Morris International (A2C2).

Definition and application of GDS

Economies consider different definitions and uses of GDS within current domestic laws or regulations. Around half of the respondents indicated that definitions of GDS and regulatory requirements for their use are still not clear. Some respondents noted that they were mainly informed about GDS with respect to the use of bar codes and radio frequency identification (RFID) tags. Regulations were implemented to focus on traceability of products with 'designation of origin' such as food products, pharmaceutical goods and clothes. In some economies, the customs agency applied communication standards for shipping systems such as implementing electronic invoices in firms and small and medium sized enterprises. One respondent noted that the application of GDS is mainly driven by the industry rather than government with suppliers following a non-mandatory guidance for product regulation.

Respondents added that GDS has been newly implemented in the following areas: retail, pharmaceutical and healthcare products, home hardware and building supplies, food products, beverages, and communication. Recent examples include the use of barcodes or RFID tags in pharmaceutical products, track and trace systems or tracking for trans-shipment, and the quick response (QR) code which is installed on smart phones and can be designed to detect illegal distribution. The industries also voluntarily apply for the application of GDS to improve communication with domestic and international partners. On the other hand, six respondents reported that they have not implemented GDS. Table 4 summarises the application of GDS as reported by the surveyed APEC members.

Table 4: Application of global data standards in APEC Economies

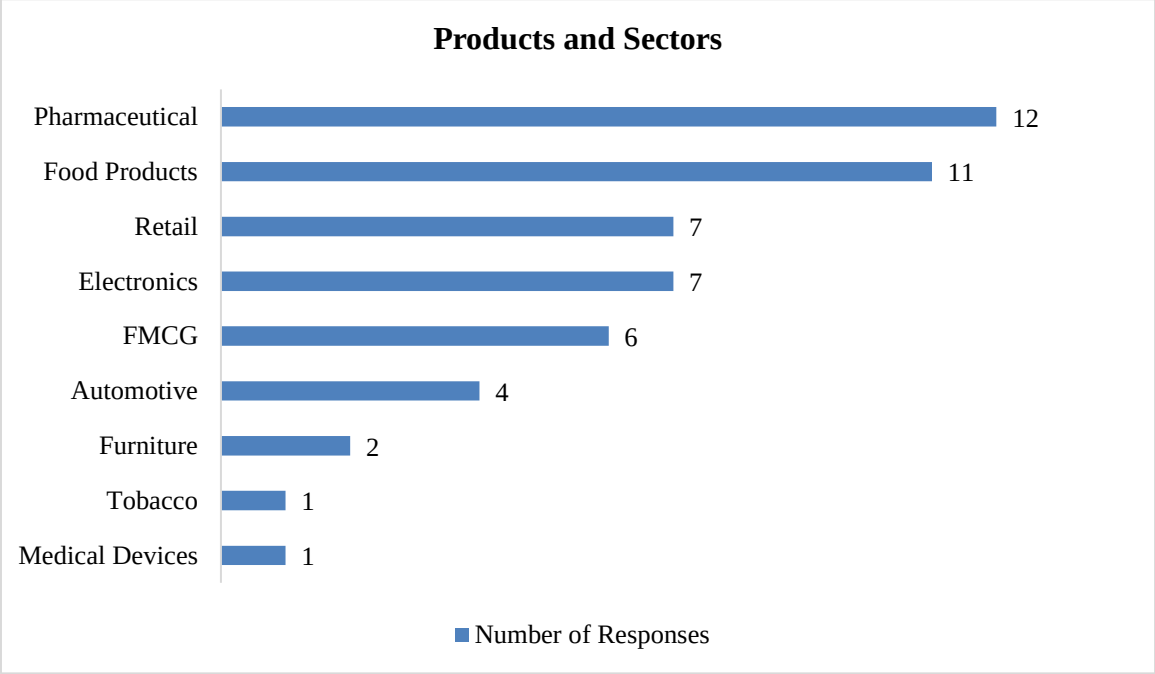
Brunei Darussalam	Adopted GDS into retail products (supermarket with Point of Sale scanning systems and product batching) and in Communications industry.
Hong Kong, China	Mentioned the following examples: • 'Supply-Chain Sector: Cross-border Supply Chain Visibility (SCV) Study Pilot (2014)' which aims to reduce trade barriers between ASEAN economies and facilitate customs and border clearance by increasing cross-border supply chain visibility. • The 'Wine Industry: APEC GDS Australian Wine Pilot (2015)' is a joint project between Hong Kong, China and Australia which contributed to APEC's goals. • The 'Food Industry: Global Traceability Standard (GTS) Implementation for Food Quality and Consumer Safety (2015)' which focuses on the importance of efficient food product recall and global food traceability at origin. Service providers can have quick and easy access to live traceability information from the platform.
Korea	Implemented GDS on Medical and Pharmaceutical products: use of bar codes or RFID tag, and introduction of track and trace system.
Malaysia	GDS application in the Department of Veterinary Services: traceability of beef carcasses, durian export and authentication underpinned by MIMOS traceability platform; E-seal bonded warehouse container tracking for transhipment.
Mexico	• Application on alcoholic beverages (specifically Tequila) from the business sector. • Federal Government efforts against illegal markets with the use of the QR code (installed on smart phones) to detect adulterated or illegally distributed products.
New Zealand	Implemented GDS in the health sector's product procurement and management, business entities including sole traders and other registered trading entities, and home hardware and building supplies sector.
Peru	Bases regulatory standards on IFTMCS (International Forwarding and Transport Message, Contract Status) and Custom Declaration. Peruvian agriculture export companies implemented traceability processes using GDS through the Global Traceability Conformance Program from GS1 Global.
Chinese Taipei	Authorities do not set out rules for the use of GDS and relative systems. Industries voluntarily apply GDS for their own needs.
Thailand	Noted that retailers use GS1 Standards for product management and brand owners for communication with domestic and international partners.

Source: APEC Policy Support Unit, Global Data Standards Survey, 2016.

Domestic agencies that are currently using or are considering GDS are port operators and customs and other trade-related organizations. Other sectors include health, technology and innovation, product regulation, agricultural sectors, communication and business sectors.

The majority of respondents indicated that the products and sectors more likely to utilise GDS are pharmaceutical and food products/industries. Figure 5 illustrates the products or sectors in which respondents thought GDS could play a key role.

Figure 5: Products and Sectors in APEC Economies where GDS could have a key role

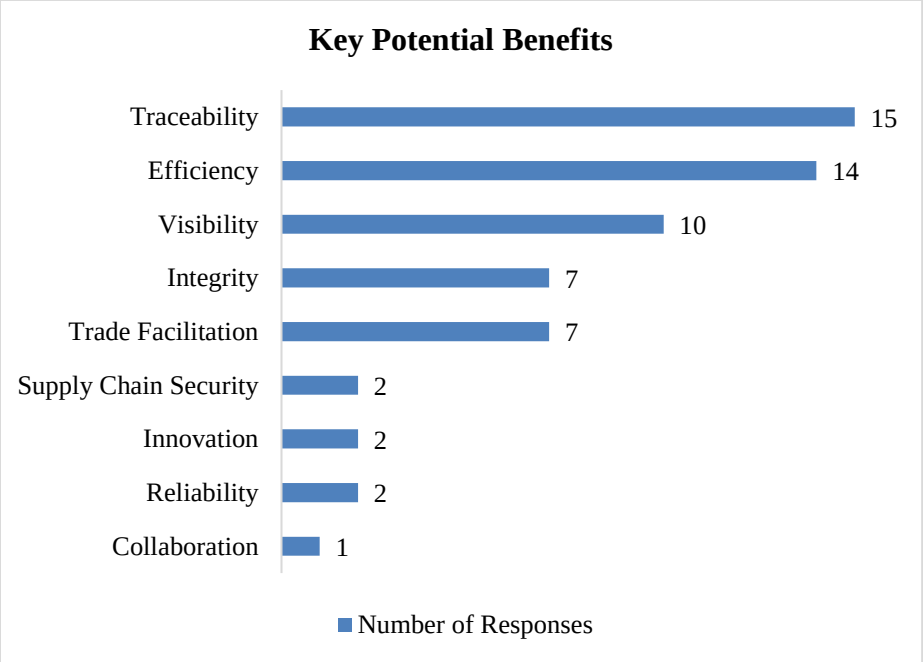


Source: APEC Policy Support Unit, Global Data Standards Survey, 2016.

Implementation of GDS in the service sector provides transparency of firms' processes which can contribute to higher value added against market competition.

Respondents identified the top three key potential benefits of GDS from a list supplied in the survey as efficiency, visibility, and traceability. These benefits will most likely make the distribution of products easier, faster, and less costly. Respondents did not consider agility, cost efficiency, or asset management efficiency as potential benefits.

Figure 6: Key Potential Benefits of GDS in APEC Economies



Source: APEC Policy Support Unit, Global Data Standards Survey, 2016.

Possible impact of GDS

The majority of the respondents had positive views on the implementation of GDS and indicated that affected sectors could benefit from the system. Increasing the efficiency of supply chains will lower the costs by improving predictability and eradicating human errors. GDS was seen to facilitate an optimal environment for safer products with unnecessary steps in the distribution of products reduced or eliminated. Moreover, collaborative processes among public and private sectors should increase once supply chains become more efficient.

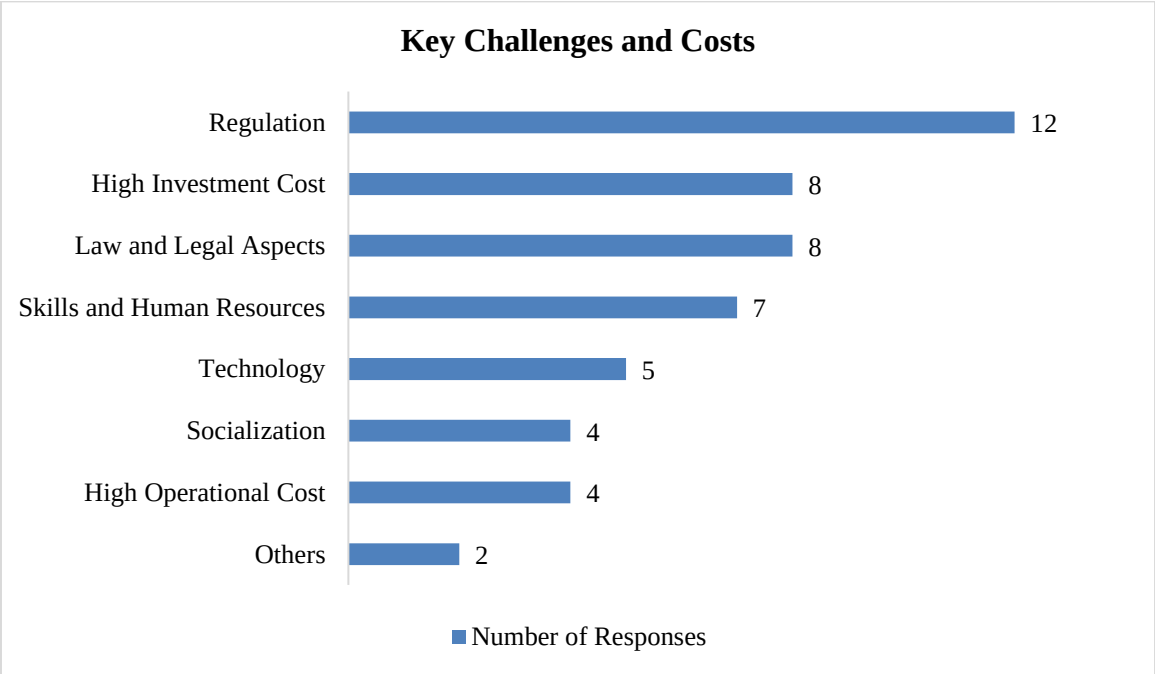
It was generally agreed that improved traceability can help traders and suppliers identify the details of the products and prepare for effective recall. The potential risk level of imports can be assessed when there is better access to data for government agencies at border control. In short, GDS will make tracking and tracing easier for public and private sectors. Additionally, consumer confidence and brand integrity, which are essential factors to business success, would also improve.

One respondent noted that it is the importers who face custom risks, so GDS will not affect the government as much as operators; hence the benefits that GDS can provide to that particular economy may be limited.

Challenges for GDS implementation in APEC economies

Respondents identified the key challenges and costs to GDS implementation are regulation, high investment costs, and legal aspects (Figure 7). Adopting GDS will require adjustments not only to processes and systems, but also to traders. Additionally, employees must be trained to operate within a GDS system. The fact that laws and regulations differ by economy may also impact on the distribution of products and increase costs in transportation.

Figure 7: Key Challenges and Cost Expected with GDS



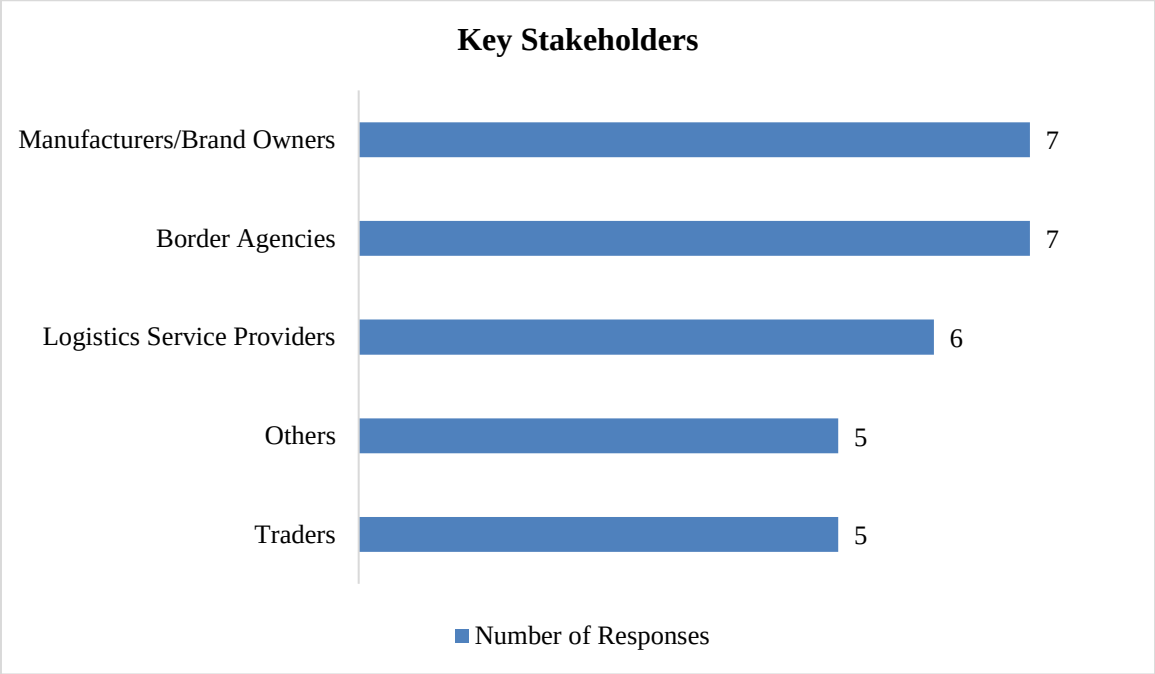
Source: APEC Policy Support Unit, Global Data Standards Survey, 2016.

Respondents commented that at this stage the costs of implementing GDS are unknown and benefits are unproven. Economies are also not well informed about the ICT systems underpinning the standards. Businesses are likely to bear the burden of providing a large amount of initial investment in hiring and supervising consultants to build the capability and in training employees. New or upgraded infrastructure also implies major costs for the government. Furthermore, it is expected that a number of regulations will need to be amended to accommodate a new system. Authorities and relevant stakeholders will need to adjust their existing processes or systems to be compatible with the newly implemented standards. However, regulations can act as barriers to new procedures and technology, and data standards will require the coordination of many parties. Other potential problems are competition among standards providers and systems, data security, and possible misuse by participants or system operators.

Given the concerns raised by the respondents, it was apparent that the biggest challenge will be to ensure that all relevant stakeholders are well informed of what GDS is and its benefits.

Figure 8 shows the stakeholders thought to be most likely to implement GDS. The top three were manufacturers, logistics service providers, and border agencies.

Figure 8: Profile of expected GDS adopters



Source: APEC Policy Support Unit, Global Data Standards Survey, 2016.

Respondents agreed with the proposition that GDS can bridge the gap between physical status and information, and that the GDS system will enable trading partners to share their product data. However, the agencies involved will first need to understand the benefits that GDS can provide. It was indicated that the GDS would be most relevant to healthcare products and in cross-border trade and that in this case, government should lead such regulatory changes. Traders will also play an important role in the implementation since they are expected to be the main beneficiaries of the system, while manufacturers should have a full understanding of using GDS to identify and track their products.

Policies to support GDS implementation

Respondents provided inputs on the policies that will help implement GDS, including:

- A pilot plan to promote understanding of the benefits of GDS;
- National or international guidelines for trade facilitation measures and initiatives to ensure organisation and easy imports for traders. Adoption of the guidelines should be voluntary but come with strong incentives;
- Electronic commerce and regulations to provide collaboration opportunities between public and private sectors. Regulations in customs and border agencies processes should be changed and realisation of the World Customs Organisation (WCO) standards should be prioritised;
- The Single Window requirement for data harmonization and interoperability between different systems.

Views were mixed as to whether mandatory adoption of GDS, for instance in food and agricultural products supply chains, would be beneficial to the economies of APEC members. A reason for non-mandatory industry adoption is that there would be no need for intervention by government if the system is beneficial for businesses and investments.

GDS is an important concept for containing sets of broad ranges of coding and data sharing systems. APEC fora should collaborate to support trade facilitation of micro, small and medium enterprises (MSME) through standardisation activities. GDS is generally interoperable and easily integrated into existing public and private systems.

Summary of key insights

Several insights emerged from the APEC survey responses. There was wide variation across APEC member economies in relation to the definition of GDS within current domestic legislation and regulations.

Current adoption of GDS in the APEC member economies in the survey ranged from agricultural commodities to retail products, including pharmaceutical products. Domestic agencies using GDS more widely were the ports and customs authorities, highlighting the importance of GDS in domestic and international trade.

Many APEC member economy respondents identified regulation and high investment costs as the main challenges for GDS implementation. On the other hand, efficiency, visibility, and traceability were the major potential benefits of GDS identified. According to many of the APEC member economy respondents, manufacturers/brand owners, logistics service providers and border agencies are the key stakeholders along the supply chains who should facilitate the introduction and implementation of GDS.

8. PROGRESSING GDS ADOPTION IN APEC

Adoption of GDS has to date been driven by major commercial partners who perceive that it would improve business value, particularly in relation to visibility in global procurement and extended supply chains. It has also been driven by regulatory requirements for product traceability in pharmaceuticals, dangerous and prohibited goods and food products.

However, in the transport and logistics industry which is pivotal to supply chain visibility, competitive advantage has been derived from proprietary systems, aimed at optimising functionality and service levels in a highly competitive, low margin industry. The hasresulted in poor interoperability and a lack of system-wide, or whole-of-supply-chain collaborative capacity.

Several options could be considered for the adoption of non-proprietary GDS across supply chains as a possible tool for standardisation of trade activities in the APEC region.

Mandatory introduction in sensitive supply chains

Given there are significant public good benefit streams associated with managing regulatory compliance for public health and safety, one option is for APEC member economies to consider mandating the adoption of GDS as part of traceability regulation for sensitive products, such as pharmaceuticals, dangerous or prohibited foods and certain categories of food for animal and human consumption, taking into account specific circumstances of individual economies. For other tradeable and low value products, a mandatory implementation will require a long lead-time and an industry facilitation program, and which have budgetary implications.

APEC members surveyed had mixed responses to the prospect of making GDS mandatory. Their legitimate concerns relate to the need for harmonisation of legislation and related regulation across APEC economies, the interface with existing regulatory systems, and the potentially prohibitive cost to small businesses.

Leading by example

Ensuring government trade and regulatory portals are GDS-compliant and the existing trade data standards are consistently applied, would be a major advancement in leading by example. This could extend to government-owned enterprises such as ports and their port community systems.

Considerable work has been ongoing in the region to harmonise trade data such as product codes. Adoption of GDS enables trade terms and the language of automated systems to be standardised in tradeable goods supply chains interacting with government systems, eliminating cross-border anomalies.

For example, a supplier seeking an export declaration number can currently enter erroneous data in the customs electronic portal. Using the GS1 Global Data Synchronisation Network (GDSN) Global Shipment Identification Number (GSIN) as a reference code, the goods can be verified against reported items in the customs system.

Supporting industry facilitation

A number of APEC members responding to the GDS Survey indicated their preference for GDS to be implemented (voluntarily) through businesses, having made a judgment on the business value to be derived from this capability. Businesses participating in the pilots were all able to indicate benefits that they could capture, however most pointed to higher order benefits located in cross-border regulatory compliance as key to justifying the costs. The survey also indicated that industry and government should work together on integrating this capacity into regulatory activities.

There are a number of approaches that can be taken to support the promulgation of GDS within trade and supply chain networks, such as:

- Promotion of the benefits of using GDS in collaboration with domestic industry peak bodies (freight forwarders, logistics associations, chambers of commerce, and trade associations);
- Establishment of a certification system with the standards provider. In September 2015, the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) endorsed the GS1 EPCIS event-tracking standard and the GS1 Core Business Vocabulary. ICT system providers, such as SAP, can now derive business value from marketing their compliance with this standard, as can suppliers such as transport firms[11];
- Development of 'Communities of Practice' for micro and small businesses, to link them to ICT integration suppliers who are certified as GDS-compliant;
- Supporting domestic and APEC regional initiatives such as the APEC GDS pilots; and
- Advancing the ability of industry to utilise data from visibility platforms in compliance activity;
- Implementing GDS in existing domestic compliance systems related to freight operations, such as mass management, driver fatigue, electronic work diaries, and vehicle booking systems.

[11] GS1, 2015, "ISO/IEC approves GS1 EPCIS standard for improving traceability and anti-counterfeiting" media release, http://www.gs1.org/sites/default/files/docs/epc/ISO_EPCIS_Release_9.15.15.pdf

9. CONCLUSION

The pilots in this study have demonstrated the time, resources and commitment required by businesses to progress the adoption of GDS. Firms will want to ensure that the expected benefits of adopting standards and building connectivity outweigh the costs. This will require accurate data and information to support the required cost-effectiveness assessments but as this study has illustrated, there are several challenges to collecting relevant and accurate information to undertake such assessments, particularly within a brief time period. It is important to recognise these challenges while helping firms to understand the potential benefits and opportunities of adopting GDS. Facilitating more pilot studies with adequate implementation times and publicising the cost-benefit information APEC-wide will be a useful approach in this regard. It is understood that more pilots covering different products and trade routes and involving different economies are already in the pipeline and should contribute important data in the future.

The two pilots have demonstrated that firm-level benefits vary significantly and, depending on the existing capability and scale of trade, the business case will vary. While recognising the business case is specific to the particular supply chain, a more general benefit in relation to regulatory reporting of cargo and enabling of dashboard reporting using GDS-compliant visibility platforms is worthy of consideration by APEC. As firms progress in the digital economy, new interactions between traders and regulatory agencies which take advantage of the automated event data should be considered in the armoury of tools at each government's disposal to fight counterfeiting and guaranteed economy-of-origin, authenticity and pedigree of products.

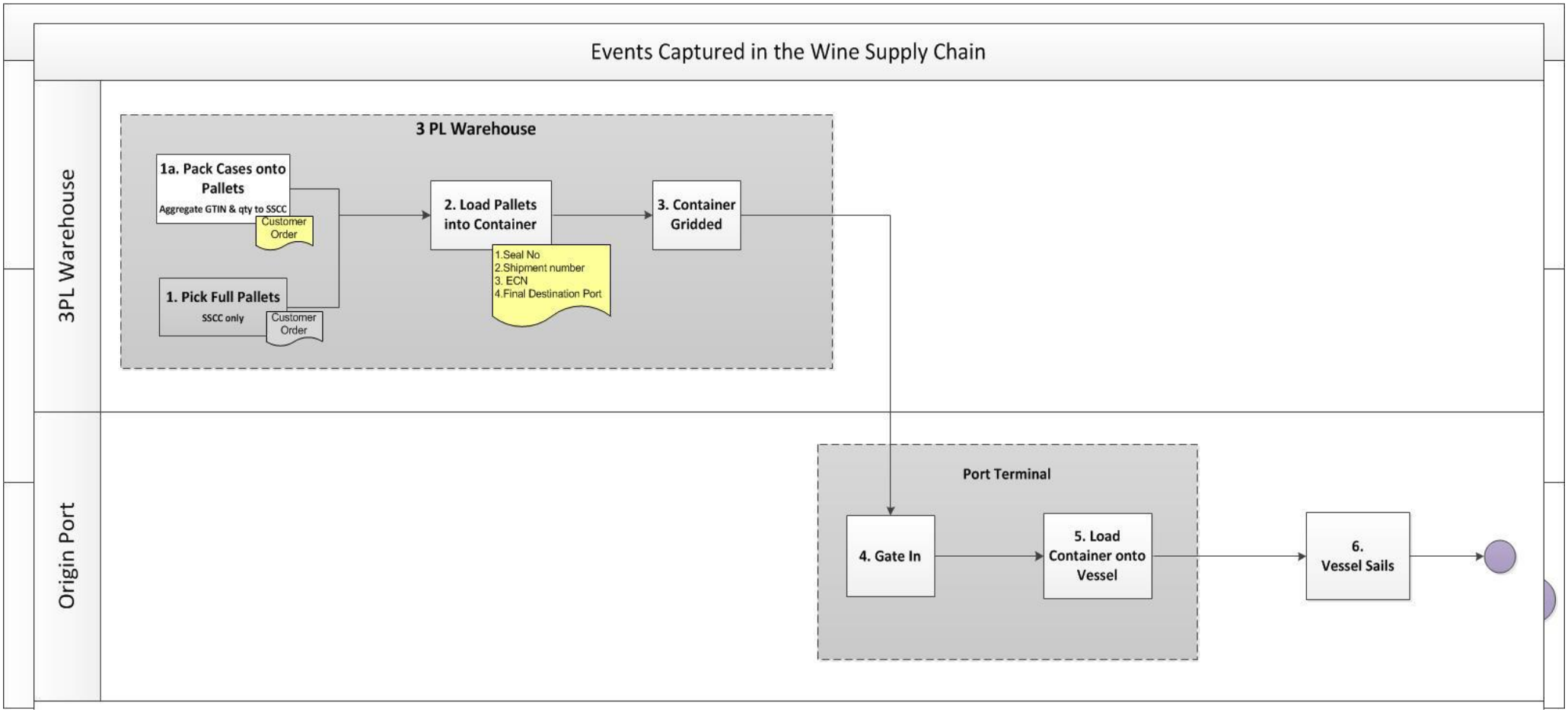
APEC governments might consider two streams of activity in relation to the adoption of GDS to facilitate trade:

- Supporting industry understanding and uptake by working with trade and logistics peak bodies and the standards providers; and
- Conducting analysis on how GDS might be utilised in gathering data related to trade regulation activities.

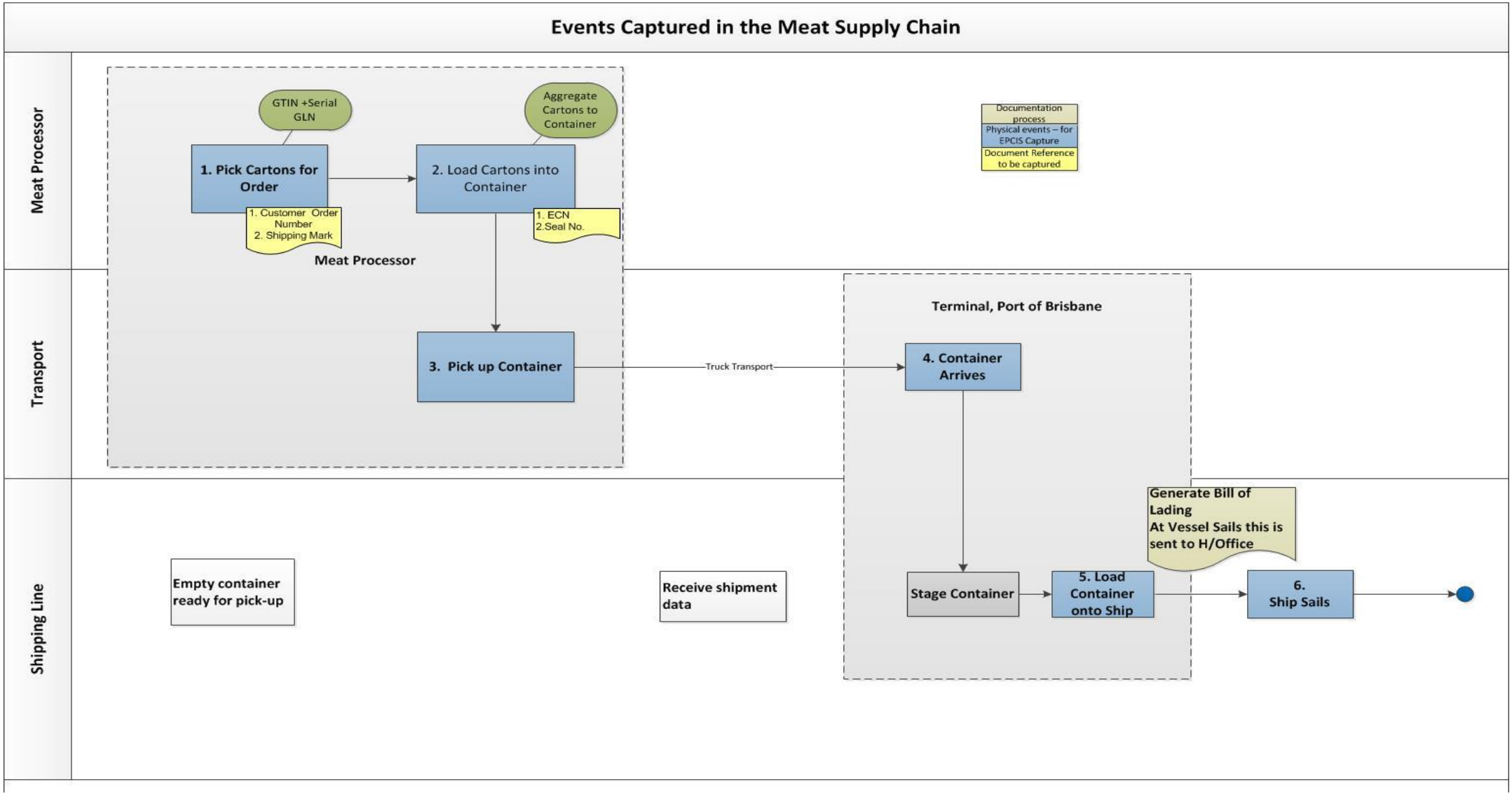
10. APPENDICES

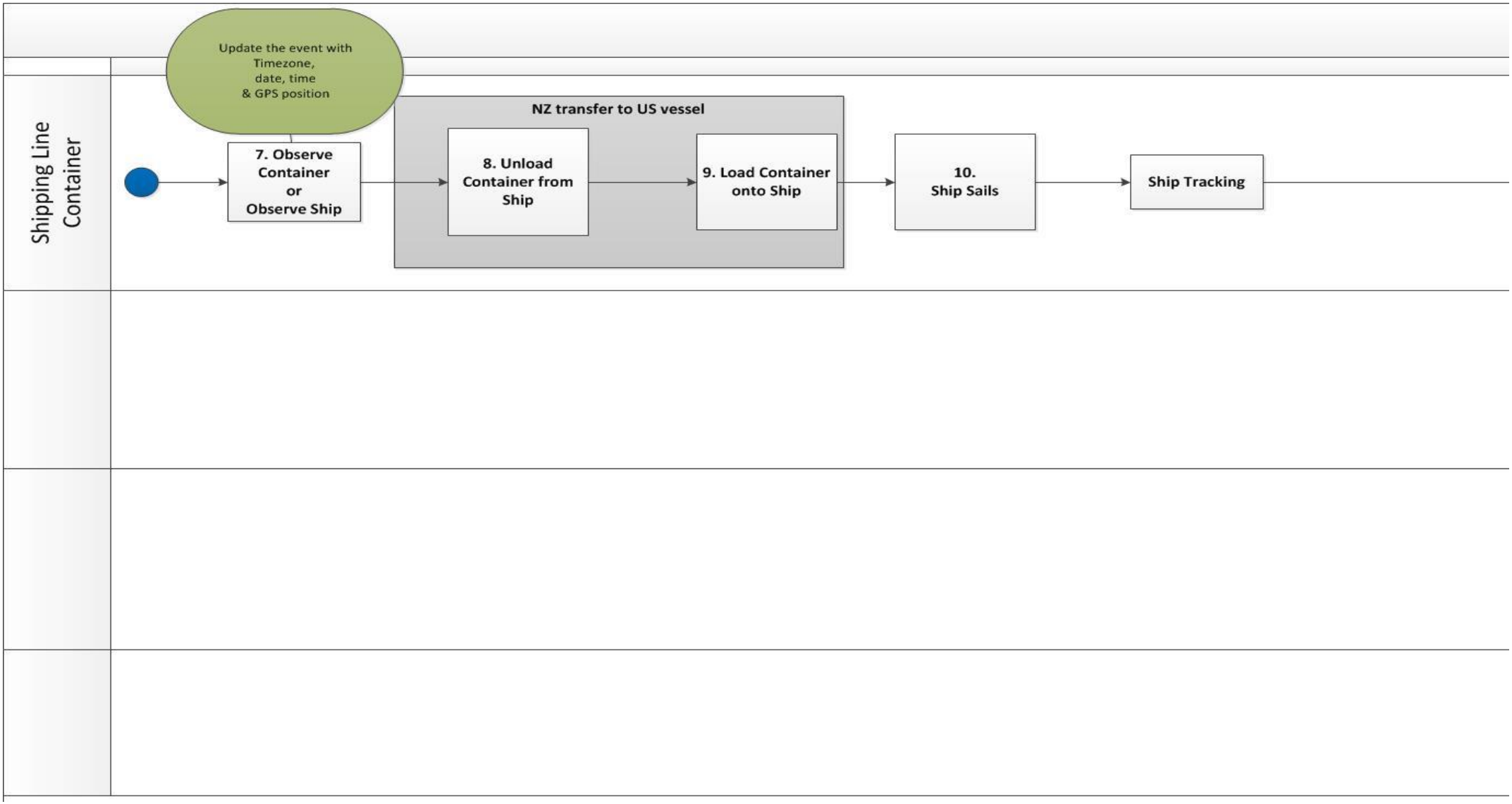
Appendix 1: Supply Chain Events and Messages

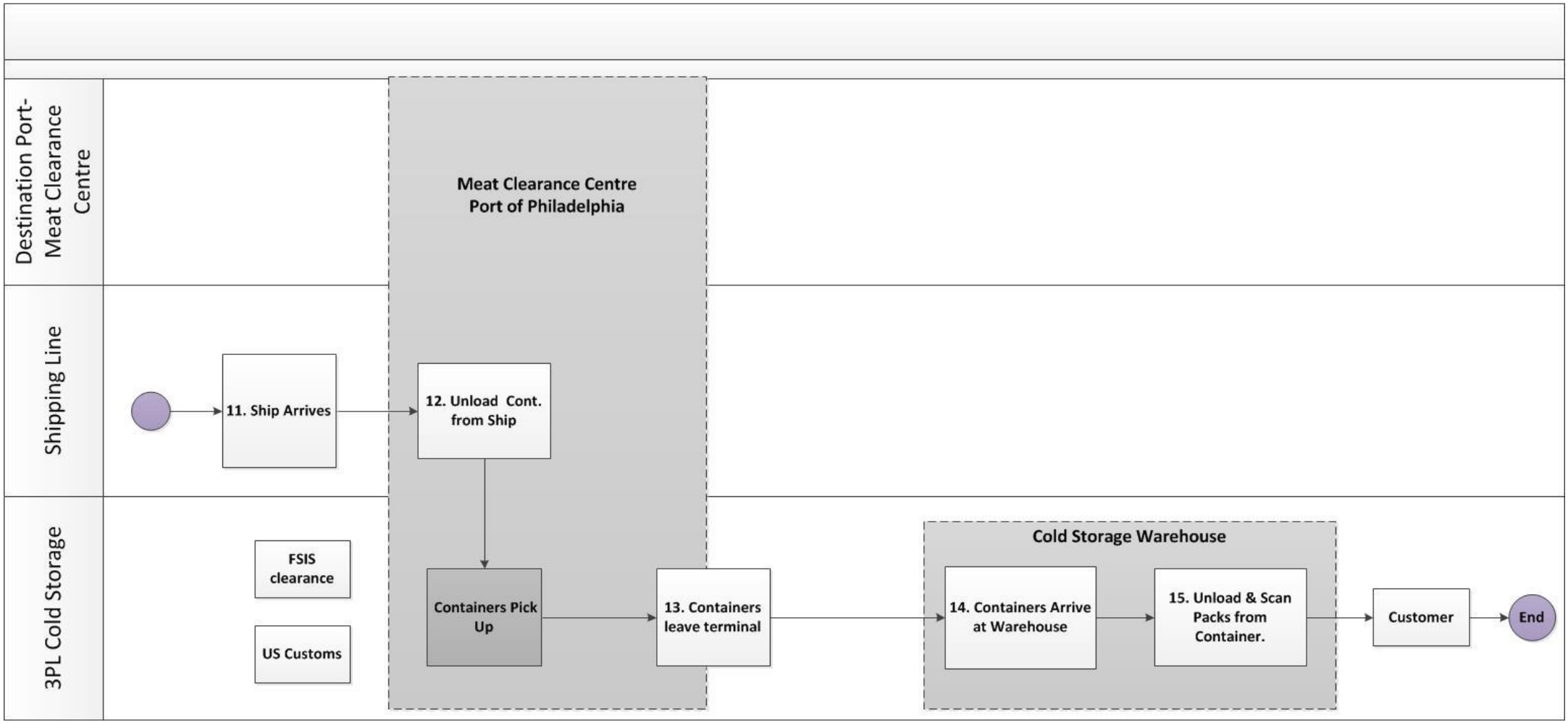
Wine exported from Australia and imported to Hong Kong, China



Boxed beef exported from Australia and imported to the USA




Shipping Line
Container
Update the event with
Timezone,
date, time
& GPS position
7. Observe
Container
or
Observe Ship
NZ transfer to US vessel
8. Unload
Container from
Ship
9. Load Container
onto Ship
10.
Ship Sails
Ship Tracking


Destination Port-Meat Clearance Centre
Shipping Line
3PL Cold Storage
Meat Clearance Centre Port of Philadelphia
11. Ship Arrives
12. Unload Cont. from Ship
FSIS clearance
US Customs
Containers Pick Up
13. Containers leave terminal
Cold Storage Warehouse
14. Containers Arrive at Warehouse
15. Unload & Scan Packs from Container.
Customer
End

Appendix 2: GDS Baseline Survey

About this survey

APEC has commissioned the Victoria University Institute for Supply Chain and Logistics (Australia) to conduct an assessment of the costs and benefits associated with implementation of global data standards (GDS) in supply chain pilots involving your company.

In order to establish a baseline from which to measure benefits and costs associated with the use of GDS, we will need to establish as accurately as possible the current situation across the international supply chain.

We have identified some key metrics associated with events along the supply chain that might be improved as a result of implementing the standards.

Please respond to the elements in this survey that relate to your activities.

No data or information which is provided will be identified. We understand that information required is potentially commercial-in-confidence. Victoria University (VU) values the privacy of participants and is committed to handling your information in a lawful and responsible manner. VU is committed to ensuring that it is compliant with the Information Privacy Principles (IPPs) in the Privacy and Data Protection Act 2014 (Vic) and to the related legal obligations by which it is bound. Where legally required, VU will comply with the Australian Privacy Principles (APPs) in the Privacy Act 1988 (Cwlth). To learn more the Victoria University Privacy Policy, please follow the link -

https://policy.vu.edu.au/view.current.php?id=00166

Contact information

Company/organisation name:

Contact Person:

Telephone

Email:

Date:

Your role in the supply chain

Please describe your company's role in the pilot supply chain:

e.g. Outbound stevedore – receive pre-receival advice; issue vehicle booking timeslot for receival at terminal; unload container from transport at terminal; connect to reefer points; load container onto vessel; notify shipping line.

……
……

Messages along the supply chain

Which of the following partners do you receive information from and provide information to?

Eg. Customs Broker deals with Importer (to and from), Customs/Border agency (to and from); Quarantine/biosecurity agency (to and from) and may organise inbound transport to Importer warehouse.

SC partner	From	To
Manufacturer/shipper		
Forwarder		
Customs Broker		
Transport company - outbound		
Transport company - inbound		
3PL storage/warehouse outbound		
3PL storage/warehouse inbound		
Container park		
Shipping line		
Stevedore/Container terminal- export		
Stevedore/Container terminal- import		
Customs/Border agency - export		
Customs/border agency - import		
Quarantine/Biosecurity – export		
Quarantine/Biosecurity – import		
Food safety regulator - export		
Food safety regulator - import		
Port authority - export		
Port authority - import		
Port Meat Clearance house		
Importer warehouse/consignee		
Other (please specify)		

How is information currently transmitted from your company to these supply chain partners?

SC partner	EDI/WEB PLATFORM	EMAIL PDF	OFFICE TELEPHONE/CALL CENTRE	MOBILE DEVICE	OTHER
Manufacturer/shipper/consignor					
Forwarder					
Customs Broker					
Transport company - outbound					
Transport company - inbound					
3PL storage/warehouse outbound					
3PL storage/warehouse inbound					
Container park					
Shipping line					
Stevedore/Container terminal-export					
Stevedore/Container terminal-import					
Customs/Border agency - export					
Customs/border agency - import					
Quarantine/Biosecurity – export					
Quarantine/Biosecurity – import					
Food safety regulator - export					
Food safety regulator - import					
Port authority - export					
Port authority - import					
Port Meat Clearance house					
Importer warehouse/consignee					
Other (please indicate)					

Please provide a sample of the data transmission formats/printouts or templates (minus any content information)

eg. Proof of Delivery (POD) screen shot – please send blank formats

Current metrics

Does your company currently record measures relevant to:

ELEMENT	Per event and average total time/cost to serve	Y/N	Alternative measure used Eg exceptions
Pick accuracy	% of orders accurately picked divided by the total number of orders picked x 100%		
Order Fulfilment	% of orders delivered in full divided by the total number of orders x 100%		
Order condition	Total orders in perfect condition divided by total orders x 100%		
Order management/admin	The sum of costs associated with managing customer data entry, maintenance, scheduling, prioritising and expedition of customer orders, invoicing and collections, tracking of shipment, labelling		
Transport	Average cycle time to complete order delivery in hours/days		
Compliance - Customs - Biosecurity agency - Food Safety	Time to clear product (hours) Cost of compliance per shipment Cost of delays per shipment		
Data Integrity	Total number of accurate orders divided by the total number of orders delivered x 100%		
Other metrics/KPIs			

Time and Cost Measures to perform your role in <u>this</u> supply chain

TASK/EVENT eg. Confirm ship arrival at port with importer	AVERAGE TIME PER CONSIGNMENT (hours)	AVERAGE COST TO SERVE (USD)

Additional time and cost when things go wrong…

TASK/EVENT eg. demurrage at port; re-booking timeslots	AVERAGE TIME PER CONSIGNMENT (hours)	AVERAGE COST TO SERVE (USD)

Anticipated benefits of using global data standards

Expected benefit to my business	Please rank 1 to 5 the five most anticipated benefits
Improved cost control, especially when things go wrong	
Improved exceptions management	
Earlier notification of transport schedules	
Improved ability to identify trends	
Better matching supply to demand	
More efficient use of labour (improved work flows)	
More predictable operations	
Improved customer reporting	
Avoidance of stock run outs	
Reduced manual processes eg labelling; data entry	
Improved data quality going into business systems	
Reduced time and cost to comply with border agencies	
Improved inventory control	
Improved collaboration between supply chain partners	
Other – please specify	

Anticipated costs of using global data standards

Expected cost to my business	Tick
Setting aside staff time to take part	
Cleaning up data	
Learning new formats for data	
Training staff in new processes	
On-boarding suppliers	
Integration with our proprietary platforms	
Other – please specify	

THANK YOU

Once completed please return to VU ISCL by emailing a completed survey to

supplychain.information@vu.edu.au

Appendix 3: KPI Metrics for Pilots

KPI Matrix Wine Pilot

KPI Metrics	Performance Attributes				Definition	Calculation	Stakeholders			
	Efficiency	Integrity	Visibiliy	Innovation			Exporter	LSP	Importer	Regulator
Values	Time, Cost	Authenticity, Risk, Quality	Better Planning	Data Analytics, Customer Service						
Pick Accuracy	TBC				Percentage of orders which items picked are in items committed.	[Total number of orders picked accurate] / [Total number of orders picked] x 100%	x	x		
Order Fulfillment			Adding EPCIS platform		Percentage of orders which all the items are received by customer in the quantities committed.	[Total number of orders delivered in full] / [Total number of orders delivered] x 100%	x	x	x	
On-time Delivery	Adding EPCIS platform		Add container tracking - avoid/mitigate delays		The percentage of orders that are fulfilled on the customers' originally scheduled or committed date.	[Total number of orders delivered in original commitment date] / [Total number of orders delivered] x 100%	x	x	x	
Perfect Condition		Authenticity via GDS / EPCIS			Percentage of orders in an undamaged state that meet specification, have the correct configuration, are faultlessly installed and accepted by customer.	[Total number of orders delivered in perfect condition] / [Total number of orders delivered] x 100%	x	x	x	
Order Fulfillment Cycle Time	Adding EPCIS platform				The average cycle time consistently achieved to fulfil customer orders. For each individual order, this cycle time starts from the order receipt and ends with customer acceptance of the order.	[Sum actuals cycle times for all orders delivered] / [Total number of orders delivered] in days.	x	x	x	
Order Management Cost	Add EPCIS & EDI (transport instruction)				The total cost of labour, automation and assets associated with responding to inquiries, order entry and maintenance, scheduling transportation, order tracking and tracing, delivery and invoicing.	The sum of costs associated with managing customer data, entry, maintenance, scheduling, prioritising and expedition of customer orders, invoicing and collections.	x	x	x	
Compliance	Traceability via GDS	Trusted Trader - providing EPCIS access	Visibility - providing EPCIS access		The total cost of labour, automation and assets associated with responding to customs/biosecurity and food safety clearance	The sum of costs associated with responding to customs/biosecurity/food safety clearances.	x	x	x	x
Data Integrity		Using GDSN to provide data to AU Customs		TBC	The percentage of orders that product and transactional data are accurate.	[Total number of orders accurate] / [Total number of orders delivered] x 100%	x	x		x

Visibility
The current baseline case (pre-October shipment) - no EPCIS visibility platform for stakeholders to track wine shipments.
First Oct shipment - includes EPCIS with following benefits:
> clear potential to identify unexpected delays and implement efficiency improvements

KPI Matrix Beef Pilot

APEC AU-US Beef Export Project - Benefits / Metrics

KPI Metrics	Performance Attributes				Definition	Calculation	Stakeholders			
	Efficiency	Integrity	Visibility	Innovation			Exporter	LSP	Importer	Regulator
Values	Time, Cost	Authenticity, Risk, Quality	Better Planning	Data Analytics, Customer Service						
Pick Accuracy	Barcoded cartons - scan w'hse to staging and staging to container				>Percentage of cartons of beef picked are in cartons that were committed.	>[Total number of cartons of beef picked accurately] / [Total number of cartons picked] x 100%	x	x		
Order Fullfillment			Adding EPCIS platform		>Percentage of cartons &/or kgs of beef received by customer are in accordance with what was ordered.	>[Total number of cartons of beef / kgs delivered in full] / [Total number of cartons / kgs of beef delivered] x 100%	x	x	x	
On-time Delivery	Adding EPCIS platform		Add container tracking - avoid/mitigate delays		>The percentage of orders that are fulfilled on the customers' originally scheduled or committed date. > Supply chain event information (using EPCIS platform) will help stakeholders to take immediate action if issues occur. >Delays owing to incorrect port ship marks	>[Total number of orders delivered in original commitment date] / [Total number of orders delivered] x 100% >Benefits of SC visibility are demonstrated through the pilot. >Cost of delays owing to incorrect port shipping marks	x	x	x	
Perfect Condition		Authenticity via GDS / EPCIS. Container temperature monitoring	Adding EPCIS platform -		>Percentage of orders in an undamaged state that meet specification, have the correct configuration, are faultlessly installed and accepted by customer. >Container temperature monitoring.	>[Total number of orders delivered in perfect condition] / [Total number of orders delivered] x 100%. > Deviation from agreed container temperature range	x	x	x	
Order Fullfillment Cycle Time	Adding EPCIS platform				>The average cycle time consistently achieved to fulfil customer orders. For each individual order, this cycle time starts from the order receipt and ends with customer acceptance of the order.	>[Sum actuals cycle times for all orders delivered] / [Total number of orders delivered] in days.	x	x	x	
Order Management Cost	Add EPCIS & EDI (transport instruction message from Teys to Chalmers Transport)				The total cost of labour, automation and assets associated with responding to inquiries, order entry and maintenance, scheduling transportation, order tracking and tracing, delivery and invoicing.	The sum of costs associated with managing customer data, entry, maintenance, scheduling, prioritising and expedition of customer orders, invoicing and collections.	x	x	x	
Compliance	Traceability via GDS	Trusted Trader - providing EPCIS access	Visibility - providing EPCIS access	Using GDS based Recall portal to send recall or withdrawal notifications to regulators and other stakeholders	>The total cost of labour, automation and assets associated with responding to customs/biosecurity and food safety clearance. >Total cost of non-GDS port ship marks >Demonstrate how Teys could use GS1 Au's recall portal	>The sum of costs associated with responding to customs/biosecurity/food safety clearances. >Measuring port shipping mark error costs. >Quanitfy benefits of leveraging GDS based recall portal	x	x	x	x
Data Integrity		Using GDSN to provide data to AU Customs		TBC	>The percentage of orders that product and transactional data are accurate. >Use of global data sync network to share product and party information with stakeholders	>[Total number of orders accurate] / [Total number of orders delivered] x 100%. >Measure benefits for stakeholder having access to product information	x	x		x

11.GLOSSARY AND ABBREVIATIONS

3PL	Third Party Logistics refers to a firm that provides outsourced logistics (and supply chain) services to shippers/suppliers
ABAC	APEC Business Advisory Council
AEO	Authorized Economic Operator
AHECC	Australian Harmonized Export Commodity Classification
APEC	Asia-Pacific Economic Cooperation
CTI	APEC Committee on Trade and Investment
Demurrage	A charge levied on the cargo owner for exceeding the free days storage at the port terminal.
Detention	A charge levied on shippers when the shipping line equipment (container) free usage time has expired. This time varies according to arrangements with the line, but usually it is between 5 and 10 days.
DIFOT	Delivery in full, on time
ECN	Export Clearance Number
EDI XML	Electronic Data Interchange (EDI) is the transfer of data from one computer system to another by standardized message formatting, without the need for human intervention. EDI permits multiple firms -- possibly in different economies -- to exchange documents electronically. Extensible Markup Language (XML) is a human- and machine-readable computing language that enables transmission of data over the Internet.
EDN	Export Declaration Number. An EDN must be notified to the stevedore 48 hours prior to the shipment being received at the terminal.
EPCIS	Electronic Product Code Information Services is a standard developed by GS1 to capture and report event based traceability data. EPCIS helps 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.
ERP	Enterprise Resource Planning is a category of business-management software, typically a suite of integrated applications that an organisation can use to collect, store, manage and interpret data from many business activities,

	including: product planning, cost, manufacturing or service delivery, marketing and sales.
FEU	Forty-food Equivalent Unit
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.
GDS	Global Data Standards
GDSN	Global Data Synchronisation Network. GDSN enables sharing of master data. This is data shared by one trading partner with many trading partners, that provides descriptive attributes of real-world entities identified by GS1 Identification Keys, including trade items, parties and physical locations.
GS1	Global Standards, or GS1, is a neutral, not-for-profit, international organisation that develops and maintains open, global standards for supply and demand chains across multiple sectors.
GS1 EANCOM	A GS1 subset of the UN/EDIFACT standard (United Nations Electronic Data Interchange for Administration, Commerce and Transport). It contains only the message elements required by business applications and mandated by the syntax.
GS1 XML, eCOM, EANCOM	These relate to transaction data. Trade transactions triggering or confirming the execution of a function within a business process as defined by an explicit business agreement (e.g., a supply contract), or an implicit one (e.g., customs processing), from the start of the business process (e.g., ordering the product) to the end of it (e.g., final settlement), also making use of GS1 Identification Keys.
GIN	General Identification Number
GTIN	Global Trade Item Number is a GS1 identification key used to globally identify tradeable items.
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
IoT	Internet of Things describes an Internet in which everyday objects have network connectivity, allowing them to send and receive data
ISO	International Organization for Standardization.

KPI	Key Performance Indicator
LCL	Less than Container Load. A shipment that does not fill a container and is therefore grouped and shipped in a container with other part-loads
MSME	Micro, Small and Medium Enterprises
PDF	Portable Document Format is a file format used to present documents in a manner independent of application software, hardware and operating systems.
QR code	Quick Response code. A two-dimensional machine-readable code.
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.
SCFAP	APEC Supply Chain Connectivity Framework Action Plan (identified 8 chokepoints).
SSCC	Serial Shipping Container Code. The 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.
TEU	Twenty-foot Equivalent Unit
TMS	Transport Management System
WCO	World Customs Organization
WMS	Warehouse Management System

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