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A Study on The Impact of Management of Cost, Service and Compliance in Cross Border Logistics and Supply Chain

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Abstract

Globalisation brings economies closer and forges more integrated destinies. Trade exchange across countries and territories is growing rapidly. Cross border logistics play a critical role in connecting international trade and become a mandatory and complex chain for every enterprise. Therefore, management of cost, service and compliance related to cross border logistics is a key factor in which importers and exporters need to enhance to gain competitive advantage. This paper presents a theoretical model for understanding the specific function and relationship of three core variables – cost, service and customs compliance management – which affect the efficiency and effectiveness of cross border logistics. Structural equation modelling using smart partial least square software is used to validate the proposed model. Based on the responses from 219 logistics professionals in various countries, the finding is that efficiency in managing the service factors is the key driver of cross border logistics performance. This is contrary to general wisdom on cost management. Customs compliance is another factor which is found to significantly impact both cost management as well as overall key performance indicators of cross border logistics. These findings suggest that companies should focus on improving those factors, reinforcing service performance and customs compliance, given their need to be treated as priorities.

1. Introduction

The global supply chain is growing rapidly. The ability to manage cross border logistics operations has become a necessity to maintain a competitive advantage in a dynamic and turbulent environment (Omar *et al.*, 2012). Companies stepping into the global market are experiencing unexpected transportation costs, higher inventory holding, longer and more unpredictable changes in cycle time, while at the same time their customers have higher expectations in term of prices, unique execution, and

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responsiveness. As a result, companies are seeking ways to make their cross border logistics procedures more flexible, reliable, and less expensive (Enslow, 2006a). The increase in complexity in today's supply chain is a factor which makes cross border traffic more focused. At the end of the eighteenth century, Adam Smith (1776), the author of the book *The Wealth of Nations*, famously noted that making a pin was divided into about 18 distinct operations across nations. Today, as Levine (2010) mentions, it requires more than 6,000,000 parts to make a Boeing 747, each part requiring many more operations (Costinot *et al.*, 2013). According to the Heaney's (2013a) benchmark report, more than 88% of companies reported that they are currently shipping goods across borders. This number will continue to increase as the global marketplace continues to expand. The management of cost, service and customs compliance related to cross border logistics becomes a key factor which importers and exporters need to enhance to win in their respective markets. The main area of logistics expertise required in cross border logistics cargo movement are mode of transportation, packaging, cargo insurance, and shipping documentation for customs clearance (Sople, 2010). Philip Kotler (2010) defined logistics as planning, implementing, and controlling the physical flows of materials and finished goods from point of origin to point of use to meet the customer's need at a profit. In the context of cross border logistics, the flow of goods is from a country of loading to a country of destination and this process involves the management of inland transportation, customs clearance and ocean transportation. Cross border logistics can be visualised through an example of plastic toys transported from China to The Netherlands as below (Overbeek *et al.*, 2012).
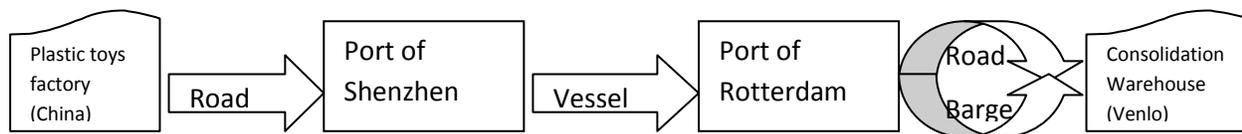
This study aims to obtain the following objectives for the concerned problems relating to cross border logistics.

(1) To provide an overview on which factors impact cost, service and compliance in cross border logistics
(2) To get a practical understanding of the relationship of cost, service and customs compliance to the performance of cross border logistics.
(3) To find out the key factors driving the efficiency in managing cross border logistics and propose solutions accordingly.

This paper is divided into seven sections following the design approach steps, summarised as follows: Section 2 discusses the related literature reviewed for the study. Section 3 outlines the research methodology. Section 4 describes the conceptual model, the experimental hypothesis and the analysis of data to validate the model. Section 5 suggests the implications for industry. Section 6 mentions limitations and scope for future research. Finally, Section 7 concludes the study's results.

2. Literature review

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Table 1 Comparison of empirical studies on the cross border logistics key performance indicators (KPI)

Literature details in chronological order	The evaluation or concerns in managing cross border logistics performance	Impact factors on cross border logistics key performance indicators	Detailed discussions on features of each factor (cost, service, compliance)	Solutions to improve the performance of cross border logistics
Logistics barriers in ASEAN. (De Souza *et al.*, 2007)	Barriers influence the free trade across Association of Southeast Asian Nations (ASEAN) countries. Total time/cost of shipping, quality/reliability of shipments are the indicators mentioned to measure logistics friendliness.	Customs procedure and inspections are the most significant barriers.	Customs procedure.	Not fully analysed.
How top companies use technology and logistics partners to improve performance (Enslow, 2006b)	How to manage cost, complexities, and uncertainties of moving goods across borders has been discussed through the best practices of eight companies.	Logistics transformation, the degree of improvement in logistics flexibility, cycle times, landed costs, the initiate beyond the logistics department, collaboration with the logistics service providers are impact factors discussed.	Cost – Focusing on cost expenses analysis.	The detailed success practices of eight companies were described.
Managing customs duties (Neville Jr., 2010)	Financial executives have little clue about the impact of customs duties on their transportation or logistics costs.	Customs duties such as exercise taxes or value added taxes are indirect tax, buried within the cost of goods sold.	Cost – Customs duties and taxes.	Product redesign to be classified as a lower duty. Utilise the duty deferral program and supply network design.
Import	Provide an	Organisational	Customs	Best practices

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operations and compliance benchmark study: the secrets of import success (Appell *et al.*, 2012)	understanding of the trends and issues impacting U.S. import operations and compliance managers.	structure, training system, operations procedures, technology and cost are the key areas which impact import operations.	compliance factors discussed in detail.	learnt from the winners are shared, such as technology leverage, organisation design, self-auditing, etc.
Aid for trade and value chain in transport and logistics (Shepherd, 2013)	A comprehensive study on cross border logistics. The logistics performance index is higher in the countries with higher incomes.	Infrastructure and red tape remain as constraints for cross border logistics. There are improvements in customs procedures, transport and logistics services providers.	Customs compliance – regulatory transparency requires extensive upgrading since the risk created by uncertain regulation is more complicated than dealing with a restrictive regulatory stance.	Not fully analysed. The solutions discussed are mainly from the government's point of view.
Supply chain visibility: A critical strategy to optimise cost and service, (Heaney, 2013b)	Longer lead time and rising supply chain management costs are the consequences of the complex global logistics network.	Operational speed and accuracy. Optimise the numbers of trading partners.	Cost and service – Lead time and cost optimisation.	Supply chain visibility - Track and Trace - Control tower
This research paper	The importance of each cross border logistics KPI is highlighted through detailed analysis.	Three core variables have strong impacts on cross border logistics identified as per research.	All features as well as the relationship between the variables have been analysed using the quantitative survey globally and structural	Future recommendations for the key factors which would help enterprises to decide which area needs to be focused on in order to improve

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			equation modelling.	cross border logistics have been discussed.

The literature review has mentioned the core variables (including both dependent and independent ones) of this research study. The dependent variable being considered is cross border logistics performance. The various independent variables have been identified as: (1) cost management including transportation cost, logistics service providers cost, insurance cost, customs related duty, and port charges; (2) the service qualities which result from customs clearance procedures, quality of customs brokers, freight forwarders, and infrastructure (i.e. airport, seaport, railway, road, technology); and (3) customs compliance via managing a harmonised system of code/classification tariffs, customs valuation, free trade agreements, licenses, permits, quotas, and certificates applications.

Table 1 shows the studies related to these variables for the past ten years and the additional contribution through this research. The table indicates that the matters relating to cost, service, and compliance have been a subject which many companies are more concerned about as international logistics become more complex and volatile. Many aspects of global logistics need to be considered and these studies focus on providing the best practices to resolve the current issues in this area.
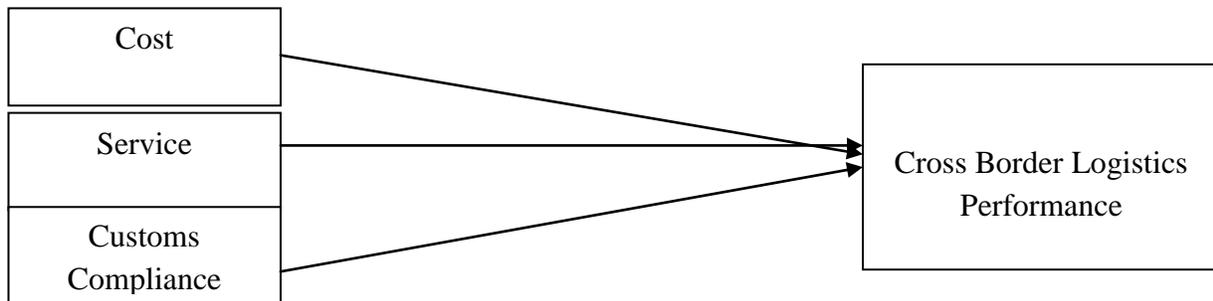

Figure 1. Research Framework

2.1 Research framework

Three core variables are developed as the result of the extensive literature review. To understand the impact of each core variable on overall cross border logistics performance and to know which one is dominant specifically, the research framework has been created to show the direct relationship of these variables. A detailed questionnaire has been sent out to logistics professionals in various countries to further quantify these relationships. 219 responses were given. Further, the study has used the Smart PLS (a structural model based tool) to examine the reliability of the data as well as to analyse the latent constructs. PLS has been selected for two main reasons. The first reason was that PLS does not impose normality requirements on the data. Secondly, it can exhibit both the measurement model and the structure model. The measurement model is a visual representation which specifies the constructs, indicator variables, and interrelationships of the model. The structure model is a set of dependent

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relationships linking the hypothesised model's constructs. The structure model determines whether relationships exist between the constructs or not.

2.2 Hypotheses development

The research framework is built up as shown in the Figure 1. The dependent variable is the cross border logistics performance. Supply chain management is about management of materials, information and cash. Logistics act as a channel of the supply chain which contributes the value of time and place utility (De Castro, 1996). Cross border logistics are a part of the supply chain and their performance management methodology will follow the same approach. However, managing international logistics is not like managing an extended domestic supply chain, as it is basically a multi-party process fraught with greater unpredictability in quality, lead time, cost, and risks (Enslow, 2006a). The relational perspective derives that performance is strongly impacted when firms have the appropriate governance structures in place (Cousins and Menguc, 2006). Nowadays, for those companies which are mostly based on products, global supply chain excellence will not be just a desirable target; it will in fact become a fundamental requirement for the business to succeed and prosper (SC Digest, 2007). Recent OECD research has found that a 10% improvement in transport and trade related infrastructure quality can increase developing agricultural exports by 30% (Shepherd, 2013). This means that transport costs have to be kept low, times have to be kept short, and uncertainty minimised. Specifically, the following areas are the key measures of cross border logistics performance.

(1) Total shipping cost: total delivered cost (the transportation cost, insurance cost, customs brokerage cost, etc.) involves the ability to analyse and predict the total supply chain cost from the source of supply to the final point of distribution. This includes the capability to combine both international and domestic logistics costs by product and delivery route. In addition, it is the ability to accurately calculate all the applicable tax, duties and other customs-related fees while factoring in any preferential trade agreements (SC Digest, 2007). Best-in-class companies are much more effective than their peers in minimising total landed costs, reducing cycle times, and minimising variability (Enslow, 2006a). Failing to understand the costs of importing goods from foreign locations can lead a company to make a decision which serves to increase costs rather than save money (Gillai and Vorburger, 2007). The ability to forecast, measure, control and minimise the total shipping cost provides an advanced competitive edge for the company versus their peers.

(2) Delivery lead time: PwC's (2013) report states that lead time is a basic, preconditional capability for companies to do business before attempting to implement the skills which separate them from the crowd, to outperform the market. It is one of the top three most important value drivers for the company. Lead time is based on the mode of transport. If the merchandise is very time sensitive, faster modes may be preferred than low-cost modes. However, with proper planning, the slower, lower cost modes can both carry much more cargo and reliably deliver just-in-time inventory needs (Corbett and Winebrake, 2008).

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(3) On time delivery: In the current global economy, competing factors have been time, cost, and reliability of delivery (Corbett and Winebrake, 2008).

(4) Loss and damage

Customers are tightening their expectations in terms of throughput time and perfect-order delivery (PwC, 2013). The downside of using multiple providers and frequent hand-offs of goods is that it can make the reported data different from the physical goods. Subsequently, shipments are at risk of loss, damage, delay or inaccuracies in documentation (Biederman, 2008). It is essential for a company to plan for contingencies which may occur. The failure to prepare a plan to mitigate losses from an interruption of the supply chain is a risk in and of itself.

(5) Regulatory compliance

Regulatory compliance measures the company's reliability in terms of fulfilling the legal obligations as well as how a company can get the savings from the special trade privileges offered by governments. According to an Aberdeen Group (2007) report, the value and importance of effective trade compliance is severely underestimated in most companies. The report also mentions that there is a huge opportunity to be taken, as many companies do not recognise potential financial improvement opportunities through trade compliance.

The following solutions are recommended for improving the performance of cross border logistics (Enslow, 2006b): (1) internet-based technology is instrumental to better performance; (2) outsourcing logistics service providers can drive leaps in performance when paired with visibility and control technology; (3) spend management in international logistics is an emerging area of focus; and (4) creating organisational buy-in is the most important factor for success. An examples is setting up an in-house trade compliance group.

A discussion of the independent variables follows:

2.2.1 Cost management

In their book, *Logistics and supply chain management*, Christopher (2012) emphasised that one of the sources of competitive advantages for an organisation is by operating at a lower cost, which subsequently generates greater profit. Cross border logistics costs are complex, with various kinds of costs since they involve many parties and can be incurred in different areas. Therefore, before a company can reduce cost, it needs insight into them. Then, companies can seek to minimise unanticipated costs such as an inability to use primary low cost transporters, miscalculated duties, customs penalties, demurrage and detention charges (Enslow, 2006a). Research conducted by Idaho National Laboratory suggested that, in order to be competitive, logistics costs should not account for more than 25% of production cost (INL, 2009).

Typically, cross border logistics costs are as follows.

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(1) Transportation costs include all direct and indirect costs related to transport, storage and handling operations (De Castro, 1996). Transportation cost management is refined by optimal use of different transport modes. Low value added goods are normally carried by sea in order to reduce transportation costs, whereas higher added values items are transported by air immediately (OECD, 2002). Effective planning, decision making and visibility in transportation and logistics help companies avoid overpaying fees, incurring damaged goods, missing delivery targets, or losing business opportunities ("Six ways to save costs", 2013).

(2) Logistics service provider costs: The growth of third party companies began back in the 1980s when businesses began to look for new ways in which they could outsource logistics functions and concentrate on their core competencies. A fourth party logistics provider, a new concept in logistics outsourcing, is an integrator to manage the resources, capabilities, and technology of its own organisation with those of complementary service providers to deliver comprehensive visibility in the supply chain (OECD, 2002). The third parties and fourth parties' roles are integrated with a company's activities and therefore become a fixed expense of the company.

(3) Insurance costs are often a deposit amount which a company can optionally choose to spend or not to mitigate the risks of goods transfer.

(4) Customs-related duty fees are buried within the cost of goods sold or a subaccount within transportation and logistics spending. This makes many companies have little or no clue about the impact of customs duties (Neville Jr., 2010). Through gaining more visibility of these costs, companies can develop a strategic plan, such as sourcing strategies and product design, to optimise them.

(5) Port charges account for a small ratio in cross border logistics spending. This kind of charge increases where the port congestion happens.

The hypothesis follows the above discussion.

Hypothesis 1 (H1): _The effectiveness of cost management including transportation costs, logistics service provider costs, insurance costs, customs duties, and port charges have a significant effect on cross border logistics performance._

2.2.2 Service management

The supporting factors for cross border movements are transportation providers (ocean, rail, and truck carriers), warehouse operators, customs officials, and third/fourth party logistics service providers (3PLs and 4PLs) which provide "one-stop" outsourced services for companies that choose not to manage logistics by themselves. In order to attain true service excellence through these outsourced parties, it is as much a journey as a goal even to the companies which have developed significant experience and capabilities with global logistics. Most companies want to achieve a full level of supply chain visibility and to have the ability to make near real-time decisions which can improve costs and service. Particularly, the efficiency of service management in cross border logistics is decided by the following factors.

(1) Customs clearance procedures refer to customs practices, documentary requirements and trade infrastructure which affect the flow of imports and exports. The key purpose is to make sure that

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goods and services crossing national borders comply with customs laws and regulations and meet technical and other quality standards (Bourdet and Persson, 2012). The complex procedures make the importers and exporters pay higher costs and encounter longer associated delays. In developing countries, the customs procedures have not caught up with the rapidly growing volume of trade in the last decade (Messerlin and Zarrouk, 2000). Customs procedures need to be improved significantly, such as streamlining procedures and introducing automation, as they impact business constraint, global value chain sourcing and investment decisions by affecting time, cost, and reliability (Shepherd, 2013). Some examples of simplified customs procedures are the national single window system, advanced automated customs processing systems, free trade agreements which can help the importer and exporter save waiting time, error costs and avoid shipments being stuck at the port (Priya and Satapathy, 2013).

(2) Quality of carriers, customs brokers, freight forwarders: Unlike in domestic logistics, it is impossible to "go it alone" in the international arena. International logistics is about managing a network of third party providers who are inland transporters, ocean carriers, customs brokers, freight forwarders, logistics service providers, and others. The way we leverage the skills (technology) of these partners as well as their quality has a significant impact on our cross border logistics performance. The quality of service providers is improving at a much faster speed than logistics operations (Shepherd, 2013).

(3) Infrastructure includes airports, seaports, roads, railways, technology, etc. The quality of the transportation system definitely effects the movement of the products across borders. While companies have to depend on the government's efforts in improving the transportation system, the company itself can find its own way to adapt with the environment. Automation and utilisation of technology is the trend which companies have started focusing on to improve their international logistics. There are technology service providers meeting this demand, such as Amber Road, E2 Open, GT Nexus, Kinaxis, One Network, Oracle, SAP, Trace Link (Gartner Research, 2013).

These hypotheses follow the above discussion.

Hypothesis 2 (H2): *Service excellence, including the good quality of carriers, service providers and infrastructure will enhance the efficiency of cross border logistics.*

Hypothesis 3 (H3): *Service excellence, including the good quality of carriers, service providers and infrastructure will help the company reduce cross border logistics costs.*

Hypothesis 4 (H4): *Service excellence including the good quality of carriers, service providers and infrastructure will enhance customs compliance reliability for the company.*

2.2.3 Customs compliance management

Importers and exporters cannot outsource responsibility for compliance with customs laws and regulations (Neville Jr., 2010). They remain ultimately responsible for the accuracy of all customs

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declarations, even when these are made by third parties on their behalf. However, there is a knowledge gap on customs compliance among small and medium enterprises (Vance, 2012). The approach of these enterprises to customs compliance is still transaction-by-transaction review. They only want to ensure the shipments are cleared from the customs gate, even though completion of customs declaration/clearance and obtaining release of the goods from customs does not necessarily mean fulfilment of customs compliance requirements. Nowadays, customs use post-importation audits as an effective tool for reinforcing compliance. The responsibility of the importer/exporter is to maintain self-compliance, which demands the vigilance to fulfil the customs requirements. Importers and exporters must keep up to date with all changes in the law and regulations and must have plans to adapt their business to a volatile trading environment. Making sure that your firm minimises the risk of monetary fines, penalties, and forfeitures arising from any kind of customs non-compliance, it is crucial to form a proactive approach (PF Collins, 2003). The common customs compliance issues companies may encounter are as follows:

(1) Product harmonised system code classification for duties and taxes: The harmonised system (HS) code classification of an imported article will decide its potential duty rate. Normally, importers want to classify their products with a tariff code which has a low duty rate. As for tariff classification, some importers will design imported goods in such a way that goods can be classified around the lines drawn by the tariff classification system (Neville Jr., 2010). The HS code classification is very complex in nature and subject to the classifier's interpretation, even though the world customs organisation provides tools and guidelines such as the general rules of interpretations and explanatory notes. Due to its complexity and importance, HS classification is one of the customs compliance areas to which both customs and importers pay much attention.

(2) Customs valuation is the value of the goods which are dutiable. Normally, the value which is assigned to the goods on the customs declaration sheet or customs entry is the invoiced price. The arm's length principle is the basis for the sellers and buyers to be independent and on equal footing. However, there are the cases where customs authorities determine customs valuation as the basis for tax payment on the imported merchandise (Abad and Van Leuven, 2009). The related party transaction is often challenged by customs because of the suspicion that all the payments made by buyer of the imported goods to the related foreign seller are not included in the customs transaction value (such as royalties, additional assists and payments, etc.). Customs valuation often incurs issues which are unfamiliar and result in unexpected additional tax costs for the tax payer.

(3) Free trade agreement (including origin management, certificates, rule of origin): One of the best ways to reduce or eliminate customs duty is by taking advantage of free trade agreements. Free trade agreements can be bilateral or regional agreements, such as the ASEAN Free Trade Agreements, the European–Korean Agreement, and the ASEAN–China agreements. A trade preference, such as the Generalised System of Preferences (GSP), or a regional program, such as the Andean Trade Preference Act or Drug Eradication Program, may also be available (Neville Jr., 2010). In order to enjoy free trade agreement benefits, the importer and exporter need to ensure that their products indeed qualify under the rule of origin and the preferential certificate of

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origin issued in the right format, otherwise it can lead to the suspension of preferential trade agreements and import/export privileges, fines, penalties and back duty payments, etc.

(4) Licenses, permits, quotas and certificates are issued by authorities to allow an activity which would otherwise be forbidden or limited. For instance, import quotas control the quantity and volume of certain merchandise which can be imported into a country (Wu, 2006). Enterprises need to understand and keep up-to-date on the conditions in the markets they operate. Failure to be compliant with the licenses, permits, and quotas causes delays in customs clearance or being banned from import or export.

Based on the above discussion, the following hypotheses are presented:

Hypothesis 5 (H5): *Customs compliance management has a positive influence on cross border logistics performance. The more compliant a company is with customs rules and regulations, the more efficient and profitable cross border logistics operate.*

Hypothesis 6 (H6): *Customs compliance management has a direct impact on the cost of cross border logistics. The more compliant a company is with customs rules and regulations, the lower the cost the company has to spend on payments such as fines and penalties.*

3. Research methodology

Based on the literature review, three core variables are selected for the study. Each core variable has from three to four factors which have an impact on the performance of each variable. The questionnaire has been developed to collect the primary data from 230 respondents.

The pilot survey was initially sent to some industry experts to get input before it was sent broadly to 2,000 professionals working in the logistics industry. The communication channels are emails, LinkedIn and through the Asia supply chain community (http://www.supplychainasia.org). The LinkedIn network was found to be an efficient and trustworthy means with a high response ratio and an assurance that the survey reached out to the right target correspondents. Overall, the response rate was 20% with 230 responses in total. After being reviewed, 219 responses were found to be valid for the analysis.

The results of the first part are summarised in Table 2. Most of the respondents are shippers or importers/exporters who are highly involved in managing cross border shipments. Most of respondents come from Asia, Australia, and New Zealand (54.3%) and large organisations with more 500 employees (52.5%). Therefore, the finding of this survey will be influenced largely by this group. The demographic result also indicates that the multi modal transport mode is the one most used for cross border shipments. Part two of the questionnaire requests that the respondents scale the importance of each key performance indicator relating to cross border logistics performance on a 5 point scale. Specifically, the respondents need to rate the importance of each factor from "Least Important" to "Most Important" in relation to its impact on cross border logistics performance. Part three of the survey is to get some practical experience from the correspondents on which methods they are using to improve cost, service and compliance in cross border logistics. There are eleven solutions or tools listed and people are asked to choose five

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options which best describe their current operational practice. The top six solutions chosen by the survey participants are supply network optimisation, just in time, outsourcing logistics service providers, track and trace systems, build in-house technology competency and centralisation management, and oversight.

Table 2 Demographic characteristics of survey participants

Number of respondents (n=219)	Number	Percentage
1. Industry		
Automotive	12	5.5%
Chemical	13	5.9%
Fashion	7	3.2%
Fast Moving Consumer Goods	20	9.1%
Government Factor	5	2.3%
Technology	27	12.3%
Petroleum	8	3.7%
Services	23	10.5%
Others (Pharmaceutical, food, etc.)	104	47.5%
2. Region in which organisation is operating		
Africa	5	2.3%
Asia, Australia, New Zealand	119	54.3%
Europe	22	10.0%
Middle East	8	3.7%
North America	59	26.9%
South/Central America	6	2.7%
3. Size of organisation		
Less than 10 employees	25	11.4%
10–49 employees	27	12.3%
50–249 employees	31	14.2%
250–500 employees	21	9.6%
More than 500 employees	115	52.5%
4. Role in cross border logistics value chain		
Shipper/Consignee	80	36.5%
Carrier	21	9.6%
Customs broker	17	7.8%
Freight forwarder	28	12.8%
Quality/Inspection agencies	9	4.1%
Customs officers	7	3.2%
Consulting firm	29	13.2%
Trade related associations	28	12.8%
5. Type of transport mode used mostly in cross border logistics		

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Air	46	21.0%
Sea	87	39.7%
Rail	1	0.5%
Road	18	8.2%
Multimodal	67	30.6%
6. Problem solving and solutions used in cross border logistics		
Supply Network Optimisation	149	14%
Track and Trace System	122	11%
Just In Time	129	12%
Outsourcing Logistics Service Provider	124	11%
Build in house Technology, Competency	110	10%
Centralisation Management/Oversight	113	10%
Five Whys Analysis	78	7%
Error Proofing (Poka Yoke)	44	4%
Value Stream Mapping	101	9%
Five S	38	4%
Associate with CBL communities and government bodies	77	7%

4. Data analysis and results

According to Bollen (1989) and Kaplan (2000), Structural Equation Models (SEM) includes several statistical methodologies used to examine a network of causal relationships, defined according to a theoretical model which links the latent complex concepts. Each concept is measured through observable indicators. Smart PLS is one of the prominent software applications for Partial Least Squares Structural Equation Modelling (PLS-SEM) (Wong, 2013). Smart PLS (Ringle *et al.*, 2005) is Java based; it is independent from the user's operating system. PLS is a component-based method for model estimation, and it is not highly demanding on sample size and residual distribution (Chin, 1998). It is well fitted for testing complex structural models as it avoids two problems: inadmissible solutions and factor indeterminacy (Fornell and Bookstein, 1982). Therefore, Smart PLS has been used to validate the measurements and to test the hypotheses.

4.1.   Data analysis

Smart PLS 2.0M3 can be downloaded from the software developer's official website at www.smartpls.de. An account registration is required prior to downloading the software. The first step is to use an iterative algorithm which separately sorts out the blocks of the measurement model to assess the quality of our measures and then, in a second step, estimates the path coefficients in the structural model to test the hypotheses (Esposito Vinzi *et al.*, 2010). There are two types of measurement scale in structural equation modelling: formative or reflective. If the indicators cause the latent variable and are not interchangeable among themselves, they are formative. If the indicators are highly correlated and interchangeable, they

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are reflective and their reliability and validity should be thoroughly examined (Haenlein & Kaplan, 2004; Hair *et al*., 2012). Smart PLS can generate T-statistics for significance testing of both the inner and outer model, using a procedure called bootstrapping.

4.1.1   Internal consistency reliability

Cronbach's alpha and composite are used to measure the internal consistency reliability of the data. Composite reliability should be 0.7 or higher. If it is exploratory research, 0.6 or higher is acceptable (Bagozzi and Yi, 1988). A commonly acceptable rule of thumb for internal consistency using Cronbatch's alpha is that a Cronbatch's alpha of 0.6 or higher is adequate (George *et al*., 2003; Kline, 2000). As shown in Table 3, the composite reliability exceeds 0.8 and Cronbach's alpha is higher than 0.7. Therefore, the data is reliable.

4.1.2   Convergent validity

Convergent validity is the extent to which indicators of a specific construct 'converge' or share a high proportion of variance in common. To check convergent validity, each latent variable's Average Variance Extracted (AVE) is evaluated. It should be 0.5 or higher (Bagozzi and Yi, 1988). Each item's loading on its underlying construct should be above 0.7 (Chin *et al*., 2003). From Table 3, it is found that all of the AVE values are greater than the acceptable threshold of 0.5. As shown in Table 4, each item's loading constructs are also above 0.7. Therefore, convergent validity has been confirmed.

4.1.3   Discriminant validity

Discriminant validity is the extent to which a construct is truly distinct from other constructs (Hulland, 1999). The correlations among all of the constructs are well below the 0.9 threshold, suggesting that the constructs are distinct from each other (Bagozzi and Yi., 1988). The correlation between any two constructs is greater than 0.7 and lower than 0.9, as shown in Table 5. Fornell and Larcker (1981) suggest that the square root of AVE in each latent variable can be used to establish discriminant validity, if this value is larger than other correlation values among the latent variables. The latent variable of cross border logistics performance's AVE is found to be 0.585 (from Table 6) hence its square root becomes 0.7649. This number is larger than the correlation values in the column of cross border logistics performance (0.5671, 0.5846 and 0.6665) and also larger than those in the row of cross border logistics performance. A similar observation is also made for the latent variables of cost, service and customs compliance. The result indicates that discriminant validity is well established.

Table 3 Reliability Validation for Latent Constructs

Overview	AVE	Composite Reliability	R Square	Cronbach's Alpha	LV Index Values
Cross border logistics performance	0.585	0.849	0.517	0.762	3.793
Cost management	0.640	0.842	0.397	0.718	3.029

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Service management	0.545	0.827	0.000	0.721	3.609
Customs compliance management	0.643	0.844	0.394	0.722	3.692

Table 4 Item loading for indicators of latent constructs

Construct	Item definition	Loadings	Ave	Composite Reliability	Cronbach's Alpha	R Square
Cross border logistics performance	6.2 On time delivery	0.8087	0.585	0.849	0.762	0.517
Cross border logistics performance	6.3 Delivery lead time	0.7972				
Cross border logistics performance	6.4 Loss and damage	0.745				
Cross border logistics performance	6.5 Regulatory compliance	0.7049				
Cost management	7.3 Insurance cost	0.7674	0.640	0.842	0.718	0.397
Cost management	7.4 Duty/Customs related fees	0.8072				
Cost management	7.5 Port charges	0.8242				
Service management	8.1 Customs clearance procedures	0.7183	0.545	0.827	0.721	0.000
Service management	8.2 Shipping carrier quality	0.7686				
Service management	8.3 Quality of customs brokers/ freight forwarders	0.7589				
Service management	8.5 Infrastructure (airport, seaport, railway, road, technology)	0.7045				
Compliance management	9.1 Harmonise system code classification	0.8071	0.643	0.844	0.722	0.394
Compliance management	9.2 Customs valuation compliance	0.8318				
Compliance management	9.3 Free trade agreement compliance	0.765				

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Table 5 Item-to-construct correlation vs correlations with other constructs

Construct	Item definition	Cross border logistics	Cost	Service	Customs compliance
Cross border logistics performance	6.2 On time delivery	**0.8087**	0.4129	0.5565	0.4448
	6.3 Delivery lead time	**0.7972**	0.4888	0.495	0.4121
	6.4 Loss and damage	**0.745**	0.4659	0.4503	0.3789
	6.5 Regulatory compliance	**0.7049**	0.4227	0.5291	0.4915
Cost management	7.3 Insurance cost	0.4895	**0.7674**	0.4321	0.3671
	7.4 Duty/Customs related fees	0.4557	**0.8072**	0.51	0.4301
	7.5 Port charges	0.4594	**0.8242**	0.488	0.4769
Service management	8.1 Customs clearance procedures	0.4526	0.4129	**0.7183**	0.4969
	8.2 Shipping carrier quality	0.4926	0.4453	**0.7686**	0.4183
	8.3 Quality of customs brokers/ freight forwarders	0.4768	0.3957	**0.7589**	0.478
	8.5 Infrastructure (airport, seaport, railway, road, technology)	0.5374	0.4986	**0.7045**	0.4571
Customs compliance	9.1 Harmonise system code classification	0.4581	0.3729	0.5395	**0.8071**
	9.2 Customs valuation compliance	0.4009	0.4201	0.5009	**0.8318**
	9.3 Free trade agreement compliance	0.4984	0.4819	0.4683	**0.765**

Table 6 Reliability and inter-construct correlations for reflective scales

LV Construct	Cross border logistics performance	Customs compliance management	Cost management	Service management
Cross border logistics performance	**0.7649**			

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Customs compliance management	0.5671	**0.8019**		
Cost management	0.5846	0.5321	**0.8000**	
Service management	0.6665	0.6277	0.5967	**0.7382**

Note: Value on the diagonal is the square root of AVE

Table 7 Summary of hypotheses tests (path coefficients and hypotheses testing)

Hypothesis No.	Hypothesis (direction)	Path coefficient	T-value	Significance (one-tailed)	Supported
H1	Cost management → Cross border logistics performance	0.2459	3.7962	p<0.01	Yes
H2	Service management → Cross border logistics performance	0.4059	7.4154	p<0.01	Yes
H3	Service management → Cost management	0.4335	6.8313	p<0.01	Yes
H4	Service management → Customs compliance	0.6277	10.9455	p<0.01	Yes
H5	Customs compliance → Cross border logistics performance	0.1814	2.713	p<0.01	Yes
H6	Customs compliance → Cost management	0.26	4.0611	p<0.01	Yes

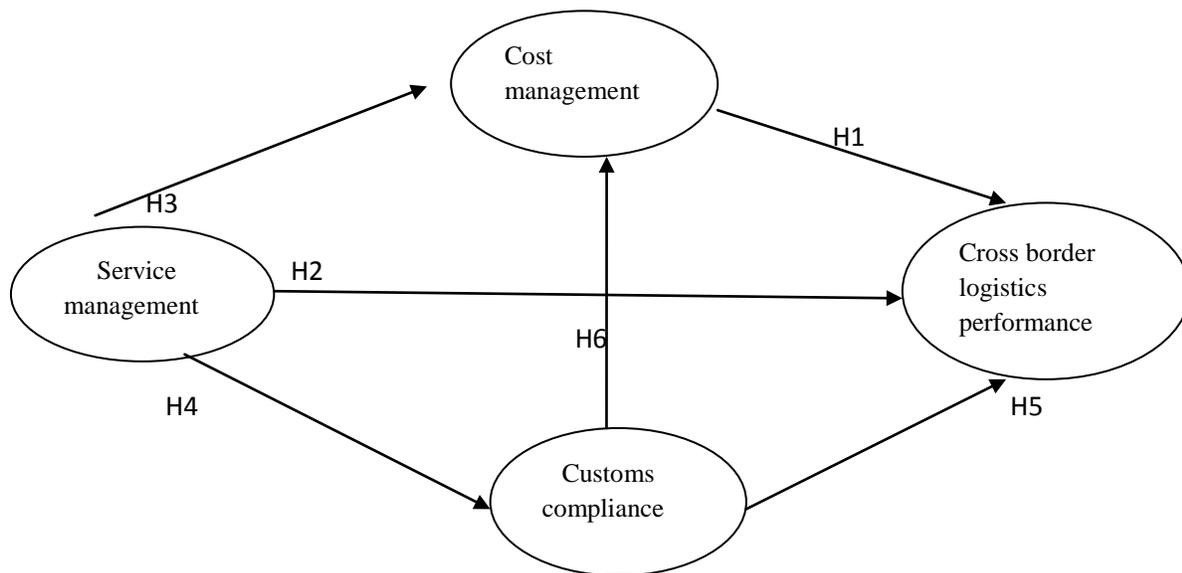| Significant values	p<0.1	1.652
	P<0.05	1.971
	P<0.01	2.499

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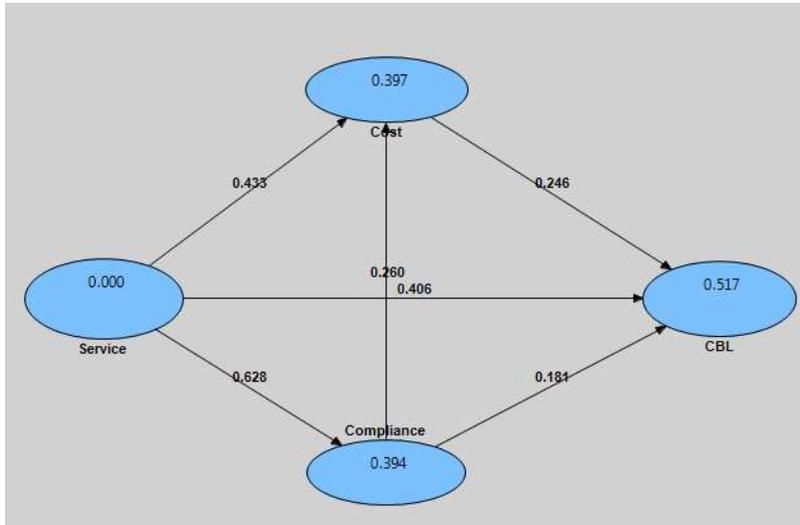Figure 2. Results of Partial Least Square structural model analysis

Figure 3. Results of PLS structural model analysis (SmartPLS snapshot)

4.2 Assessment of structural model

The proposed hypotheses were evaluated by examining the structural model. The path coefficients show how strong the relationship between the dependent variable and independent variables is. This is a test of the structural model (Chin, 1998). Bootstrapping is a major tool in the resampling technique arsenal (Wu, 1986) and is used to examine the significance of formative indicators' outer weight. 219 bootstrap samples in this research are used to determine the significance level of the paths within the structural model (Chatelin *et al.*, 2002; Chin, 1998). After running the procedures, T-tables are filled with t-values. Each t-value is in a column which is specific to a given significance level. Using a two-tailed t-test with a 5% significance level, the path coefficient is significant if the T-statistics are larger than 1.96 (Wong, 2013). The results of the structural equation model are shown in Table 7.

As summarised, all six hypotheses are supported. The variance can be explained from 39% to 52%.

Hypothesis H1 is supported because the path from cost management to cross border logistics performance is significant (b= 0.2458, p<0.01). Cross border logistics are impacted by many types of costs as mentioned in the literature review. The more efficiently cost is managed and controlled, the better cross border logistics performance is.

Hypothesis H2 is supported (b= 0.74153, p<0.01). Service management has an impact on cross border logistics performance. If the service providers deliver their work excellently, the customs procedures are smooth and other factors such as quality of carrier and infrastructure are improved, meaning overall performance of the cross border logistics will be improved significantly.

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The path coefficient from service management to cost management is also significant (b=0.4335; p<0.01). Therefore, hypothesis H3 is supported. If the logistics service providers operate excellently, the logistics costs will be reduced.

Hypothesis H4 is strongly supported (b= 0.6277; P<0.01) because service management plays an important role in enhancing the level of customs compliance of the company. If you use a good service provider or the customs clearance procedure is simple and transparent, you are more likely to comply with the customs requirements.

Hypothesis H5 is supported (b=0.1818; P<0.01), indicating that customs compliance affects the performance of cross border logistics. The better a company complies with rules and regulations, the easier they can avoid the issues of delayed shipments due to the lack of the licenses or being challenged on the HS code or import price. Therefore, it will enhance delivery performance. A company with good records is prioritised during customs clearance procedures through the green lane or express lane without physical inspection. Furthermore, the company can enjoy the duty privilege program.

Hypothesis H6 is supported (b=0.26; p<0.01) because customs compliance impacts cost management. If a company violates the customs rules and regulations, they will encounter fines, penalties, delays or product seizures. These will increase the spending and the complexity of cost management as normally the company would not anticipate these kinds of fees.

4.3 Assessment of Fit

The goodness-of-fit (GoF) of a statistical model indicates how well a specific PLS model can explain a set of observations (Henseler and Sarstedt, 2013). Several research studies such as Esposito Vinzi *et al.* (2010) and Chin (2001 have presented GoF. The empirical PLS path modelling applications conducted by Sarstedt and Ringle (2010); Duarte and Raposo (2010) have used GoF. According to Tenenhaus *et al.* (2004), the GoF index takes into consideration both the measurement and structural models' performance. Therefore, it provides a single measure for the overall performance prediction of the model. The GoF index is proposed as a global criterion to validate a PLS path model (Tenenhaus *et al.*, 2005). The formula for calculating the GoF proposed by Wetzels *et al.* (2009) is: GoF = square root of: (average AVE) x (average R-squared).

$$GOF = \sqrt{\overline{AVE} \times \overline{R^2}}$$

In this research model, the GoF value is 0.44 (geometric mean of average communality is 0.60 and average of R^2 is 0.33). This was calculated based on the guidelines of Wetzels *et al.* (2009) in order to validate the PLS model of this research. Wetzels *et al.* (2009) also suggested that the GoF value threshold for large sizes of R^2 is 0.36. The GoF value for this research is qualified since it exceeds the minimum cut-off value.

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5. Implications for industry

The research focuses on the key variables of cost, service and compliance. Contrary to general wisdom, cost management is not the top factor which impacts cross border logistics performance. A major finding of this research is that service management is the key driver affecting overall cross border logistics. Service management has a strong relationship with cost and customs compliance management. Service management as mentioned in the literature review includes the quality of carriers, customs brokers, freight forwarders, the efficiency of the customs clearance procedures and infrastructure factors. Therefore, the company should focus on the selection process for a quality logistics service provider who can help to improve their cross border logistics in general. Specifically, if the service is managed well, it will enhance the compliance of the company with rules and regulations. A service provider with strong competence and customs expertise can reduce the errors of declarations, the inaccuracy of HS code classification, and delays from a lack of the licenses. Subsequently, a good service provider can avoid the unanticipated cost of penalties and fines from customs. The service provider decides the delivery performance including delivery lead time and on time delivery. It can be financially quantified in terms of cost such as reducing on hand holding inventory cost. To improve service management in cross border logistics, companies should apply the latest technologies, such as track and trace or data exchange systems, in managing the movement of shipments, allowing them to have end-to-end product and shipment visibility and make real time interventions. Beside the effort from enterprises, the role of the customs authority is also significant in improving the customs clearance procedure and infrastructure to facilitate the movement of cross border shipments. Companies should establish a regular connection to the government by associating with cross border logistics communities and government bodies in order to get support from them.

The next finding of the research is the role of customs compliance in the process of moving shipments across the border. Customs compliance performance has a significant influence on both cross border logistics performance in general and cost management in particular. It is contrary to general wisdom that global trade is no different than domestic trade. This often leads to a waste of time, money, and opportunity (Peterson *et al.*, 2012). It is time for companies to rethink the way they view global trade management, specifically for customs compliance management, which is very complex in nature. A research reported conducted by Heaney (2010) had a similar finding and provided some suggestions to enhance the compliance in the enterprises, such as: (1) improve the trade compliance department; (2) centralise the trade compliance department across the enterprise; and (3) utilise and collaborate with trade compliance management service providers. An effective and comprehensive customs compliance procedure will result in lower costs, higher profit, increased competitive advantages and greater control.

6. Limitations and scope for further research

The research is meant to be representative of the cross border logistics globally. However, the majority of responses came from Asian countries (54.3%). This is one of the limitations of the research since cross border logistics are very much different between Asian countries where the logistics system is less advanced than North American countries (OECD, 2002). For future research, larger numbers of

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responses from different regions and territories will bring a more comprehensive picture of international logistics.

Another improvement opportunity for the research is that the respondents are mainly from the large companies with more than 500 employees (52.5%). Businesses of all sizes may face various challenges and have their own approaches when they deal with import and export shipments. For instance, small enterprises may be less focused on customs compliance compared with big companies and they will outsource the logistics related areas, while the multinational companies still have their trade compliance control and governance departments within their organisations.

The research has been focused primarily on the three core variables of cost, service and customs compliance based on the literature review. As mentioned, the area of cross border logistics is complex and broad. There are a lot of opportunities for further research in other fields such as the impact of technology, automation or free trade agreements in the management of cross border logistics.

7. Conclusions

This study has taken a detailed look at the cost, service and customs compliance of cross border logistics management. However, it is equally important to understand other factors such as human resource management or automation and technology which impact the delivery of excellent results for cross border logistics. The study has pointed out that the major driver for the excellent performance of cross border logistics is service management. Excellent logistics execution helps successful companies to transform a cost proposition into a value proposition (Christopher, 2012). Cost is not the key consideration for the shipper and consignee if they want to deliver a shipment on time without customs compliance issues. This observation is supported and built on the argument of Enslow (2007). Enterprises do not settle for the cheapest or easiest solution as they often don't fit the specific needs of the company. For many companies, compliance issues are an afterthought. Companies should not let financial models trump compliance requirements as this will add cost in the long run. Striking a balance is necessary for the long term. This would be especially critical in a global environment where risk and rewards lead to significant consequences (good or bad) and as firms take advantage of international economies of scale and scope, the impact will be in the same proportion (Roth and Morrison, 1992).

In an environment where demand is changing rapidly, industry characteristics are evolving quickly, regulation is uncertain and technology is developing, cross border logistics continue to face new challenges. Enterprises will need to keep themselves up to date and take the necessary actions to continue to get advantages from cross border logistics excellence in order to stay competitive in the market.

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Appendix

Questionnaire: Management of Cost, Service, and Compliance in Cross Border Logistics

Q1 = What is the industry of your company? *

- ○ Automotive
- ○ Chemical
- ○ Fashion
- ○ FMCG
- ○ Petroleum
- ○ Technology
- ○ Government Factor
- ○ Services
- ○ Others

Q2 = What is the sector/activity of your company in the cross border logistics value chain? *

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- ⚪ Shipper/Consignee
- ⚪ Carrier
- ⚪ Customs broker
- ⚪ Quality/Inspection Agencies
- ⚪ Customs
- ⚪ Freight Forwarder
- ⚪ Consulting firm
- ⚪ Trade related associations

    Q3 = In which region is your organisation operating? *

- ⚪ Asia & ANZ
- ⚪ Europe
- ⚪ America
- ⚪ Africa
- ⚪ Middle East

    Q4 = What is the size of your organisation? *

- ⚪ Less than 10 employees
- ⚪ 10 - 49 employees
- ⚪ 50 - 249 employees
- ⚪ 250 - 500 employees
- ⚪ More than 500 employees

    Q5 = What transport mode do you mostly use for cross border shipments? *

- ⚪ Air
- ⚪ Sea
- ⚪ Road
- ⚪ Rail
- ⚪ Multimodal

    Q6 = Please rank the KPIs of cross border logistics (CBL) from most to least important to your organisation *

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1= least important; 5 = most important

	Least Important	Slightly Important	Important	Very Important	Most Important
Total Cost of Shipping	○	○	○	○	○
On Time delivery	○	○	○	○	○
Delivery Lead time	○	○	○	○	○
Loss and Damage	○	○	○	○	○
Regulatory Compliance	○	○	○	○	○

Q7 = Please rank the following cost types, from most to least important to your organisation, in relation to their impact on cross border logistic performance *

	Least Important	Slightly Important	Important	Very Important	Most Important
Transportation Cost	○	○	○	○	○
Logistics Service Provider Cost	○	○	○	○	○
Insurance Cost	○	○	○	○	○
Customs related Fees/Duty	○	○	○	○	○
Port charges	○	○	○	○	○

Q8 = Please rank the following service factors, from most to least important to you, in relation to their impact on cross border logistics performance *

	Least Important	Slightly Important	Important	Very Important	Most Important

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	Least Important	Slightly Important	Important	Very Important	Most Important
Customs Clearance Procedures	○	○	○	○	○
Quality of Carrier	○	○	○	○	○
Quality of Customs Broker/Freight Forwarders	○	○	○	○	○
Infrastructure (airport, seaport, railway, road, technology)	○	○	○	○	○

Q9 = Please rank the customs compliance issues which your company faces, from most to least important. *

	Least Important	Slightly Important	Important	Very Important	Most Important
Harmonised System code/Customs Duty tariff	○	○	○	○	○
Customs Valuation (Pricing)	○	○	○	○	○
Free Trade Agreement	○	○	○	○	○
Licenses/ Permits/Quotas/Certificates	○	○	○	○	○

Q10 = Which problem solving tools as well as solutions do you use to improve cost, service, and compliance in cross border logistics? *

Please choose any applicable

- ☐ Five Whys Analysis
- ☐ Error Proofing (Poka Yoke)

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- ☐ Value Stream Mapping
- ☐ Five S
- ☐ Just In Time
- ☐ Outsourcing Logistics Service Provider
- ☐ Build in house Technology, Competency
- ☐ Supply Network Optimisation
- ☐ Track and Trade System
- ☐ Centralisation Management/Oversight
- ☐ Associate with CBL Communities and government bodies