

UNDA 7-th tranche project on Strengthening the Capacity of Developing and Transition Economies to link to Global Supply Chains through the reduction of trade obstacles

Roadmap to Enhancing Information Exchange in International Supply Chains

(Executive Summary)

Geneva, February, 2013

Abstract

Economic growth through exports is a key strategy for both developing and transition economies globally. These economies have capitalized on companies in the developed economies outsourcing manufacturing and production, in order to arbitrage lower labour and material costs, to achieve export growth. However, the mobility of global multinational companies and their willingness to migrate to the next low cost location creates an ongoing threat to sustainable growth and development in developing and transition economies.

Growing indigenous companies' participation, particularly local small and medium sized businesses, in export markets is a key focus for policy makers in developing and transition economies working to create sustainable growth in export trade. However, policy makers need to address the complexity and volume of information required for international trade along with the administrative burden of preparing the required documentation for multiple stakeholders in order to encourage greater participation of small and medium sized businesses in international trade.

Experts participating in the Geneva Global Trade Facilitation Conference on single window and supply chains in December 2011 recognized the key role of supply chain information management for future competitiveness of national economies. The participants at the conference concluded that efficiency and security in international trade are crucially dependant on the availability and quality of supply chain information for the actors in the supply chain combined with their ability to process this information automatically.

The conference participants also recognized that the developing countries and transition economies need to share in global information exchange and harness opportunities provided through electronic data exchange combined with automation of business processes to enhance their competitiveness and to link to the advanced markets and supply chains of developed markets. In order to achieve this Government agencies and managers in private sector companies in developing countries need to have a solid understanding of the functioning of information exchange in international supply chains to plan and manage the development of advanced and automated logistic platforms for international trade such as open Customs systems, Port Community Systems or Single Windows.

It was further recognized that policy makers needed a common reference model describing the information exchange in global supply chains when developing measures for cross border information exchange.

This Roadmap Study builds on the recommendations of the December conference. The main objectives of the study are to:

- *Present a model of regulatory, procedural and business processes, and requirements for information flow in global supply chains, both in general and in the specific case of perishable produce and time-sensitive goods;*
- *Identify the specific opportunities that better information sharing in global supply chains can bring to exporters of developing and emerging economies;*
- *Elaborate a roadmap for prerequisites and actions that government and businesses should put in place in order to support information exchange and processing in existing and emerging modern global supply chains, accompanied by a checklist.*

This paper is presented as an executive summary of a more detailed companion paper that elaborates our research and supporting analyses.

Part one of this paper presents a high level summary of our analyses and the key findings of our research

Part two presents the roadmap for prerequisites and actions that government and businesses should put in place in order to support information exchange and processing in existing and emerging modern global supply chains, accompanied by a checklist.

Our analysis has shown that both existing and emerging information technology (IT) solutions can potentially;

- (i) Deliver a step change in the efficiency and effectiveness of international supply chains (ISC) by streamlining import/export administrative procedures and removing information exchange bottlenecks and enabling the evolution of a collaborative supply chain model; and*
- (ii) Facilitate the participation of small and medium sized businesses by reducing both the administrative burden and technological barriers, and by providing easier access through easy to use on line applications.*

However, our research has also highlighted;

- (i) The inefficiencies associated with the current level of fragmentation in information exchange across the international supply chain. These include replication of data as it is exchanged across multiple stakeholders with the associated risks of error, delay and additional costs;*
- (ii) The importance of behavioral prerequisites including mutuality, reciprocity, trust, and commitment as key determinants of the extent of information integration and sharing among the supply chain trading partners; and*
- (iii) That the degree of involvement of the various supply chain partners in dealing with the regulatory and procedural processes in the International Supply Chain depends on the commercial model in place in a specific supply chain. For example three distinct models were identified in the cut flower supply chain. In each case a dominant stakeholder (in terms of commercial power) had the highest degree of involvement in completing the regulatory and procedural processes. This observation suggests that the dominant stakeholder will benefit most from the implementation of advanced and automated logistics platforms for international trade (Open Customs Systems, Single Window or Port Community Systems).*

However, it should be also stressed that these systems have the potential to increase the opportunity for SMEs to participate in international trade, as simplified processes and procedures combined with ease of access make it easier for SMEs to cope with complex regulatory requirements and will facilitate information exchange. Governments can simplify and streamline processes and procedures to create a business environment that will encourage small and medium sized businesses to take advantage of the systems solutions, thereby increasing their participation.

Introduction

This paper is presented as an executive summary of a more detailed companion paper that elaborates our research and supporting analyses.

Part one of this paper presents a high level summary of our analyses and the key findings of our research.

- The Generic Mapping of the International Supply Chain, presented in summary form, provides a contextual framework for the rest of the paper.
- An analysis of trends in the International Supply Chain highlights how current and emerging International Supply Chain Management (ISCM) trends are intensifying the need for information exchange among the commercial supply chain partners and governmental agencies; and identifies potential changes that should take place in the existing information exchange paradigm in order to accommodate the emerging needs.
- A review of information exchanged in the International Supply Chain highlights the volume and complexity of information exchanged within the current international supply chain model; with up to 30 different documents, many containing similar data sets, exchanged between as many as 13 separate parties.
- A qualitative analysis of the impact of information exchange on key value levers in the international supply chain provides a framework for a business case to support investment in improvements in information exchange processes and systems in the International Supply Chain.
- A review of the commercial models in the cut flower supply chain shows dominance of particular parties in the international supply chain and highlights that the benefits to small to medium sized companies from improvements to information exchange in a given supply chain are likely to accrue indirectly.
- Consideration of previous analyses of the behavior of different parties in the International Supply Chain highlights that trust, mutuality, reciprocity, and commitment, are prerequisites for enabling collaboration in the International Supply Chain regardless of the supporting processes procedures or technologies.
- The conclusions and recommendations emerging from the research are summarized under three headings;
 - Recommendations for governmental and regulatory policy makers
 - Recommendations for commercial actors in the International Supply Chain
 - Opportunities for SMEs in Developing and Transition Economies

Part two of this paper presents a roadmap for prerequisites and actions that government and businesses should put in place in order to support information exchange and processing in modern and future global supply chains, accompanied by a checklist.

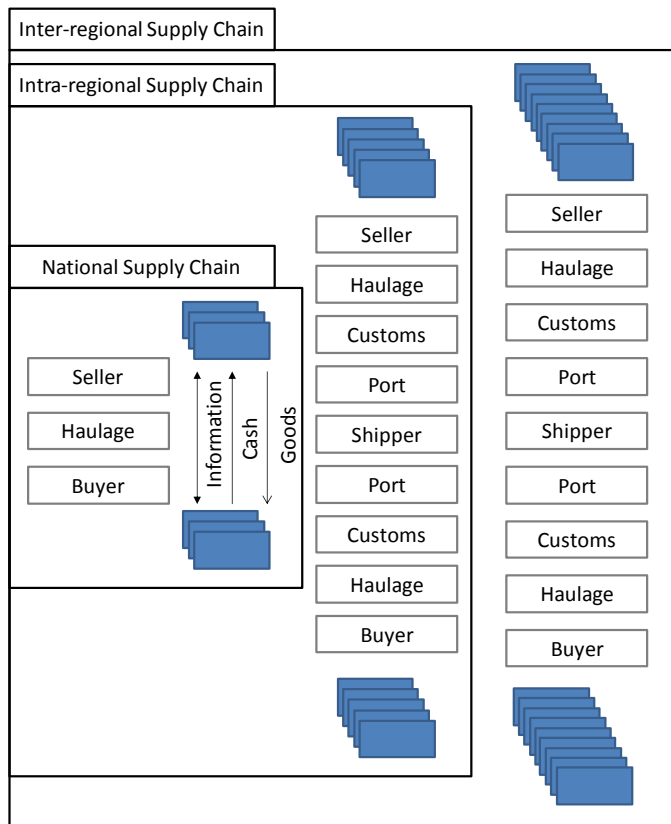
Part 1: Research Analyses and Findings

Background

Economic growth through exports is a key strategy for both developing and transition economies globally. These economies have capitalized on companies in the developed economies outsourcing manufacturing and production, in order to arbitrage lower labour and material costs, to achieve export growth. However, the mobility of global multinational companies and their willingness to migrate to the next low cost location presents an ongoing threat to sustainable growth and development in developing and transition economies. Growing indigenous companies' participation, particularly local

small and medium sized businesses, in export markets is a key focus for policy makers in developing and transition economies seeking to create sustainable growth in export trade.

Figure 1: Impact on number of stakeholders and administration due to the migration from domestic to international trade



Source: Project Team Analysis of Supply Chain Information Flows

There is a significant step change in the number of actors and activities moving from a domestic to an export supply chain (Figure 1). Even at this level of abstraction it is clear that there is a significant increase in the number of stakeholders and the administration necessary to support export processes. The number of additional stakeholders is similar for both intra-regional and inter-regional trade. However, the administrative burden increases further as you move from regional exports, where intra-regional trading blocs (Common Markets, Customs Unions or Free Trade Areas) mitigate some of the paperwork and information exchange requirements, to inter-regional trade.

Analysis completed for a report on enabling trade for the World Economic Forum highlights that international airfreight requires up to 30 different documents exchanged between a minimum of nine parties including the buyer and seller, this compares with four documents and two or three parties for a typical domestic transaction.

This presents a challenge to policy makers in developing and transition

economies trying to encourage and facilitate the participation of small and medium sized businesses in international trade. The lack of sophistication in the target businesses combined with the complexity and volume of information required for international trade, along with the administrative burden of preparing the documentation required for the additional stakeholders may act as a barrier to the participation of these businesses.

Experts participating in the Global Trade Facilitation Conference on single window and supply chains in December 2011 in Geneva recognized the key role of supply chain information management for future competitiveness of national economies.

Our analysis confirms the conclusions of the participants at the conference that efficiency and security in international trade is crucially dependant on the availability and quality of supply chain information combined with the ability of the various actors in the supply chain to process this information automatically.

The participants also recognized that the developing countries and transition economies need to share in global information exchange and harness opportunities provided through electronic data exchange combined with automation of business processes to enhance their competitiveness and to link to the advanced markets and supply chains of developed economies. In order to achieve this Government agencies and managers in private sector companies in developing countries need to have a solid understanding of the functioning of information exchange in international supply chains in order to plan and manage the development of advanced and automated logistic platforms for international trade such as open Customs systems, Port Community Systems or Single Windows.

Participants at the Global Trade Facilitation Conference further recognized that policy makers needed a standardised model for the international supply chain to be used as a common reference model to

describe the information exchange in global supply chains when developing measures for cross border information exchange, particularly in light of regional trade integration and commitments discussed in negotiations under the Doha Development Round.

This paper presents a generic model of regulatory, procedural and business processes, and requirements for information flow in the international supply chain supported by specific case studies for Fresh Cut Flowers exported from Africa to Europe and Field Programmable Logic Devices exported from Asia to Europe and the United States of America.

The analysis of the current international supply chain process combined with the analysis of the information exchanged in the process highlights both the volume and complexity of the documentation exchanged in the international supply chain.

A parallel analysis of existing and emerging trends in information and communications technology solutions used in the international supply chain (ISC) highlights the evolution of easy to use, internet enabled solutions that can deliver significant benefits and lower the barriers to participation of small and medium sized businesses in international trade.

We have identified the specific opportunities that better information sharing in global supply chains can bring to exporters of developing and emerging economies. The analysis indicates that both existing and emerging information technology (IT) solutions along with appropriate streamlining of International Supply Chain (ISC) processes have the potential to: (i) improve the efficiency and effectiveness of international supply chains (ISC) by removing information exchange bottlenecks, and (ii) facilitate the participation of small and medium sized businesses by reducing the administrative burden and providing easier access through easy to use on line applications. However a recent World Economic Forum report on Enabling Trade highlights the need for streamlining of regulatory processes and procedures and the participation of all actors in a particular ISC.

IATA estimates that e-freight could yield US\$ 12 billion in annual savings for shippers and the air transport industry. However, Government regulations, barriers in information and communications technology, and the failure to achieve a critical mass of users to achieve network-effect benefits have prevented the e-freight initiative from being universally adopted leaving substantive savings on the table.

Whilst advanced and automated logistic platforms for international trade have been developed and implemented in various countries it is clear that the potential of these solutions is not being fully exploited. A recent article by Port Strategy highlighted the slow development of Port Community Systems in the US in particular:

*Port Community Systems are taking their time to spread beyond Asia and Europe. In the US, they are virtually unknown outside their uses in security and safety. One US executive contacted by **Port Strategy** assumed the term refers to group activities in suburbs and towns close to ports....*

Our analysis has also highlighted the importance of a number of behavioral prerequisites for achieving information sharing and exchange among the supply chain stakeholders. A study covering more than 150 companies in Asia, Europe, and USA has shown that mutuality, reciprocity, trust, and commitment are the major determinants leading to information integration and sharing among the supply chain trading partners. Therefore, any effort targeted to achieve high levels of information integration and sharing must consider these behavioral prerequisites (Tsanos and Zografos, 2012).

The Port Strategy article goes on to highlight the impact of behavioral barriers on the ability of the parties in the supply chain to fully exploit the potential of these systems through collaboration:

In the US, the focus of information exchange is almost solely on safety and security, a consequence of the 2001 terrorist attacks. Commercial and operational information sharing is almost non-existent, and the reason is the extremely competitive culture that pervades business... (Martin Rushmere, Port Strategy, Nov 2011)

Our research has also highlighted the impact of the commercial models (i.e. the commercial relationships between the actors in a given supply chain) operating in the international supply chain.

The analysis of the commercial model in a number of supply chains has highlighted that the trade management process is usually managed by a dominant stakeholder and therefore that process simplification will primarily benefit that dominant stakeholder. However, the combination of process simplification and increased ease of access will also facilitate greater participation of small and medium sized businesses in international supply chains.

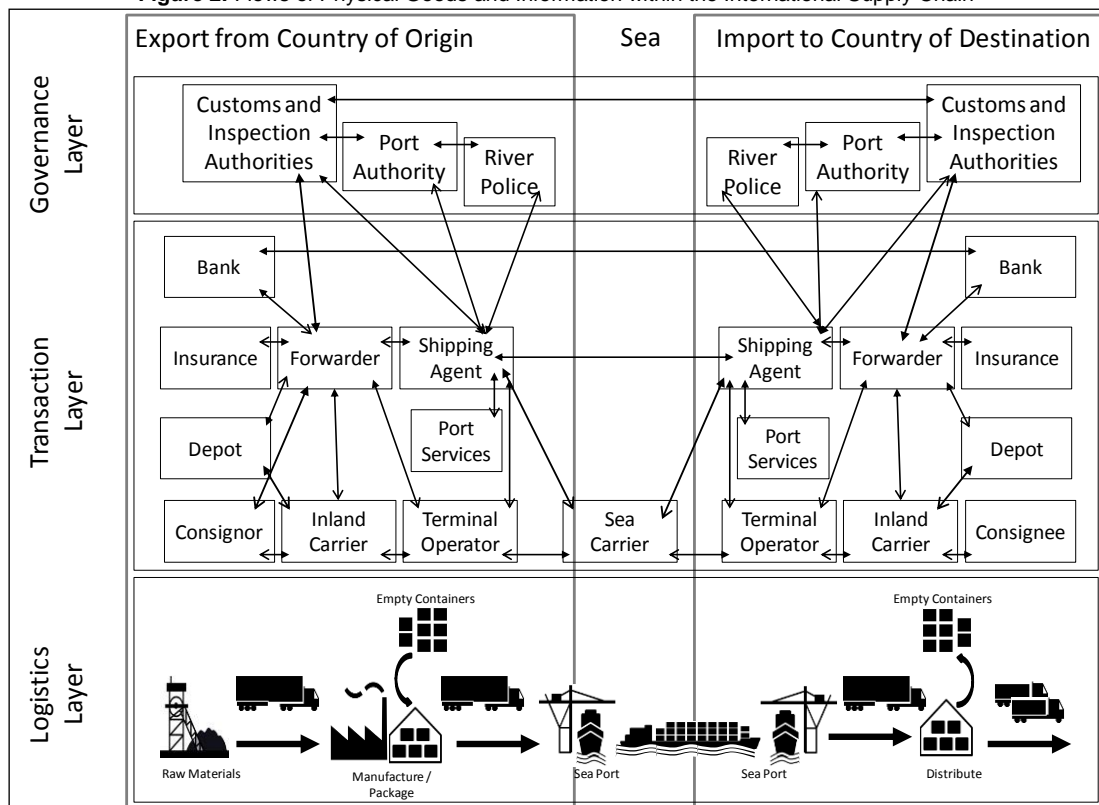
The World Economic Forum Report; Enabling Trade: Valuing Growth Opportunities (2013) highlighted a study of German SME's on eBay. The report concluded at the combination of complex regulations, poor international shipping services, and high fixed costs of international trade discourage SMEs, who often enter markets only with reliable shipping and transparent or few regulations. The authors of the report estimated that removing such barriers could trigger between an increase of 60% to 80% in cross-border SME sales based on preliminary eBay and other outside data.

Generic Mapping of the International Supply Chain

The processes involved in an International Supply Chain and the actors participating in these processes are influenced by a host of factors including; the commercial model; the type of product; the country of origin and the country of destination of goods; the transport mode(s) and trade routes utilized; the types of shipment, e.g. Full Container Load (FCL) vs. Less Than Full Container Load (LTFCL), and the types of operations assumed for the preparation of the container.

All these factors complicate the mapping of a Generic International Supply Chain (GISC). This complexity arises in part from the fact that a multitude of combinations of the attributes and factors identified are possible and consequently so too are a multitude of different representations of the International Supply Chain. The generic mapping is further complicated by the selection of the level of detail used to describe the various processes and the participation of the relevant actors in the model. There is essentially a tradeoff between the level of aggregation used to represent an International Supply Chain (ISC), and the functional utility of the model.

Figure 2: Flows of Physical Goods and Information within the International Supply Chain¹



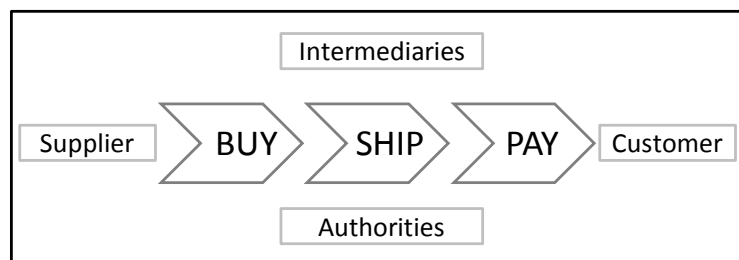
¹ Van Oosterhout, M.P.A., M. Zielinski and Y.H. Tan (2000). "Inventory of flows and processes in the port". Virtual Port, deliverable T2.D1a.

Figure 2 above presents a high level map of the international supply chain with the supporting exchanges between operational and regulatory actors in the supply chain. The map shows the main steps in the physical flow from extraction of raw materials in the country of origin through to the distribution of finished goods in the country of destination. The map also shows the main actors in an international supply chain and the primary information flows between them. The map highlights the symmetry between the export and import processes.

The ISC construct recognizes three major processes that are present in any international trade transaction, namely;

- (i) The *Buy* process encompassing all the activities involved in a commercial transaction related to the ordering of goods and the conclusion of a sales contract;
- (ii) The *Shipping* process involves all activities associated with the physical movement of goods including controls performed by governmental agencies, such as customs, security, border control etc., and services offered by a number of intermediaries, such as insurance agents; and
- (iii) The *Pay* process refers to activities relevant to the payment for goods.

Figure 3: Simplified view of a Generic International Supply Chain
(After UNECE Recommendation 18)



The ISC model also incorporates four major types of actors (stakeholders) involved in these processes;

- (i) A Supplier (or seller);
- (ii) Intermediaries (bank, transport company, insurance agent);
- (iii) Authorities (customs, security agencies, border control agencies, port authorities); and
- (iv) A Customer (importer),

Figure 3 above illustrates the highest level of the International Supply Chain construct. For the purposes of this analysis we have used a number of standard frameworks and insights to develop the generic map of the international supply chain, including;

- (i) The reference model provided in recommendation 18 (UNECE, 2001);
- (ii) The business process analysis guide to simplify trade procedures (UNNExt, UN ESCAP, UNECE, 2009); and
- (iii) Relevant reports of business process analysis of ISC in various countries (ARTNeT and UNNExt, 2011; Hossain et al., 2011; Keretho and Naklada, 2011; Rajkarnimar, 2011; Ramasamy, 2011)

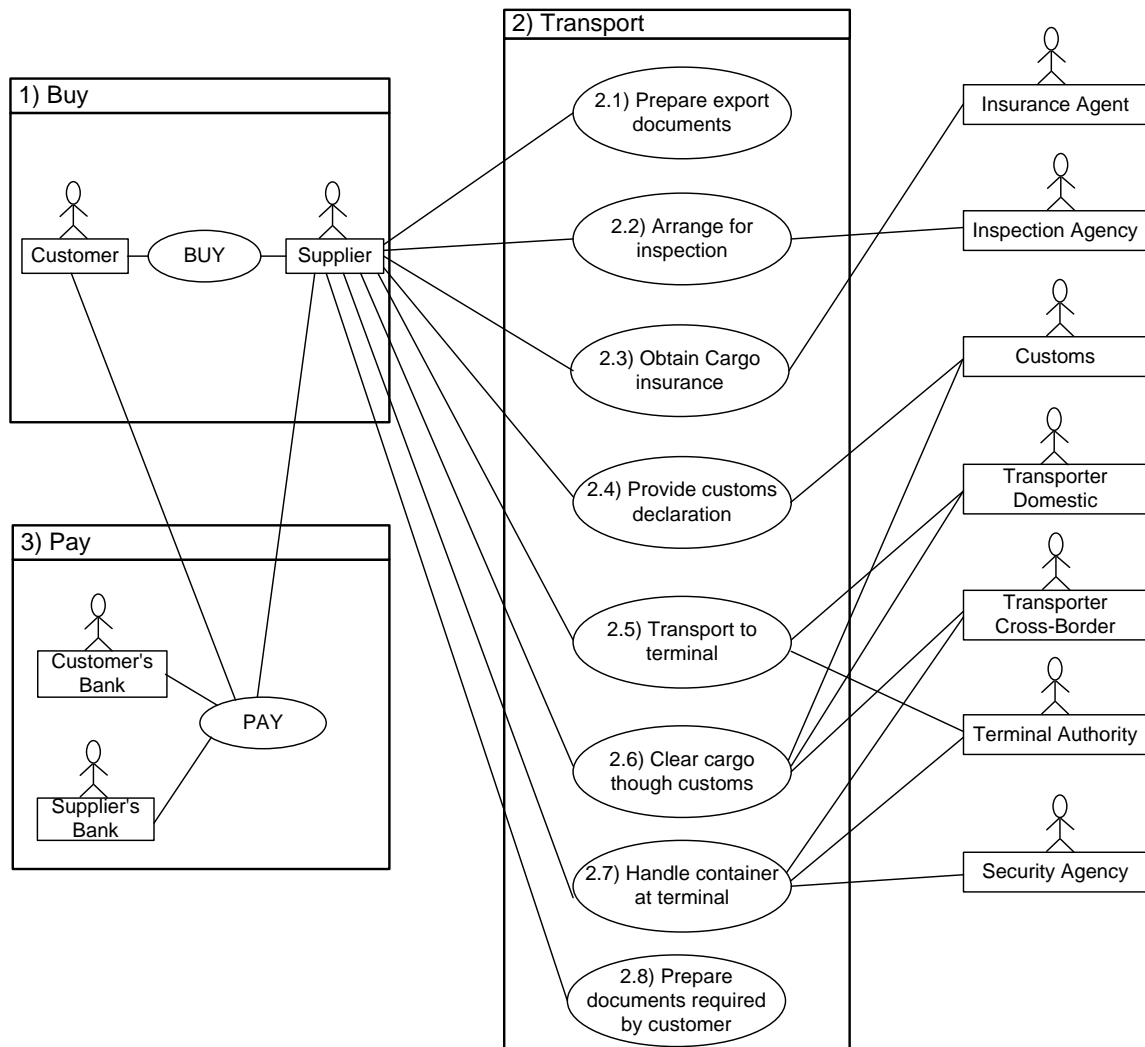
The Generic International Supply Chain mapping presented describes supply chain processes without taking specific requirements stemming from either special commercial or operational handling requirements into account; and assumes that the goods are shipped to one single consignee as a Full Container Load (FCL). The term “International” is used to signify cross-border trade requirements and regulatory procedures.

The process maps are presented as use case diagrams for export processes and import processes, (figures 4 and 5 respectively). Export process requires the engagement of various service providers including domestic transport, the terminal operator, the carrier, an inspection agent, a security agent, an insurance agent and a banker. The export process also requires interaction with the relevant regulatory agencies including customs and if required an export licensing authority.

The sub-processes incorporated within the generic mapping are:

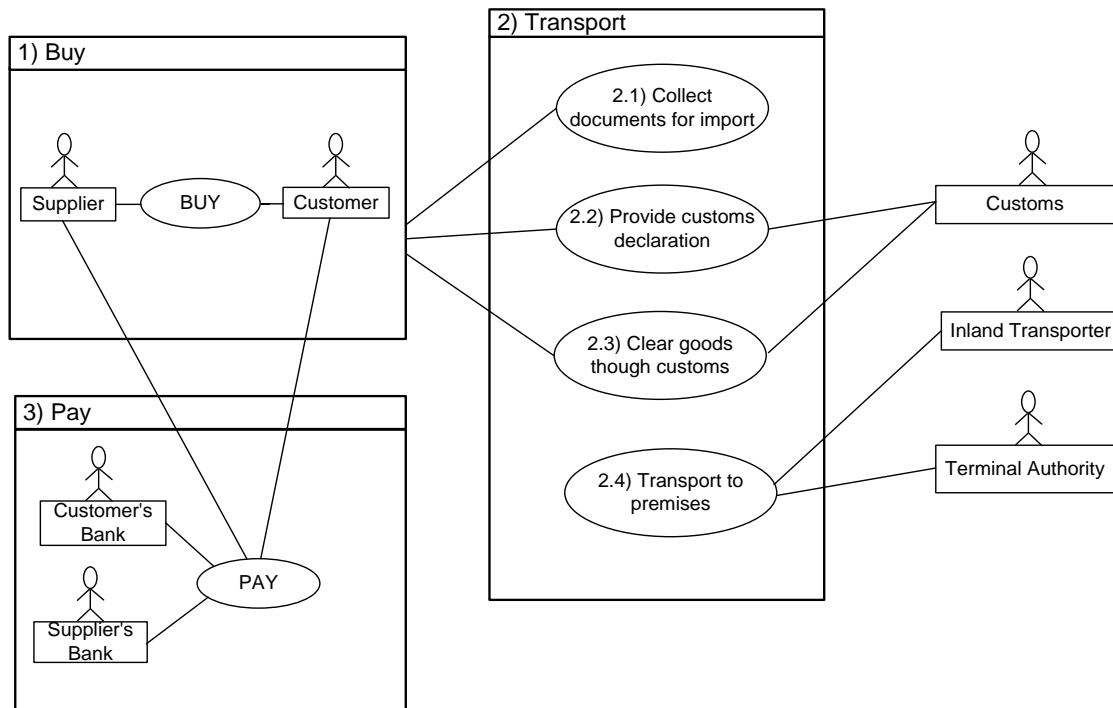
Buy	Ship	Pay
<ul style="list-style-type: none"> Conclude a contract and agree on its terms 	<ul style="list-style-type: none"> Prepare export documents Arrange for inspection Obtain cargo insurance Provide customs declaration Transport to terminal Clear cargo through customs Handle container at terminal Prepare documents required by customer (importer) Collect documents for import Provide customs declaration for import Clear goods through customs for import Transport to premises of customer (importer) 	<ul style="list-style-type: none"> Conclude the payment process

Figure 4: Export processes description of a Generic International Supply Chain



The import process requires engagement with a similar complement of service providers and regulatory agencies at the port of destination.

Figure 5: Import processes description of a Generic International Supply Chain



Trends in the International Supply Chain

The Globalized economic environment has intensified competition for the production and distribution of goods to meet customer requirements in terms of product quality, level of service, and cost. A number of Supply Chain Management Trends have emerged in response to these market pressures leading to the realignment and restructuring of International Supply Chains (Zografos and Giannouli, 2001, TRANSLOG, 2003).

Trends in International Supply Chain management can be categorized in three major groupings as follows:

- (i) organization of production
- (ii) spatial organization, and
- (iii) patterns of product flow, (Zografos and Giannouli, 2003a).

Table 1 below summarizes these trends.

Table 1: International Supply Chain Management (ISCM) Trends (After Zografos and Giannouli, 2003a)

Trends in International Supply Chain		
Organization of Production	Spatial Organization	Patterns of Product Flow
Postponement	Spatial Concentration of Production	Nomination of Day and Time of Deliveries
Vertical Disintegration of Production	Spatial Concentration of Inventory	Direct Deliveries
Application of Time Compression Principles	Wider Geographical Sourcing and Distribution	Reverse Logistics
	Rationalization of Supply Base	Development of Break Bulk / Transshipment Capabilities
		Development of Hub-satellite systems
		Concentration of International Trade on Hub Ports and Airports

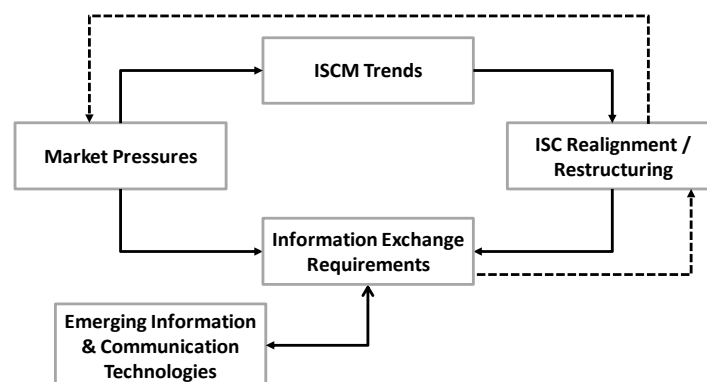
Trends associated with the organization of production, i.e., postponement (i.e. delaying conversion of materials or customisation of finished product until demand is confirmed), vertical disintegration of production (i.e. geographical separation of raw materials extraction, primary manufacturing, secondary manufacturing, and packaging) and application of time compression principles (i.e. shortening the time between steps in a process so that errors are identified more quickly and intermediate inventories are minimized) increase the need for information visibility and timely exchange of information among supply chain partners.

The growth in global sourcing and low cost country sourcing has created both extended and fragmented supply chains. Companies in the developed economies have outsourced manufacturing and production to low cost countries in order to arbitrage lower labour and material costs. While global sourcing has provided lower costs it has also led to higher inventories and reduced responsiveness.

The relationship between market pressures, formation of ISC management trends, information exchange requirements, and ICT utilization is dynamic. The information exchange needs are changing overtime in order to respond to market pressure and accommodate the emerging supply chain management trends. Therefore information exchange requirements for ISC requires the identification of current and emerging International Supply Chain Management (ISCM) trends.

The combination of market pressures and emerging supply chain trends determine the information exchange requirements and needs among the supply chain stakeholders. Existing and Emerging Information and Communication Technologies (ICT) both facilitate and accelerate the requirements for information exchange in these emerging models. Overtime the realignment and restructuring of the supply chain may generate new market pressures and additional information exchange needs (see feedback loop indicated with dashed lines in Figure 6 below).

Figure 6: Relationship between Market Pressures, International Supply Chain Management (ISCM) Trends and Information Exchange Requirements (Modified after Zografos and Giannouli, 2001; TRANSLOG 2003)



The emerging supply chain management trends generate three major requirements for supply chain information processing and exchange;

- (i) Information visibility,
- (ii) Information timeliness, and
- (iii) Traceability (Integrity, 2008; Van Stijin et al., 2011; Tsanos and Zografos, 2012).

The information that needs to be exchanged among the supply chain trading partners include data needed to coordinate: (i) demand management activities, e.g. sales forecasts (ii) sales and operations planning, e.g. sales data, (iii) resource planning, e.g. inventory data, (iv) materials planning, and (v) capacity planning, e.g., production delivery schedule (Lee and Whang, 2000; Tsanos and Zografos, 2012), (vi) supply chain event management, e.g. order status tracking, (Lee and Whang, 2000), security and safety (Integrity, 2008; Van Stjin et al, 2011), (vii) environmental and social sustainability performance of the supply chain, e.g. CO₂ production data, adherence to labour regulations etc.

Visibility, timeliness, and traceability provide private and public sector decision makers alike with the possibility to increase the performance of ISC in terms of the efficiency and effectiveness of the underlying operations (Tsanos and Zografos, 2012). Current and emerging information and communication technologies (ICT) can be used to improve visibility, timeliness, and traceability along

the supply chain. Although the use of ICT is a necessary condition for fulfilling the emerging supply chain information processing and exchange requirements it is not sufficient. A major barrier in achieving visibility, timeliness, and traceability along the supply chain resides with a number of behavioral factors, like trust, mutuality, reciprocity, that influence the degree of collaboration amongst supply chain partners and hence their willingness to use ICT solutions that will enhance the visibility, timeliness, and traceability of their supply chain.

Information visibility, timelines, and traceability among the trading partners may lead to better coordination of both demand and supply side Operations Planning and Control (OPC) activities, and better Supply Chain Event Management (SCEM) with beneficial impacts on the performance of the entire supply chain (Integrity, 2008; Tsanos and Zografos, 2012).

In addition to ongoing pressures to reduce costs there are also pressures to maintain or increase supply chain responsiveness. Wider geographical sourcing and distribution and rationalization of the supply base also increase the need for information exchange. Global supply chain managers are faced with the challenge of monitoring and managing millions of supply chain events as they occur on a day to day basis. International supply chains in the Globalized economic environment are vulnerable to disruption due to weather, political or social upheaval or security threats (e.g. Piracy in the Indian Ocean). Furthermore, emerging ISCM trends related to nominated day and time of deliveries and direct deliveries have increased the number of products that are considered time sensitive (Nordas et al., 2006), and have increased the need for fast, adaptive, and agile supply chains, which in turn increases the need for information visibility, timeliness, and traceability.

Timely information sharing between trading partners and governmental organizations, and among governmental organizations, has the potential to decrease delays encountered at border crossings, reduce documentation and reporting effort, and increase supply chain security and safety (Van Stijn et al., 2011). The research findings in this paper highlight barriers and areas of potential improvement for international supply chains. Similarly the World Economic Forum Report; Enabling Trade: Valuing Growth Opportunities, (2013) describes barriers, and quantifies the potential impact.

The World Economic Forum report on Enabling Trade Valuing Growth Opportunities, (2013) cites the case of a Chemical Company importing products to the US. Delays in chemical products are sensitive because of storage problems, demurrage charges, and potential confiscation of products.

When the company exports into the US, its products can fall under the jurisdiction of up to 12 regulators, including the FDA, the Drug Enforcement Agency (DEA), the Department of Commerce Bureau of Industry and Security (BIS) and the Department of Homeland Security. These agencies operate independently and often lack effective coordination of communications, which results in the imposition of additional rules and regulations and increased delays. In the case of Acetyl imports obtaining licenses and lack of coordination of five agencies, who often fail to coordinate and communicate effectively with one another, leads to delays in up to 30% of product shipments – with potential demurrage charges of US\$60,000 per day

Supply chain managers need visibility of specific events as they occur to allow them to take proactive, corrective actions to optimize productivity, inventory and process cycle times; thereby managing customer satisfaction and overall supply chain efficiency. Supply chain managers need to maintain schedules and milestones to allow them to systematically trace events to a specific date and time. However, cost pressures do not allow for teams of people monitoring every transaction. Supply chain managers need systems to identify and flag disruptions and delays to allow personnel throughout the supply chain to respond to and manage adverse events in real time.

Existing and emerging i) platforms such as Enterprise Resource Planning (ERP) systems (e.g. SAP, Oracle, JD Edwards, BAAN, etc), Port Community Systems (PCS), and National Single Windows, (SW), ii) data acquisition technologies such as RFID, GPS, and container scanning, and iii) data exchange and integration technologies such as, cloud computing, XML/EDI, and iv) data processing and decision making systems such as intelligent agents, event managers, supply chain optimization software, provide the capability to improve information acquisition, exchange, processing, and accuracy (Integrity, 2008; TRANSLOG, 2003).

However, a step change is needed by the public and private sector to:

- Improve the connectivity of systems used to exchange information: i) among trading partners, ii) between trading partners and authorities, and iii) among authorities. The positive experience accumulated from the introduction of Single Windows and Port Community systems at national level should be used to connect these systems internationally.
- Stakeholders should consider modifying the existing document-based, data pushed, paradigm of information exchange, to an information technology enabled data pull concept where data needed by governmental agencies can be pulled from existing information systems of the trading partners (Van Stijn et al., 2011).

Information Exchange in the International Supply Chain

The preceding section has discussed how current and emerging International Supply Chain Management (ISCM) trends are intensifying the need for information exchange among the commercial supply chain partners (B2B) transactions, among governmental agencies (G2G) transactions, and between commercial partners and governmental agencies (B2G) transactions; and identified potential changes that should take place in the existing information exchange paradigm in order to accommodate the emerging needs. This section discusses the inefficiencies generated by the existing information exchange paradigm and argues for the need for change.

The number of documents required for supply chain management increases as the supply chain progresses from domestic through intraregional (in this context intraregional trade is considered to be within a customs or free trade area) to international / interregional trade. There is a degree of similarity between the documents used.. for intraregional and international / interregional movement of goods. However, intraregional trade is simplified by the use of single administrative documents for import, export and revenue declarations; and the time taken to move products between countries within a trading bloc is reduced by the reduction or elimination of border controls between member states of the trading bloc.

The EU Single Administrative Document (SAD) was introduced in 1988 replacing 200 different forms in use across the 18 original user countries. The standardization and harmonization of data requirements significantly reduced traders and Customs work load and subsequently enabled the evolution of Electronic Data Interchange (EDI) between traders and member countries Customs systems. Since 1993 the paper SAD has increasingly been replaced by (EDI).

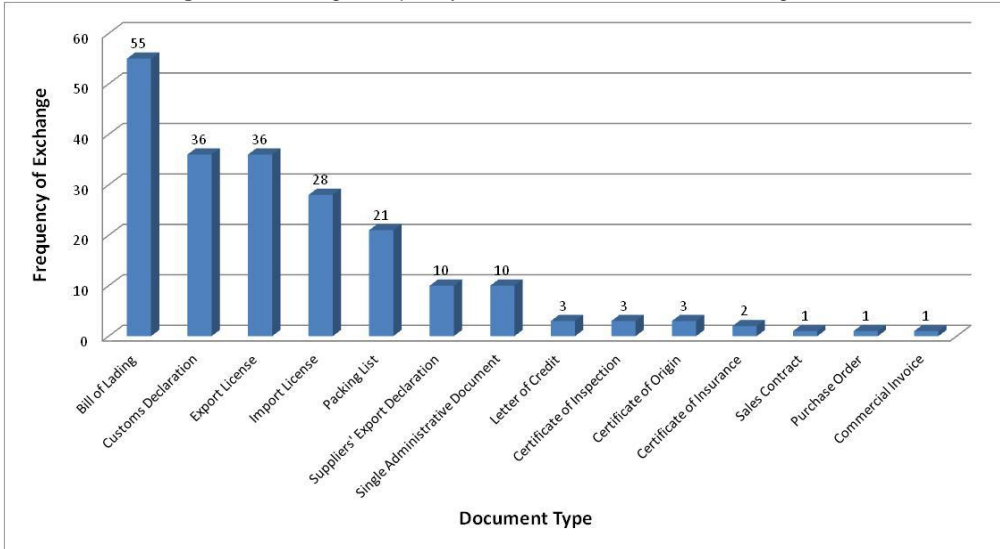
While there are separate documents exchanged between the parties there is a substantive overlap in the information contained in the documentation used..The types of information exchanged between the various supply chain stakeholders during the three major stages, i.e. buy, ship, pay, of an International Supply Chain were identified through a review of the key documents used and a comprehensive literature review, (CETLE, 2011; CrimsonLogic, 2007; DISCwise, 2012; EPCSA, 2011; INTEGRITY and SMART-CM, 2008; Koh Tat Tsen, 2011, Pedersen, 2011; PORTEL, 2009; Smit, 2004; Van Stijn, et al., 2012). Information extracted from these documents has been used to produce figure 7 and figure 8 (see below) which illustrate respectively the frequency of document exchange and the stakeholders exchanging these documents.

Figure 7 shows graphically the frequency of exchange of the various types of documents involved in International Supply Chain Management. This figure suggests that four documents namely; bill of lading, customs declaration, export license, import license, and packing list are the documents with the highest frequency of exchange among the participants of an international supply chain. For example the bill of lading is exchanged 55 times during a complete export/import cycle.

This analysis underlines the importance of automating the information included in the frequently exchanged documents in order to avoid duplication of effort, reduce errors, and provide an environment for efficient information exchange and customization.

On the other end of the spectrum there are documents with a lower frequency of exchange, e.g. there are seven out of the fourteen documents that are exchanged between 1 to 3 times during the entire export/import cycle.

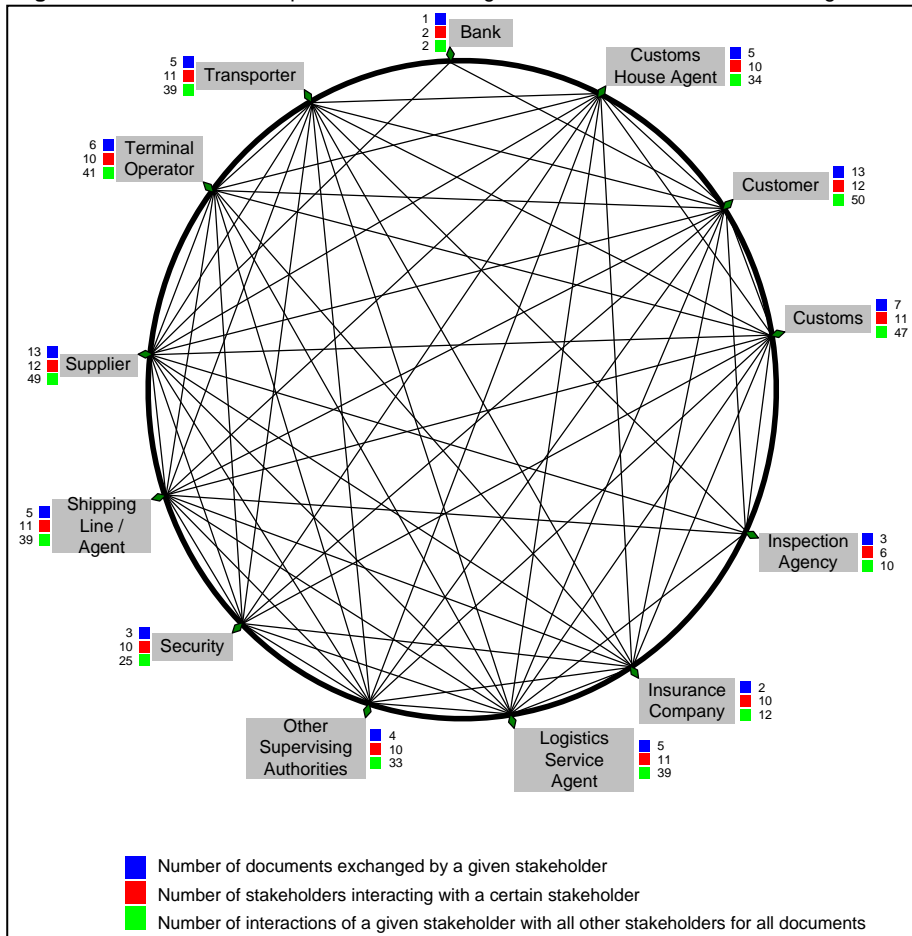
Figure 7: Exchange Frequency of Documents Used in ISC Management



Source: Project Team Analysis

These documents are exchanged between specific parties and the case for automating the exchange of these documents will be dependent on the frequency of transactions (e.g. number of orders per day, week, month etc.).

Figure 8: Stakeholder Participation in the Exchange of Documents Used in ISC Management



Source: Project Team Analysis

Figure 8, illustrates the frequency of participation of the different types of stakeholders in the information exchange for a complete export/import cycle of an International Supply Chain. The blue

bars of this diagram indicate the participation of each stakeholder in exchanging documents with other stakeholders. For example the number 13 beside the *blue* bar of supplier indicates that the supplier exchanges 13 documents with all other stakeholders. The *red* bars indicate the number of stakeholders with whom a given stakeholder exchanges information. For example the number 12 beside the supplier bar indicates that the supplier exchanges information with 12 other stakeholders.

This part of the figure suggests that, with the exception of the banks and the inspection agencies, all other stakeholders exchange information with just about the same number of stakeholders, (around 10). The green bars of Figure 8 indicate the intensity of the interaction in terms of information exchange among stakeholders. Thus, the green bars indicate in how many document exchanges a given stakeholder participates. This figure suggest that ten out of the fourteen stakeholders namely customer, supplier, customs, terminal operator, transporter, logistics service agent, shipping Line/Agent, security, and other supervising authorities participate intensively in the exchange of information among the International Supply Chain partners. This intensity ranges between 50 and 25 (participation in document exchanges).

It is important to recognize that the model as presented represents a single buyer supplier relationship. Any buyer or supplier will in reality deal with multiple suppliers and customers respectively; and each of the other stakeholders will interact with multiple buyers and suppliers.

These findings suggest that the stakeholders that demonstrate very high intensity in information exchange participation and the documents frequently exchanged among them would benefit most from participation in integrated information exchange platforms, such as Port Community Systems, Single Windows, etc.

Table 2: Summary of Data Elements Exchanged in the Supply Chain by Application

Data Elements	Operational	Commercial	Control	Regulatory
1. Supplier Identification	✓	✓	✓	✓
2. Buyer Identification	✓	✓	✓	✓
3. Carrier Identification	✓	✓	✓	✓
4. Port of Departure	✓	✓	✓	✓
5. Port of Arrival	✓	✓	✓	✓
6. Product List	✓	✓	✓	✓
7. Product Classification Information	✓	✓	✓	✓
8. Package List	✓	✓	✓	✓
9. Container List	✓	✓	✓	✓
10.Pricing Information		✓	✓	✓
11.Value		✓	✓	✓
12.Insurance Information		✓	✓	
13.Country of Origin	✓	✓	✓	✓
14.Country of Manufacture	✓	✓	✓	✓
15.Quality Information	✓	✓	✓	✓
16.Inspection Information	✓	✓	✓	✓
17.Financing Information (Letter of credit) ¹		✓	✓	✓
18.Export License Information	✓	✓	✓	✓
19.Import License Information	✓	✓	✓	✓
20.Proof of Delivery	✓	✓	✓	
21.Sales Contract		✓	✓	
22.Freight Contract		✓	✓	
23.Terms (Sale, Payment, Delivery)		✓	✓	

Source: Project Team Analysis

Typically there are in excess of 100 separate data elements required across the set of international trading documents. An analysis of the key data elements in each document highlights a significant overlap in the information provided. The same information may be rekeyed several times in the production of the standard documents used in the supply chain. In addition to increasing the administrative burden in the supply chain multiple entries of key data elements creates a risk that discrepancies and inconsistencies will arise between different forms. Discrepancies between forms can create issues at border control and may invalidate key document including letters of credit and shipping insurances.

The documents used in the international supply chain are designed to support operational, commercial, control and / or regulatory requirements. For example a customer order is a commercial document initialing a sales transaction and an operational document detailing the customer's specific requirements. A Bill of Lading is an operational document confirming the contents in a shipment for each of the key actors in the supply chain up to the point of delivery to a customer and a control document for regulatory authorities. The Commercial Invoice is a commercial document confirming pricing and terms for the seller and the customer; and a regulatory document confirming the value of a shipment for the application of taxes and duties.

Table 2 above summarises the main data elements recorded on the documents used in the international supply chain and indicates the application of the information for operational, commercial, control and / or regulatory purposes. The table highlights the overlap in the application of specific data elements at a macro level.

A review of the information presented in the physical documents and forms exchanged in the international supply chain suggests that:

- There is substantial duplication of data exchanged among supply chain stakeholders participating in the various supply chain processes.
- Minor variations in the information provided on different forms can distort the supply chain process including voiding letters of credit and insurances.
- The volume of additional documentation required for international trade combined with the increased risk in international trade appear as barriers to participation for small to medium sized companies.
- The additional administrative burden combined with the increased risk of loss in an extended supply chain and the risk of losses due to adverse currency movements and the uncertainty of payment in certain jurisdictions may act to deter participation of small and medium sized businesses.

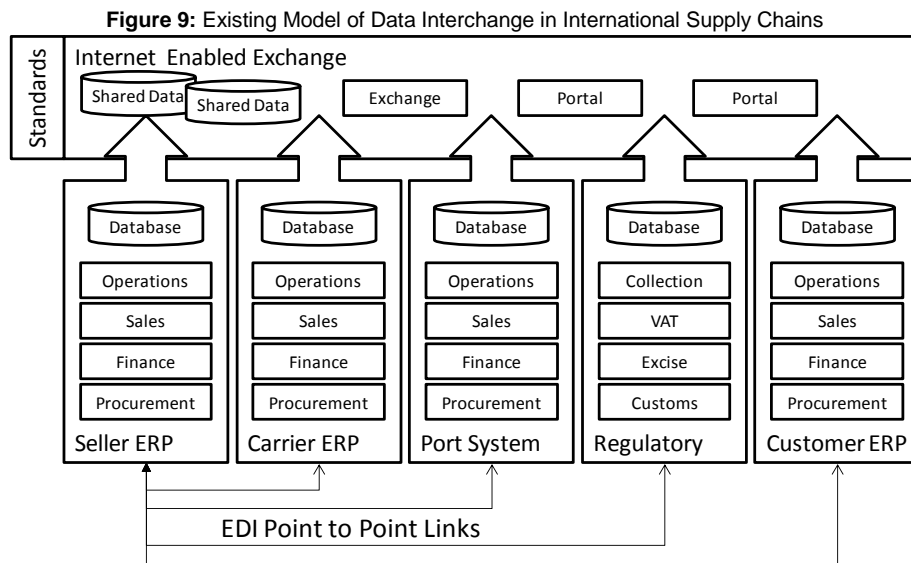
At an abstract level the volume of additional documentation required for international trade combined with the increased risk in international trade appear as barriers to participation for small to medium sized companies.

However, the analysis of the specific regional supply chains highlights that the administrative burden and the main risks in the supply chains are taken by the more dominant commercial actors in the supply chain. The initial analysis of the information flow in the international supply chain highlights that the structure of, and the relative commercial strength of the various actors in, the supply chain have a more significant impact on the participation of small and medium sized companies.

The preceding analysis suggests that the performance of International Supply Chains depends highly on their ability to allow all relevant stakeholders, both trading partners and governmental organizations, to have access to information regarding all supply chain processes in a timely and transparent fashion.

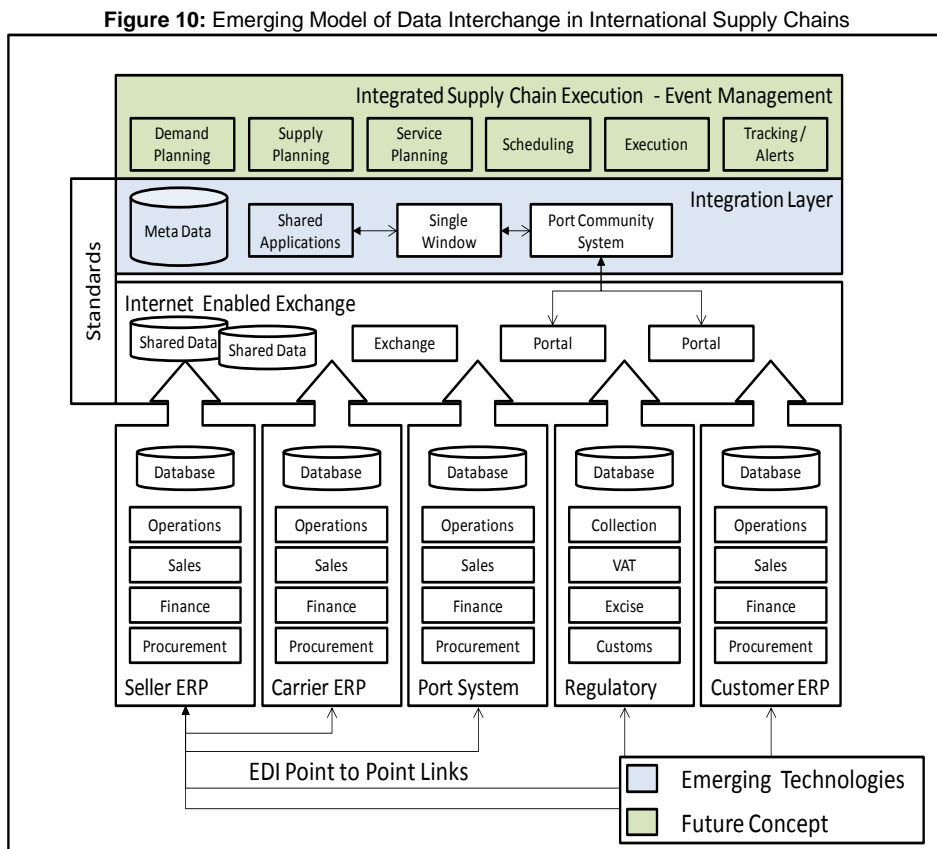
There is a need for a new information exchange concept that will be able to facilitate the timely, accurate, and transparent exchange of information between the trading partners (private sector) and governmental agencies (public sector) while at the same time reducing the duplication of data entry and documentation effort. The Data Pipeline concept has been proposed recently (Van Stijn et al., 2011) as a means of achieving these objectives.

Although the data pipeline concept holds a lot of promise for improving information visibility and timeliness for ISC, currently there is no empirical evidence able to support its applicability and viability under real world ISC transactions. Therefore, pilot applications of the data pipeline concept should be implemented before embarking to a large scale implementation of this concept.



Source: Research Team Analysis

The current model for data interchange in International supply chains is characterized by independent stakeholders operating largely stand alone systems. Existing legacy applications support internal processes and communicate through a combination of point to point or electronic data interchange systems, or use Internet enabled alternatives.



Source: Research Team Analysis

We are also seeing the emergence of internet portals to share information. However, the use of these portals are largely mandated by a dominant actor. Information visibility across the supply chain decreases uncertainty (e.g. supply uncertainty due to capacity or operational constraints, demand uncertainty due to fluctuations in market requirements). Traditional means of sharing information between functional units and between organisations are slow and reduce information velocity. Limited information visibility and reduced information velocity makes it difficult to implement cross-organisational cooperation. Aligning transactions across a customer-focused process or a pull system requires timely access to appropriate information.

Figure 10 (above) shows an emerging model for information exchange in the international supply chain. The evolution of shared applications and integrated platforms will enable a more integrated model allowing all stakeholders to work from a single common dataset in real time. The single data set is underpinned by a common data definition and, standardized processes and communication protocols, to facilitate interoperability between systems. This step change will provide a platform for supply chains to operate to a pull system enabling the development of robust ISCM policies. The integrated data exchange also enables common, traceable and measurable criteria (Carey, 2012). This further enables the development of aligned and integrated processes for consistency and reliability.

Impact of Electronic / Emerging Technologies on Information Exchange on ISC Processes

The increasing demand for achieving higher levels of information visibility, timeliness, and traceability is motivated by the increasing complexity of global supply chain operations, the need to improve supply chain operational speed and accuracy, the increasing demand by trading partners to improve the accuracy and timeliness of shipment event information, and the intensifying competition among supply chains to reduce supply chain execution costs (Heaney, 2012). The introduction of information exchange concepts that will facilitate visibility and timeliness in ISC (see above) will affect the performance of all ISC processes, i.e. buy, pay, transport, and consequently the performance of the entire supply chain (Tsanos and Zografos, 2012).

Table 3: Impacts of Information Exchange on International Supply Chain Processes

Impacts of Information Exchange	Major ISC Processes			Supply Chain-wide Performance
	Buy	Pay	Transport	
Increased Speed	3	3	2	3
Increased Reliability	3	3	3	3
Improved Accuracy	3	4	4	3
Increased Flexibility	2	3	2	3
Increased Safety	2	2	2	2
Improved Security	0	0	3	2
Lower Risk	3	3	3	3
Environmental Sustainability	2	0	3	2
Social Sustainability	3	0	0	2
Cost of Process Execution	2	2	3	2
Cost of Products	Not Evaluated	Not Evaluated	Not Evaluated	2

Source: Project Team Analysis

Our analyses highlight the fragmented nature of international supply chains. Fragmentation by definition means that gaps exist in terms of communications, execution, measurement and reporting. Consequently there is a need for improvements (Carey, 2012). These improvements will enhance current supply chain models and enable the growth of extended supply chain opportunities for emerging companies and countries.. By combining internal integration with supplier integration and customer integration, a system, such as that shown in figure 10, enables a supply chain to operate in an integrated manner. The supply chain is therefore better placed to respond to the dynamics of the marketplace. The availability of information enables the supply chain to be managed in a market-

focused manner. Information reduces demand uncertainty, supply uncertainty, and internal uncertainty. Reduced uncertainty allows the organisation to increase performance in terms of efficiency and effectiveness. For example, efficiency can be improved through the reduction of inventories, effectiveness can be improved through the increase in responsiveness. Increased efficiency and/or effectiveness leads to an increase in competitive advantage and therefore to increased profitability.

The primary benefit of emerging information exchange technologies and concepts is real time exchange of information. A qualitative assessment of the impact of the emerging information exchange technologies on a number of key measures of supply chain performance i.e. i) speed, ii) reliability, iii) accuracy, iv) flexibility, v) safety, vi) security, vii) risk, viii) environmental sustainability, ix) social sustainability, x) cost of process execution, and xi) cost of products is summarized in table 3 below.

We have estimated the scale of benefits attributable to improved information exchange for each of the key supply chain processes across the range of metrics identified. The scale of benefit is measured on a five point scale from no benefit (Blank Circle) to significant benefit (Completely Shaded Circle). For example real time exchange of information increases the speed at which transactions and administration activities can be completed ergo the benefit to the buy and pay processes are relatively high. However, there is a limit to the extent that real time exchange of information can influence physical processes e.g. bar-coding reduces the effort of physically checking and counting goods received from hours to minutes whilst RFID reduces it to seconds. However, the goods still have to be moved and handled and real time information has a less of a direct impact on these processes.

The qualitative assessment is validated by the findings in a recent paper from the World Economic Forum (Enabling Trade: Valuing Growth Opportunities, 2013) The report indicates that “many of the inefficiencies in supply chain operations reflect a lack of reliability due to delays and uncertainty stemming from manual paper-based documents, redundancy in data requirements and absence of pre-arrival clearance and risk management based approaches” (Enabling Trade: Valuing Growth Opportunities; World Economic Forum, 2013, p.27). To cope with delays and lack of reliability companies are forced to hold additional inventory an actions that leads to an increase of the supply chain-wide costs.

IATA which has estimated that the adoption of electronic documentation for the air cargo industry could produce benefits to the amount of \$ 12 billion, while it will prevent 70-80 % of the paper-work related delays.

The analysis of the specific interregional supply chains highlights a high level of sophistication in the management of the international supply chain, even for commoditized lower value products. There is a willingness amongst the participants to embrace new technology to reduce or eliminate supply chain costs.

A stem cut in Kenya at 6am on Monday morning will grace a table in Kent before lunch on Tuesday

In recent decades, with the increasing use of air freight, it has become economic for high value crops to be grown far from their point of sale; the market is usually in developed countries. East African and South American countries have successfully grown their share of the \$40 billion world market for cut flowers. Typical of these is the production in Kenya and Uganda for the European market with; and production of roses in Colombia, mainly for the US market.

Cut flowers take a number of routes to the consumer, depending on where they are grown and the commercial model for sales. Flowers cut at 6am in Kenya will be on sale in Europe between 24 to 48 hours later. Fresh cut flowers are packed flat in boxes enabling large quantities to be packed for air freight. Some growers cut and pack flowers and send them directly out to a mail order consumer from the nursery. Cut flowers are also sent to packing companies, who grade and arrange the flowers in bunches, in advance of shipment to order for supermarkets and or mail order consumers. The majority of cut flowers are graded and sleeved by the growers and sold at wholesale flower markets; the wholesalers then sell them on to florists who condition and arrange the flowers for the consumer.

Growers in Kenya use the internet to process orders from large UK Supermarkets and Dutch Distributors as well as individual customers. The combination of electronic information exchange and expedited customs clearance facilitate a high velocity supply chain.

The emergence of internet enabled solutions for information exchange in the International Supply Chain has the potential to allow real time data exchange with multiple partners whilst reducing the time and effort taken in data administration.

- The analysis of the frequency of document exchange and the number of stakeholders participating in each exchange highlights the potential benefit of a systems platform that would enable collaborative exchange of documents
- Internet enabled portals will allow participants to publish information to all stakeholders in international supply chains simultaneously.
- Single entry systems will reduce the number of times any piece of information is re-keyed between systems and partners in the supply chain.
- Single entry of key data elements in a standardized electronic format will reduce the opportunity for error and may greatly facilitate the exchange of this data throughout the supply chain whilst expediting supply chain processes.
- Existing and emerging technologies such as Barcode and RFID scanners also reduce the opportunity for error and the effort in recording of information along the supply chain. RFID Scanners in particular can significantly reduce the time taken to scan a full shipment.
- Standardization of data requested by various security initiatives (along the lines of the WCO-SAFE) program will enhance security without compromising supply chain efficiency
- The implementation of security measures in the supply chain may also introduce delays that have the potential to substantially increase supply chain costs. Cargo Scanning (CAR) or Non Intrusive Inspection (NII) technologies facilitate a faster inspection process
- GPS, GMS and Sensor Technologies have the potential to increase the capability to track and trace goods along the supply chain in real time and to improve supply chain visibility with beneficial business, environmental, regulatory, and security results
- Data consolidation will enable the conversion of data to decision making information in end to end supply chains.
- Increased information visibility combined with robust supply chain planning and management systems will allow participants pull information and to reduce costs by reducing investments in inventory and scheduling other resources (port staff, warehouse operatives, inland carrier resources) more efficiently.

The Commercial Model

The analysis of the specific interregional supply chains highlighted the impact of the commercial model overlaying the supply chain and the role of different stakeholders in a given model. The initial analysis of the information flow in the international supply chain indicates that the structure of, and the relative commercial strength of the various actors in, the supply chain have a more significant impact on the participation of small and medium sized companies. The analysis identified three different commercial archetypes or Models.

1. Distributor driven
2. Customer Driven
3. Supplier Driven

Distributor Driven

In the distributor driven archetype a distributor acts as an intermediary sourcing products and selling them on to an end customer. A producer sells product to the distributor in the country of origin. The producer delivers the products with the delivery & packing lists to a freight forwarder at the port of departure (note port in this context can be a seaport, an airport or a rail head). The distributor takes responsibility for the remainder of the international trade processes up to the delivery to a customer at the final destination. (See figure 11 above)

Customer Driven

In a customer driven archetype the producer sells the product directly to the customer in the country of origin and the customer takes responsibility for all aspects of the international trade process.

Figure 11: Responsibility for International Trade Processes in a Distributor Driven Model

Process Steps	Responsible Actor
	Producer
Transport to Freight Forwarder (At Port / Airport)	Distributor
Prepare Export Documents	
Arrange Inspection	
Obtain Cargo Insurance	
Provide Customs Declaration	
Clear Cargo Through Customs	
Handle Container at Terminal	
Prepare Documents Required by Customer	
Collect Documents for Import	
Provide Customs Declaration	
Clear Goods Through Customs	
Transport to Customer	Distributor or Customer

The producer will deliver the product to the port or to another domestic location specified by the customer with the delivery & packing lists. The customer is responsible for the remainder of the process up to the delivery to a final destination. The customer may also source additional services in the country of origin e.g. finally assembly or preparation for packing for immediate onward sale to the consumer.

Figure 12: Responsibility for International Trade Processes in a Customer Driven Model

Process Steps	Responsible Actor
	Producer
Transport to Freight Forwarder (At Port / Airport)	Customer
Prepare Export Documents	
Arrange Inspection	
Obtain Cargo Insurance	
Provide Customs Declaration	
Clear Cargo Through Customs	
Handle Container at Terminal	
Prepare Documents Required by Customer	
Collect Documents for Import	
Provide Customs Declaration	
Clear Goods Through Customs	
Transport to Customer	

The decision to source local services can be driven by a combination of factors including; (i) arbitrage of lower labor rates (particularly for manually intensive tasks); (ii) access to specific local skills (availability of a technically qualified work force); (iii) access to lower cost materials; and (iv) access to specific materials.

Supplier Driven

In a supplier driven archetype the producer sells the product to the customer in the country of final destination. Producers aggregate demand through an agent, who will source freight and port services, and manage the international trade processes acting on their behalf. (See figure 13 above)

The analysis of the specific regional supply chains indicate that the administrative burden and the main risks in the supply chains are taken by the more dominant commercial actors in the supply chain.

Figure 13: Responsibility for International Trade Processes in a Supplier Driven Model

Responsible Actor	Producer	Producer										Agent or Customer
		Agent acting on behalf of one or more Producers										
Process Steps	Transport to Freight Forwarder (At Port / Airport)	Prepare Export Documents	Arrange Inspection	Obtain Cargo Insurance	Provide Customs Declaration	Clear Cargo Through Customs	Handle Container at Terminal	Prepare Documents Required by Customer	Collect Documents for Import	Provide Customs Declaration	Clear Goods Through Customs	Transport to Customer

It is possible for a small or medium sized company to export directly on their own behalf. However, our analysis of the commercial models outlined above highlights that in each of the cases analyzed the interregional trade processes are managed by a large scale highly specialized stakeholder. This indicates that access to the customer and the ability to source the necessary services at an economic cost are as likely to be significant barriers to the participation of small to medium sized companies from developing economies in international trade. This finding is echoed in the World Economic Forum report *Enabling Trade: Valuing Growth Opportunities* (2013).

Governments should simplify and streamline processes and procedures to create a business environment that will encourage small and medium sized businesses to take advantage of the systems solutions, thereby increasing their participation.

In parallel Governments should facilitate the development of collaborative marketing services and cost effective distribution services to support small and medium sized businesses participation in international trade.

Enabling Collaboration in the International Supply Chain

A key issue that merits attention in introducing technological solutions aiming to increase supply chain visibility is the issue of how the resulting supply chain-wide benefits and costs are allocated among the supply chain stakeholders and how the balance of power among the various supply chain stakeholders, and therefore their behaviors are impacted.

There is a degree of competition between stakeholders with respect to the development and implementation of emerging technologies based on perceived commercial advantage, (e.g. the emergence of carrier, supplier and customer driven portals as a medium of information exchange). Carriers are investing in portal technologies to reduce their administrative burden and potentially tie customers into their service offering. Customers and Suppliers are developing their own portals as vehicles to aggregate demand or supply and leverage their position in the supply chain relative to each other and the service providers in the supply chain.

Although, information sharing has been proven to be beneficial for the performance and competitiveness of the entire supply chain its achievement relies on more than the technological capabilities of the stakeholders involved to integrate their fragmented information systems.

Previous research has highlighted the importance of reinforcing a number of specific behavioral antecedents (i.e., trust, mutuality, commitment, reciprocity, satisfaction) that influence the acceptability of information exchange by the participating stakeholders as a major prerequisite for enhancing information exchange in International Supply Chains (ISC), (Tsanos and Zografos, 2012).

Martin Rushmere writing in Port Strategy (Nov 2011) identified the level of rivalry and internal competition in the US market as an impediment to collaboration and information sharing and the extension of the use of Port Community Systems beyond safety and security.

According to the Business Transformation Enablement Program introduced by the Canadian Government (BTEP: An Executive Overview, 2004) enabling multiple stakeholder engagement is a “procedural imperative” in the implementation of transformative changes. The development and implementation of projects leading to enhanced information exchange among the public and private sector stakeholders definitely requires transformative changes of the public and private organizations involved in International Supply Chains.

David Braue (CIO, Government of Australia) writing in CIO Magazine (June 2004) identified the challenges facing regulatory and governmental authorities;

“... Procedural isolationism is a way of life within many departments that have become so accustomed to operating independently that data sharing is sometimes inconceivable. Furthermore, such departments often lack the common sense of purpose that drives private business leaders to work together. Given that data exchange is a fundamental component of ubiquitous e-government, such attitudes represent a significant obstacle”

Governmental agencies can play an instrumental role in developing a “relationship environment” that is conducive to information exchange. Governmental organizations need to be actively engaged in both internal and external stakeholder relationship management activities in their efforts to facilitate the development of a healthy “relationship environment”. Research from Ipsos MORI (2009) highlighted that in order for governmental organizations to be able to effectively manage the relationships among stakeholders they need to;

- (i) Demonstrate good leadership with clear vision and direction,
- (ii) Effectively communicate and act on stakeholder views, and
- (iii) Have available credible and consistent staff at all levels .

The World Bank report on “Doing Business” provides some illustrative examples of Governmental initiatives that have contributed to regulatory reforms. For instance regulatory reform committees reporting directly to the president using “doing business” indicators to measure progress made have been introduced in Brunei, Darussalam, Colombia, Rwanda. These committees are aiming to coordinate efforts across various agencies. Committees aiming to increase inter-ministerial coordination have been established in thirty five countries around the world. These actions demonstrate leadership and clear vision and direction for improvement. Similarly the availability of well qualified and stable cadre of civil servants in Latvia has contributed to the implementation of the country’s regulatory reform agenda.(World Bank, 2013). An effort recently undertaken in Greece with the technical support of UNECE highlights the importance to effectively communicate and act on stakeholder views.

The most frequently reported governmental actions, in the past eight years, leading to trade facilitation reforms relate to (World Bank, 2013):

- Introduction or improvement of electronic submission and procedures
- Improved customs administration and introduction of Single Windows
- Introduction or improvement of risk based inspection
- Improved port procedures.

Conclusions and Recommendations

A review of the information flows and the documents used in the international supply chain highlights that:

- There is substantial duplication of data entry, documentation, and document exchange effort associated with the operation of International Supply Chains. This duplication stems from the existing international trade information exchange paradigm. Currently the information exchange among ISC stakeholders is based on documents that should be exchanged between trading partners, trading partners and authorities, and between authorities in order to fulfill the requirements of ISC processes. Thus, the same data are included in different documents submitted to different stakeholders participating in different processes.
- The sheer volume of data required in the various documents increases the probability for data entry errors when data are entered manually. Data entry errors have a detrimental effect on the supply chain performance in terms of cost, level of customer service, and customs clearance procedures. Thus, automation of the data entry process through the use of technologies like RFID, GPS, and avoidance of data entry duplication can greatly enhance the performance of International Supply Chains.

A parallel review of the emerging requirements for information exchange and processing among the supply chain stakeholders indicate that:

- Information visibility and exchange of information among supply chain stakeholders constitute a need that will intensify in the future as the complexity, safety, security, and social and environmental sustainability requirements for effective Supply Chain Management will increase.
- Information that allows the real time tracking and tracing of the shipments is essential for the effective management of unexpected events and can contribute to the development and operation of safer, more secure, more resilient, and more environmentally and socially responsible supply chains.

However, a step change is needed by the public and private sector to:

- Improve the connectivity of systems used to exchange information: i) among trading partners, ii) between trading partners and authorities, and iii) among authorities. The positive experience accumulated from the introduction of Single Windows and Port Community systems at national level should be used to connect these systems internationally.
- Modify the existing document-based, data pushed, paradigm of information exchange, to an information technology enabled data pull concept where data needed by governmental agencies can be pulled from existing information systems of the trading partners (Van Stijn et al., 2011).

Recommendation 1:

- Analyse the supply chain and identify those areas of the supply chain where simplification and automation of information flows can improve the supply chain process (as is analysis)
- Develop clear and specific objectives and strategies for the simplification and automation of information's flows in the supply chain (to be scenarios); define and agree on key performance indicators.
- Develop a data interchange agreement between core stakeholders (this agreement should include objectives for electronic data interchange, responsibilities of parties, protocols and testing methods)
- Complete a cost benefit analysis of the researched improvements, develop a phased implementation strategy and agree on key performance indicators
- Develop a data exchange portal to facilitate single entry of information to a common data pool for all participants

Actions for Government

- Governments should harmonize their regulatory data requirements across

Actions for Businesses

- Support the analysis of the supply chain to identify those areas of the supply chain where

<p>Departments and Agencies.</p> <ul style="list-style-type: none"> • Governments should eliminate (where possible) unnecessary duplication of documents and compliance tests which generate more intensive information exchange needs. • Governments should publish data requirements and standard for G2G and B2G data interchange. • Governments should engage in an open dialogue with the trade community on the objectives, architecture and implementation strategies for planning and implementation of interagency information systems such as Single Windows Systems, integrated Customs management systems or Port Community systems. In planning and implementation these systems, Governments should apply International standards and managerial best practice. • Governments can act as an “honest” broker and work with the private sector stakeholders to extend the single window facility to include their requirements. • Governments can also work with authorities in other jurisdictions to extend the scope of the shared data set to encompass relevant data requirements. <p>Investment of Government</p> <ul style="list-style-type: none"> • Governments should invest in harmonizing internal data requirements across agencies involved in import and export control and regulation • Governments should encourage and facilitate investment from private stakeholders in shared facilities for data exchange 	<p>simplification and automation of information flows can improve the supply chain process (as is analysis).</p> <ul style="list-style-type: none"> • Adopt open data and information technology development standards in any internal systems development. • Engage in dialogue with the Government to agree common objectives for the architecture and implementation strategies for planning and implementation of interagency information systems such as Single Windows Systems, integrated Customs management systems or Port Community systems. • Engage with trading partners to harmonise information requirements for B2B data interchange. <p>Investment for Businesses</p> <ul style="list-style-type: none"> • Invest in internal systems to take advantage of shared facilities for data exchange • Invest in shared facilities for data exchange
<p>Available Tools</p> <ul style="list-style-type: none"> • UNECE: UN/CEFACT recommendation to governments on data harmonization (recommendation No. 34 ENG FRE RUS) + SW recommendation and UN/CEFACT recommendations in General • UNESCAP/UNECE UNNEXT Guide for the Design of Aligned Trade Forms for Paperless Trade • UNESCAP/UNECE UNNEXT Data harmonization and Modelling Guide • UNESCAP/UNECE UNNEXT Guide for the planning and implementation of Single Window • The UNESCAP Guide to Business Process Analysis to Simplify Trade Procedures • The UNESCAP Data Harmonization and Modelling Guide for Single Window Environment 	
<p>Available Guides for Data</p> <ul style="list-style-type: none"> • UN/CEFACT Core Component Library • UN/CEFACT UN/EDIFACT • UN Trade Data Element Directory UNTDED • UN Location Code (UN/LOCODE) • Etc. (See UN/CEFACT Website for other standards) 	

Behavioral Prerequisites (e.g. (i.e., trust, mutuality, commitment, reciprocity, rivalry, competition) are potentially more significant impediments to achieving collaborative working and process integration in the international supply chain.

Although, information sharing has been proven to be beneficial for the performance and competitiveness of the entire supply chain, implementation relies on more than the technical capabilities of the stakeholders involved to integrate their fragmented information systems. Previous research has highlighted the importance of reinforcing a number of specific behavioural prerequisites (i.e., trust, mutuality, commitment, reciprocity, satisfaction) that influence the acceptability of information exchange by the participating stakeholders as a major prerequisite for enhancing information exchange in International Supply Chains (ISC), (Tsanos and Zografos, 2012).

Research from Ipsos MORI (2009) highlighted that in order for governmental organizations to be able to effectively manage the relationships among the stakeholders involved in an international supply chain they need to;

- Demonstrate good leadership with clear vision and direction,
- Effectively communicate and act on stakeholder views, and
- Have available credible and consistent staff at all levels.

Recommendation 2:

- Governmental agencies can play an instrumental role in developing a “relationship environment” that is conducive to information exchange.
- Governmental organizations need to be actively engaged in both internal and external stakeholder relationship management activities in their efforts to facilitate the development of a healthy “relationship environment”.

Actions for Government

- Develop and articulate a clear vision and strategy for information management in the international supply chain.
- Become an exemplar for the external stakeholders: Review and address internal behaviours. Ensure inter departmental and agency alignment and integration.
- Identify and engage with key external stakeholders.
- Communicate and act on stakeholders’ views.

Investment of Government

- Invest in inter departmental and agency transformation to ensure alignment and integration between agencies
- Invest in training and development or recruitment to ensure availability of suitably qualified staff to enable organizational alignment

Actions for Businesses

- Participate and actively engage in multi-stakeholder fora aiming to facilitate inter-organizational information exchange..
- Identify and engage with key external stakeholders.
- Identify risks and issues with open engagement.
- Develop risk mitigation strategy.
- Take a lead on open engagement with supply chain partners.

Investment for Business

- Invest in training and development or recruitment to ensure availability of suitably qualified staff to enable organizational alignment

Available Tools

- Not Applicable

The responsibility for dealing with the regulatory and procedural processes in the International Supply Chain is driven by the commercial model in place in a specific supply chain. For example three distinct models were identified in the cut flower supply chain. In each case a dominant stakeholder was responsible for completing the regulatory and procedural processes. We can conclude therefore that beneficiaries of the implementation of advanced and automated logistics platforms for

international trade (Open Customs Systems, Single Window or Port Community Systems) will in large measure will be the dominant stakeholder in the first instance.

However, governments can simplify and streamline processes and procedures to create a business environment that will encourage small and medium sized businesses to take advantage of the systems solutions, thereby increasing their participation in export activity.

Greater utilisation of technologies will reduce inefficiencies and build consistency into information exchange. The emergence of internet enabled solutions for information exchange in the international supply chain offers businesses in emerging economies the opportunity to access export markets with greater ease and at a lower cost than heretofore.

There are opportunities for emerging economies to avoid considerable investment in IT infrastructure and access developed technologies with minimal investment. Internet enabled applications allow Small and Medium sized companies in developing economies to access robust technologies without the cost and risk inherent in developing their own systems.

The evolution of single points of entry through internet portals shared by Revenue and Governmental authorities (Single Window) and internet portals shared by all stakeholders at a given port (Port Community Systems) also provide small and medium sized businesses the opportunity to reduce the administrative burden associated with international trade. Single points of entry also reduce the opportunity for error and eliminate the risk of conflicts between the specific details enter on or transcribed between both manual forms and stand alone systems and applications.

Single Window applications also have the virtue of simplifying the import – export process making it easier for businesses to comply with regulatory responsibilities as well as increasing the visibility of import export activity, ultimately driving up compliance and reducing opportunities for evasion.

Timely exchange of information decreases order cycle and increases reliability of deliveries and consequently increases the competitiveness of SMEs since it gives them the opportunity to participate in ISC of sophisticated and time sensitive products.

Recommendation 3:

- Governments and companies should explore the options to adopt web enabled information systems to accelerate development of information exchange capabilities
- Governments should identify opportunities to simplify and streamline import and export processes to encourage greater participation of small and medium sized businesses in international trade.

Actions for Government

- Governments should streamline their own import / export administrative procedures and remove information exchange bottlenecks.
- Governments should support the development of open platforms and common standards in preference to proprietary systems.
- Support and enable the evolution of a collaborative supply chain models.
- Facilitate small and medium sized businesses by reducing both the administrative burden and technological barriers by providing easier access through easy to use on line applications.

Investment of Government

- Investment in streamlining and simplifying

Actions for Businesses

- Assess technical capabilities and identify gaps
- Identify and assess internet enabled solutions to fill gaps
- Develop business case for development of capability
- Select and deploy chosen applications

Investment for Business

- Invest in deployment of web enabled

<p>international trade processes.</p> <ul style="list-style-type: none"> ▪ Encourage and incentivise SME's to <ul style="list-style-type: none"> ○ Develop technical capabilities ○ Utilise internet applications to fill gaps 	<p>applications</p> <ul style="list-style-type: none"> ▪ Invest in capability development
<p>Available Tools</p> <ul style="list-style-type: none"> • Not Applicable 	

PART 2

Roadmap to enhance information exchange in international supply chains

This paper has highlighted the high number of documents exchanged between the various actors in a typical import / export transaction in the international supply chain. The research has also highlighted the duplication of data elements across these documents. Regulatory processes and procedures contribute significantly to the volume of paper in the international supply chain. Streamlining these regulatory processes and procedures in conjunction with the adoption of enhanced systems for information exchange in the international supply chain can release significant value.

A World Economic Forum Report, Enabling Trade; Valuing Growth Opportunities concluded that reducing supply chain barriers to trade including regulatory hurdles could increase GDP by nearly 5% and trade by 15%.

Regulations and procedures should be evaluated on the basis of removing supply chain barriers to trade. A step by step evaluation process is outlined below.

Figure 14 illustrates a high level roadmap for the development of a strategy for enhancing information exchange in International Supply Chains. The key steps in the planning phase are outlined as:

1. Assess The Current State

Each country, company and international supply chain will have a different current state. It is necessary to identify and assess each supply chain that is materially important to a country's competitiveness, growth and economic sustainability. The assessment will take into account such factors as: technical capabilities, policy approach and stakeholder behaviors. These are explained in greater detail below. The methodology outlined assumes a combination of business process analysis combined with an assessment of current and target capability. A set of maturity grids (Tables 4,5 and 6 below) presented below can be used to document an assessment of current capability along a number of key dimensions. The grid can also be used to define a set of future capabilities.

2. Define the Future State

The future state will be determined by the trends and information exchange requirements of a specific supply chain. This will require an assessment of how the existing and/or emerging information and communication technologies will accommodate the requirements of a target International Supply Chain Management model.

3. Identify Key Tasks to Develop an Implementation Plan

Bridging the gap between the current and future states provides a framework for an implementation plan.

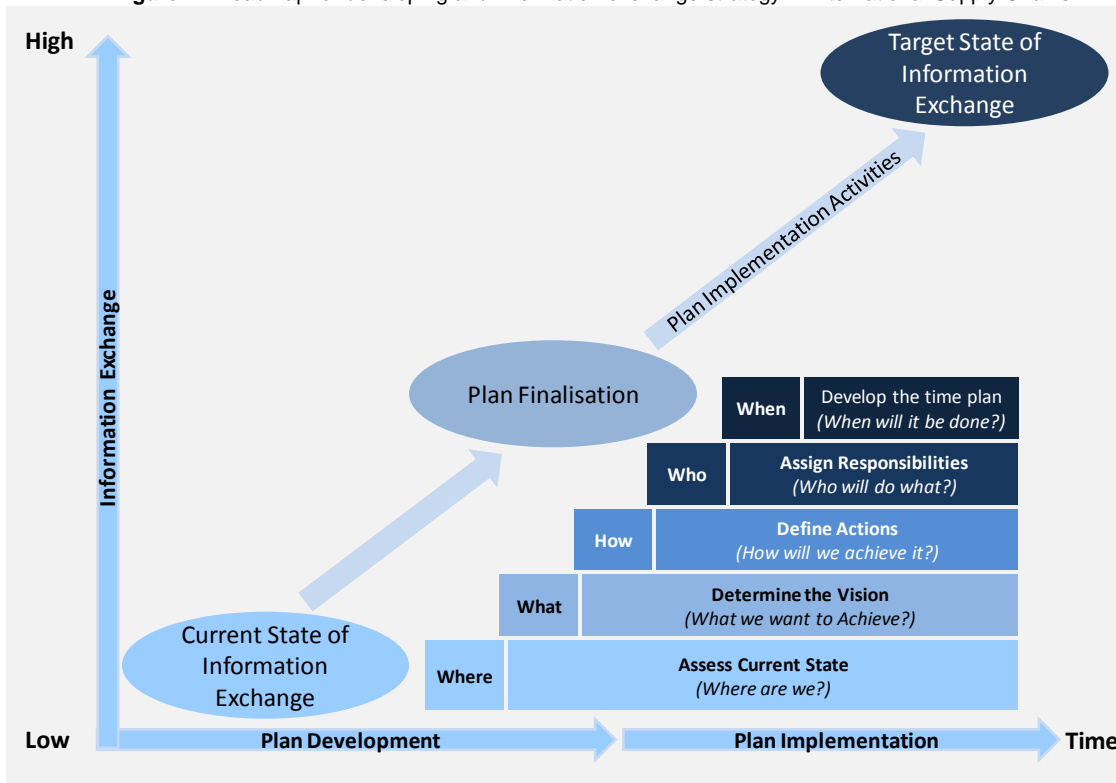
Assess Current State

The start point for each Regional Assessment should be a current state assessment. In order to increase the benefits that will result from the reengineering of the ISC it is advisable to start the effort from supply chains with substantial economic bearing for the geographical area under consideration and/or supply chains of time critical goods. The key steps in the current state assessment are:

1. Map the major processes involved in both the exports and imports. The analysis of these processes should be based on a standardized methodology like the one proposed by UNECE Recommendation 18(UNECE, 2001, and covered in the UNNEXt Guide on Business Process Analysis (UNNEXt, 2009).
2. Use the maturity grid to plot the maturity of current capabilities. Assess the current level of maturity for a given supply chain, (or organization within a supply chain), in terms of technical capabilities, policy approach and stakeholder behaviors.

In parallel to the analysis of the supply chain processes it is essential to analyze the state of maturity of ICT used by all stakeholders both trading partners and governmental agencies, involved in and/or affected by ISC operations. Current capability can be assessed using a maturity grid (see tables 4, 5 and 6 below for sample maturity grids for technical, policy and behavioral capability respectively).

Figure14: Roadmap for developing and information exchange strategy in International Supply Chains



Source: Team Analysis

Given the fact that information exchange is highly susceptible to a number of behavioral issues that dictate the relationships among the various ISC stakeholders, e.g. trust, mutuality, reciprocity, it is imperative to also determine the level of maturity of the relationships amongst and between trading partners and governmental organizations. This will include procedural and regulatory requirements. In examining these relationships it is also essential to analyze the impact of existing public and corporate policies on the level of development of these relationships.

3. Identify the relevant commercial model(s) for the specific sector / industry. It is important to recognize that multiple commercial models can exist simultaneously within any given market segment. The analysis of the Cut Flower Supply Chain from Africa to Europe highlighted three main commercial models; (i) buyer driven, (ii) agent / distributor driven and (iii) seller driven.

The commercial model will determine which stakeholders in any given supply chain are most likely to benefit most from regulatory action to stimulate or facilitate activity in the International Supply Chain. For example regulatory actions to simplify import and export processes and lower administrative cost in a buyer driven supply chain will deliver more immediate cost benefits to the buyer and than the small to medium sized companies supplying produce to the buyer.

Governments can stimulate small and medium sized businesses participation by simplifying and streamlining processes and procedures. However, research conducted by the World Economic Forum support by Bain & Co. and the World Bank (Enabling Trade: Valuing Growth Opportunities) highlights that increasing participation of these businesses requires a combination of regulatory, and other commercial changes (e.g. simplified import and export processes and paperwork, and robust economic distribution services).

Define Future State (Where do we want to be?)

The second step is to define the target future state. In order to define the future state it is necessary to examine the ISC management trends and how these trends and what types of information exchange requirements are generated by these trends for the geographical area under consideration. An analysis should also be performed in order to assess how the existing and/or emerging information and communication technologies will accommodate the requirements of the envisaged International Supply Chain Management model.

Table 4: Maturity grid for Technical Capabilities

	Absent	Basic	Good	Advanced	Leading Edge
Technical Capability					
1. Power Supply	Intermittent power available in major urban centers	Stable power in major urban centers Intermittent power in other areas	Stable power in all areas		
2. Internet Access	No Internet	Fixed line internet access	Fixed Line Broad Band Access	Fixed Line Broad Band Access Mobile Broadband Access	Fibre Optic Broadband High Speed Mobile Access
3. Operational Systems	Manual / Paper based systems	Stand alone ERP. Limited Internal integration	Full function ERP. EDI integration with partners.	Full function ERP. EDI and Web enabled integration with partners.	Web based applications Web based integration
4. Regulatory Systems	Manual / Paper based systems	Stand alone systems for each functional area	Integrated systems shared data between functional areas	Integrated systems shared data between functional areas Web enabled user self service	Integrated systems shared data between functional areas Web enabled Single Window
5. Standards	No standards for data communication No standard Processes	Multiple Standards for coding and classification; and processes	Industry standard coding and classification; and processes	Cross industry standard coding and classification; and standard processes	Integrated standard coding and classification; and processes

Source: Project Team Analysis

Table 5: Maturity grid for Policies

	Absent	Basic	Good	Advanced	Leading Edge
Policies					
1. Import Export Processes	Stand alone manual processes	Streamlined manual processes	Streamlined integrated processes	Streamlined integrated web enabled processes	Streamlined integrated web enabled real time processes
2. Trade Documentation	Stand alone documents for different agencies	Shared documents between related agencies	Minimize number of documents Shared documents between related agencies	Single Administrative Document Shared across regulatory agencies within one jurisdiction	Shared Single Administrative Document across trading partners
3. Capacity Building	Stand alone programmes across multiple agencies	Single development agency Stand alone programmes	Single development agency Stand alone programmes	Single development agency Integrated programmes	Single agency Client Directed Integrated programmes
4. Integration of Regulatory Bodies	Multiple independent regulatory agencies	Minimize number of agencies based on functional areas	Minimize number of agencies based on functional areas	Single Regulatory agency operating multiple processes	Single regulatory agency operating integrated processes

Source: Project Team Analysis

The target future state can also be defined using the maturity grids. Each maturity grid defines a progression from basic to leading edge capability. We have defined the key attributes that characterize each stage of maturity. Thus, if a country or a region aims to reach (i.e. wants to be at) a given level of information exchange maturity, e.g. leading edge, it has to make sure that the corresponding attributes are present.

Table 6: Maturity grid for Behaviours

	Absent	Basic	Good	Advanced	Leading Edge
Behavioural					
1. Relationship maturity	Transactional Relationship	Contractual Relationship Competitive	Strategic relationship based on enlightened self interest	Strategic relationship based on shared interests	Strategic relationship based on maximizing market opportunities
2. Trust	No Basis for Trust	Minimal level of trust based on contract enforcement	Trust based on shared economic interests	High level of trust based on shared economic interests	High level of trust based on shared economic interest and understanding of opportunity to extend benefits
3. Transparency	No Transparency	Sharing of minimal operational and technical information	Open sharing of planning and capacity information	Joint planning of demand and capacity by key stakeholders. Development of shared plan	Shared Strategic Plan based on shared 11 goals and long term development of shared interests

Source: Project Team Analysis

Note it may be possible to leapfrog stages in the maturity grid. For example a small or medium sized company currently operating on paper could leapfrog the development stages and cost for an ERP system and rent or lease capacity on a web enabled service. This would allow them to minimize both capital investment and development time by renting a ready to use capability over the web. The trade off is the cost of the on-line service (pay per use type costing) and limitations on customization options.

Develop the Implementation Plan

Develop the Action list (What should be done & How?)

The gap between the current and future states defines the scope of an implementation plan to migrate from current to future state. The difference between current capability and target capability on the maturity grid provides the basis of a gap analysis that will identify the types of actions that should be considered in order to achieve the strategic objectives.

The checklist set out in table 7 (below) provides a set of sample actions that will bridge the gap between current and future states for technical capabilities. Similar actions should be identified for policies and behaviors. The examples are presented at the highest level. Migrating from a current to a future state may require substantive capital and infrastructure projects. However, as noted above there may be options to leapfrog stages and enable capability utilizing modern technology. E.g. mobile telecoms infrastructure can be easier to implement than fixed line technology. If the mobile solution meets the functional requirements it can be a cost effective way of enabling a capability.

Estimating and allocating the costs and benefits of migrating from a current state for information exchange to a target state is a necessary prerequisite to completing a transformation plan.

The potential benefit areas identified in table 3 above are speed, reliability, accuracy, flexibility, safety, security, risk, environmental and social sustainability and the cost of process execution and cost of goods.

The estimation of benefits will depend on the extent of business performance improvement achievable migrating from the current state to the future state in a specific supply chain. The allocation of the benefits will depend on the relative strength of the stakeholders within the commercial model adopted for a given supply chain.

The potential costs are equally dependent on the starting point and the target end state for a specific supply chain, and the specific steps needed to migrate between the two points. (Additional checklists to support drafting the implementation plan are included in the accompanying technical report).

The nature of the cost and benefits associated with the enhancement of information exchange in an international supply chain, (e.g. benefits and costs that are difficult if not impossible to express in monetary terms), coupled with the existence of multiple stakeholders with diverse and sometimes unaligned objectives, calls for the use of a methodology that goes beyond traditional cost-benefit analysis. We would propose the use of a multi-criteria impact assessment methodology as an alternative approach. Multi-criteria impact assessment methodologies, in contrast to the traditional benefit-cost analysis, do not require the conversion of all impacts into a single measure of effectiveness, e.g. money. Thus, the benefits and costs encountered in migrating from a current to a future (target) state of information exchange can be measured in various units. Furthermore, the use of multi-criteria methods provide to the various stake-holding groups the ability to express their preference regarding the relative importance of the various impacts.

We have already highlighted the importance of addressing the behavioral antecedents in order to realize the full benefits of enhancing the processes and systems for information exchange. A detailed risk assessment and a risk management plan combined with a change management plan should be developed to augment the technical implementation plan. As part of the planning process consideration should also be given to additional actions and specific approaches that may be needed to address specific issues and risks based on the relative state of maturity for a given international supply chain e.g. pilot projects, additional training, technical infrastructure etc.

Table 7: Checklist for actions to enhance Technical Capability

Technical Capabilities	
Example scope of analysis for Technical Capabilities	<p>1. Access Technologies: PC Technology, Stable Power Supply, Internet Access, Broad Band Access</p> <p>2. Baseline Systems: Robust set of underlying applications:</p> <ul style="list-style-type: none"> • <i>Regulatory:</i> VAT Collection, Excise Collection, Customs; Border Control • <i>Operational:</i> ERP, Supply Chain Planning; Port Authority Systems; Terminal Operator; Ocean/Air/Rail Carrier; Inland Carrier; Freight Forwarder; Shipping Agent; Container Management Systems <p>3. Advanced Systems:</p> <ul style="list-style-type: none"> • (Integration Layer) Single Window; Port Community Systems; Stakeholder Portals; Applications to facilitate collaboration • Application Layer: Internet enabled operational systems (pay per use) ERP, Supply Chain Planning; Plug and play solutions <p>4. Information / Intelligence Layer: Enhance current analytics to convert data into information.</p> <ul style="list-style-type: none"> • Business processes to support integrated technology. • Enable greater collaboration across the supply chain stakeholders. <p>5. Common Standards: Coding; Product Descriptions; Form Contents; Processes; Systems Interoperability.</p>
Potential Actions to be Taken	<ul style="list-style-type: none"> ▪ Ensure availability of access technologies such as, Stable Power Supply, PC, Internet, Broad Band ▪ Ensure availability of robust baseline operational (B2B) and regulatory (G2G) and (B2G) applications. ▪ Promote the development and adoption of data standards, e.g. UN/EDIFACT. ▪ Promote the development and adoption of IT standards. ▪ Promote the use of analytics and decision making solutions aiming to improve supply chain planning and execution decisions. ▪ Promote the development of analytics for integrated cross supply chain performance measurement ▪ Encourage the development and use of integrated B2B, G2G, and B2G systems

Assign Responsibilities and Schedule the Actions (Who and When)

The final part of the planning phase is to assign responsibilities and determine the order in which specific actions can be implemented. The order of implementation will be in part driven by interdependencies between different capabilities and by availability of personnel. For example developing web enabled regulatory processes will only yield benefits if the stakeholders in the target supply chain have internet access and the relevant hardware and software infrastructure to utilize their internet access. Availability of skilled resources may also limit the pace of implementation as key skills may be needed for projects which could theoretically be completed in parallel but need to be sequenced consecutively due to scarcity of specific skills.

Proposed Further Analyses

The scope of this study was to develop a roadmap to enhance information exchange in international supply chains. As part of that research we have identified other areas that merit further research. Specifically, we suggest to further explore:

- The development of a common data model that can be used to facilitate a data pull model for information exchange. The recommendations provided in the second interim deliverable of this study constitute a good starting point for this effort.
- The development of a multi-criteria approach that will be applied to a feasibility study to assess the impact of a programme as part of the implementation plan for enhancing information exchange in an international supply chain.
- The development of a prototype for a stakeholder engagement plan that will be used by public organizations in their efforts to secure and reinforce the necessary behavioral antecedents for information exchange to underpin the implementation and operation of the target enhancements in information exchange.

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