GLOBAL ALLIANCE
FOR TRADE FACILITATION

METHODOLOGICAL NOTE | VERSION 1.0

Total Transport and Logistics Cost (TTLC)

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GLOBAL ALLIANCE FOR TRADE FACILITATION

The Global Alliance for Trade Facilitation is a collaboration of international organisations, governments and businesses working to help developing and least developed countries implement the World Trade Organization's Trade Facilitation Agreement. We do it by bringing together governments and businesses as equal partners to address delays and unnecessary red-tape at borders and deploy targeted reforms that deliver commercially quantifiable results.

Alliance projects help to create an environment where businesses can trade more easily, with predictable procedures, streamlined regulations and modern automation.

When cross-border trade is simple, fast and cost-effective, it can create new business opportunities, enable greater economic and social development and reduce poverty.

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FOREWORD

The Alliance was conceived as a data-driven initiative, as it aims to deliver projects that lead to quantifiable and commercially meaningful reductions in the time and cost of cross-border trade. To achieve such a goal, the Alliance utilises and collects extensive and reliable data to both inform the design of its projects and assess their impact.

The Alliance also values and leverages the expertise of its business partners. In doing so, it adopted and further developed the Total Trade and Logistics Cost (TTLC) methodology, originally developed by A.P. Møller – Mærsk A/S, to measure the direct and indirect costs of trading across borders and assess the potential returns of trade facilitation interventions.

There are numerous methodologies available for measuring the performance of supply chains, albeit with varying scopes of analysis. The TTLC differentiates itself in its ability to assess trade costs holistically by taking into consideration not only the direct costs associated with import and export processes, but also by quantifying the indirect costs induced by long lead times, delays and unpredictability in the supply chain.

The TTLC is primarily utilised by the Alliance as an impact assessment tool. However, the methodology and results can be used for numerous applications, including the diagnostic of trade barriers (which is also carried out by the Alliance as needed) and to track progress in the implementation of trade facilitation reform. Results can also be used as inputs to assist in the estimation of the impacts of trade facilitation interventions on the time and cost of trade in a given country.

The purpose of this document is to present the conceptual and methodological foundations of the TTLC and offer a transparent perspective of its opportunities and limitations. As the Alliance scales the deployment of the TTLC methodology through its projects, the lessons learned from each deployment will be actively sought to guide periodic revisions of the methodology and ensure continuous improvement.

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ABBREVIATIONS & ACRONYMS

CFS	Container freight station
CIPE	Center for International Private Enterprise
FCL	Full container load
GATF	Global Alliance for Trade Facilitation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HS	Harmonized System
ICC	International Chamber of Commerce
ICD	Inland container depot
LCL	Less than a container load
LPI	Logistics Performance Index
M&E	Monitoring and Evaluation
MNE	Multinational enterprise
OECD	Organisation for Economic Cooperation and Development
SME	Small and medium-sized enterprise
T/C-D	Time/Cost-Distance
TFA	World Trade Organization's Trade Facilitation Agreement
TRS	Time Release Study
TTLC	Total Transport and Logistics Cost
UNCTAD	United Nations Conference on Trade and Development
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
WACC	Weighted Average Cost of Capital
WEF	World Economic Forum
WTO	World Trade Organization

EXECUTIVE SUMMARY

Developing and emerging economies are often prone to long lead times,[1] delays and unpredictability in the supply chain resulting, in large part, from unreliable infrastructure and inefficient procedures. These increase trade costs that, in turn, limit the participation of their firms in regional and global value chains and hamper economic growth (WTO 2014, WTO 2015, UNCT AD 2016).

In addition to the existing direct costs, long lead times, delays and unpredictability negatively affect a country's competitiveness by generating significant indirect costs. Such indirect costs can take the form of demurrage and detention charges, higher and lengthier storage requirements, theft and spoilage, and penalties for late deliveries. They also drive up costs by forcing firms to hold additional inventory to prevent production stoppages or supply interruptions to customers. In developing countries, such safety stocks can equal up to one year of expected sales (WTO 2014).

Indirect costs may be the domain where most gains can be achieved with trade facilitation reform and policy as they—unlike direct costs—could have a multiplying effect by generating additional delays and further costs downstream in the supply chain.

Despite their negative impacts on trade, indirect costs are typically not fully accounted for in the design of trade facilitation policy, as reliable estimates are not generally available. This omission could nonetheless lead policymakers and supply chain stakeholders to misidentify the interventions that could be the most impactful and cost-effective to facilitate trade and/or to not fully appreciate the impact of specific trade facilitation reforms.

The Total Transport and Logistics Costs (TTLC) methodology aspires to fill this data gap by combining measurement of direct costs, such as transportation and customs fees, with estimates of indirect costs accruing from long lead times, delays and unpredictability to more accurately assess the total cost of transport and logistics in cross-border trade. By estimating the time and costs incurred in completing each step of the import and export supply chains, the TTLC can be used as a baseline tool to identify bottlenecks and estimate ex ante the potential returns of trade facilitation reform.

It can also be used to assess ex post the impact of specific trade facilitation interventions on the total costs of transport and logistics.

There are various methodologies aiming to measure supply chain performance. These tend to vary in scope, periodicity and granularity. However, none are designed to account for costs accrued from delays during the import or export process. This is the main contribution of the TTLC methodology in this field.

One of the key assumptions of the TTLC is that indirect costs correlate with time, whereby the longer a consignment is delayed by a given supply chain process, the higher will be the attributed indirect cost. A container idling multiple days at terminal, whether it is waiting for clearance by customs or because it is misplaced by a terminal operator, may incur additional costs in the form of demurrage, storage and losses from spoilage, for example. The TTLC approach proportionally allocates these costs along the supply chain according to the time required to complete a specific step relative to the total time to complete the import or export process, and the type of indirect costs applicable at this step. The TTLC is calculated using survey data collected through interviews with key supply chain stakeholders.

This note explains the methodology underpinning the TTLC, detailing its key components and setting it apart from other methodologies that similarly aim to measure the costs and/or time of trade. Section 1 provides an overview of existing methodologies developed to capture the time and costs associated with specific import and export processes. Section 2 explains the TTLC conceptual framework, including the operational definition of its key components. Section 3 explains the survey methodology, sampling strategy, survey instruments and potential biases and limitations. Section 4 explains the computation of results, and Section 5 details the TTLC implementation process at the country level. The Appendix lists the indicators used in the computation of the results.

1. In this methodological note, lead times include both process and transit times for goods throughout the supply chain.

1. DIRECT & INDIRECT COSTS: Definitions, importance & gaps

The TTLC measures the total cost of transport and logistics in cross-border trade, broken down into two components: direct and indirect costs. Direct costs are the costs incurred by an importer or exporter to complete an import or export process through a given point of entry or exit. These can include payments for terminal handling, trucking charges related to the movement of cargo, and administrative and transaction fees related to documentary compliance. Indirect costs are defined as costs related to time, which include the average lead time, delays and the time variance of completing an import or export process. These may include penalties for late delivery, demurrage and detention charges, additional storage and inventory costs, among others.

THE IMPORTANCE OF TIME AND SUPPLY CHAIN RELIABILITY FOR TRADE

To consider the relationship between time and indirect costs is critical to comprehensively assess the total cost of trade and capture the complexity of the supply chain. There is ample evidence suggesting that long lead times, delays and time variability are costly for firms (Hummels and Schaur 2013; Carballo et al. 2014, Volpe Martinicus 2016). Hummels and Schaur (2013) estimate that each additional day in transit is equivalent to a value-added tariff of 0.6% to 2.3%. Analysing a sample of 16 Latin American countries, Wilmsmeier et al. (2006) find that longer customs procedures at seaports are associated with higher shipping costs. With regards to time variability, Frankel (1999) estimates that a standard deviation of 20% of transport time can lead to a 45% increase in transport costs for maritime freight.

In most countries, the costs caused by import delays exceed those from tariffs, while costs due to export delays exceed those of tariffs faced by exporters in all country groupings except for OECD and East Asia and Pacific countries (Hummels 2017). Arvis et al. (2007) suggest that the overall reliability of the supply chain and hedging against uncertainty of delivery time make up a significant part of logistics costs in developing countries.

When delivery schedules are unpredictable, importers need to keep higher inventory to prevent interruptions in production and/or in the supply to the customers (Alessandria et al. 2010; Guasch and Kogan 2003). In developing countries, such stock buffers can correspond to one year of expected sales, adding significantly to production costs and impairing competitiveness (WTO 2014). The financial cost of inventory can be especially high for importers in developing countries given the higher cost of capital (Guasch and Kogan 2003).

To the extent delays can be anticipated, exporters can either arrange for goods to be shipped in advance or pay a premium for faster delivery solutions (Hummels and Schaur 2013). Alternatively, they may incur penalties for late arrival or risk damaging their relationship with customers. Both options significantly increase operational costs and/or impair competitiveness.

Costs induced by time have additional implications for international trade. Various studies have demonstrated that higher logistical costs and longer transport times have negative effects on trade volumes and on firms' ability to export (Hummels and Schaur 2013; Djankov et al. 2010; Portugal and Wilson 2009). As expected, these effects are higher for firms operating in time-sensitive sectors such as electronics, fashion and food, where short and predictable turnaround times and low costs constitute a key source of comparative advantage (Harrigan and Venables 2004, Djankov et al. 2010; Freund and Rocha 2010). With an increasing range of goods becoming time-sensitive, countries will need to shorten lead times and increase predictability to become or remain competitive. Understanding where such bottlenecks are located is key in designing efficient and cost-effective policies to address them.

A REVIEW OF EXISTING METHODOLOGIES

A few methodologies and tools are available to estimate costs and/or assess the performance of supply chain logistics. The most commonly referred methodologies are briefly explained below, and subsequently compared to the TTLC to highlight the gap it attempts to fill within this field.

In general, while the methodologies reviewed below capture the time and direct cost necessary to complete documentation and border clearance procedures, none considers the additional costs associated with delays/supply chain reliability. By including a measure of indirect costs, the TTLC provides a more holistic measure of the cost of trade borne by firms and the potential gains from trade facilitation interventions.

The **Trading across Borders** indicators from the **Doing Business** survey published by the World Bank are probably the most well-known sources of data on trade time and cost. This methodology captures the average time and cost (excluding tariffs) of three procedures: documentary compliance, border clearance and domestic transport. Data are collected via surveys administered to 1,616 respondents in 190 economies (for the 2019 report). To ensure cross-country comparability, which is necessary as countries are ultimately ranked according to the estimated ease of doing business, the methodology makes a set of assumptions about the traded goods, the port of entry and exit, the destination of the shipment, and the value and unit of the shipment, among others. For example, it assumes that each economy imports a standardised shipment of 15 metric tons of containerised auto parts, though export shipments do not necessarily need to be containerised.[2] The Trading across Borders indicators are displayed as a single average value per procedure per country, however they do not capture intra-country variance in time and cost.

The World Bank's **Logistic Performance Index (LPI)** offers two perspectives on supply chain performance: international and domestic. The international LPI provides a qualitative assessment of the performance of a country's supply chain by its trading partners on six core components: the efficiency of customs and border clearance, the quality of trade and transport infrastructure, the ease of arranging competitively priced shipments, the competence and quality of logistics services, the ability to track and trace consignments, and the frequency with which shipments reach consignees within scheduled or expected delivery times. The domestic LPI provides a more detailed country-level assessment from the perspective of domestic logistics professionals. Specifically, it captures qualitative and quantitative information on infrastructure, services, border procedures and time, and supply chain reliability. Though the domestic LPI collects data on the time required to complete border clearance procedures and to transport goods inland, it does not collect data on the cost for these processes. In the latest edition of the LPI, the survey was administered to 869 logistics professionals in 108 countries.[3]

The World Bank's **Enterprise Survey** collects data exclusively on border clearance procedures. Specifically, it asks respondents the average number of days it takes to clear imports and exports through customs at any point of entry (e.g. port, airport, etc.). Only manufacturing firms are administered the question on customs clearance times for imports. An interesting feature of this survey is that it provides firm-level data, which allows for the analysis of the variance of customs clearance times across firms. Data on the costs of importing and exporting are not collected. While the Enterprise Survey covers 139 countries, data are not collected annually in each country.[4]

The World Customs Organization's **Time Release Study (TRS)** measures the total time cumulated between the arrival of goods at a port/airport/land border and their physical release. Under the general guidance of the WCO, it is being increasingly conducted by customs administrations. It disaggregates border procedures into processes such as preparation of documents and completion of formalities, and movement of cargo between countries. In turn, each process can be further divided into shorter segments. For example, the average time to complete customs procedures can be divided into average time for documentary control and for physical examination of goods. The data used to compute these indicators can come from primary or secondary sources. For instance, the average physical release times may be collected through a survey or retrieved from information systems. The TRS focuses only on measuring time and does not estimate the direct and indirect costs of importing and exporting.[5] The results are usually not publicly disclosed unless it is shared by the proprietor of the study.

Of the measures reviewed in this section, the **Time/Cost-Distance (T/C-D)** methodology developed by UNESCAP is potentially the closest methodologically to the TTLC. The T/C-D collects cost and time data associated with transport processes through structured interviews with freight forwarders and transport operators. The T/C-D's purpose is to identify bottlenecks along a particular transport corridor by looking at the cost and time at every milestone along that transport corridor. Each milestone is agreed upon at the onset of the T/C-D to define the scope of the assessment. Unlike the TTLC, however, the scope of the T/D-C is limited to processes related to the physical movement of cargo and does not cover the time and cost required to complete import or export documentation procedures by firms.

The methodologies highlighted in this section vary in scope, periodicity and granularity. To the extent that comparisons are meaningful, the data collected through these sources may be used to complement or triangulate those collected through the TTLC.

2. For a full description of the methodology, refer to http://www.doingbusiness.org/en/methodology/trading-across-borders.
3. For a full description of the methodology, refer to https://lpi.worldbank.org/about.
4. For a full description of the methodology, refer to https://www.enterprisesurveys.org/methodology.
5. For a full description of the methodology, refer to http://www.wcoomd.org/en/topics/facilitation/instrument-and-tools/tools/time-release-study.aspx.

TABLE 1: COMPARISON OF METHODOLOGIES AND TOOLS TO ESTIMATE TRADE TIME AND COST

METHODOLOGY	DIRECT COSTS	TRANSIT TIME	INDIRECT COSTS	DATA DISTRIBUTION**	AGGREGATION LEVEL	DATA TYPE	SUPPLY CHAIN SCOPE
Doing Business: Trading across Borders	Yes	Yes	No	No	National	Survey	Documentation, border clearance, inland transit
Logistics Performance Index (LPI)	No	Yes	No	No	National	Survey	Documentation, border clearance, inland transit
Enterprise Surveys	No	Yes	No	Yes	Firm	Survey	Border clearance
Time Release Study	No	Yes	No	No	National	Mixed*	Variable
Time/Cost-Distance	Yes	Yes	No	No	Firm	Survey	Border clearance, inland transit
TTLC	Yes	Yes	Yes	Yes	Firm	Mixed*	Documentation, border clearance, inland transit

* Combination of survey and secondary data

**. Data allow a distributional analysis of time and costs across firms for a given process

PROPOSING A NEW APPROACH

Despite the evidence showing that delays and time variability in the supply chain can lead to significant indirect costs for firms, the methodologies reviewed in the previous section are not designed to capture these measures. As a result, they are unable to quantify the burden imposed by indirect costs and, consequently, fully estimate the total transport and logistics costs of trade.

Another feature not provided by these methodologies is the ability to assess cost and time variability across firms and over time. In most cases, data are collected as single-value averages of a supply chain process. Though the firm-level data of the Enterprise Survey provide a distributional perspective on average clearance times across firms through sample variation, they do not capture lead time fluctuations stemming from failures in the supply chain.

The main contribution of the TTLC methodology is precisely to fill these gaps by quantifying time variability and indirect costs. At the same time, the TTLC provides a step-by-step analysis of the full supply chain in terms of cost and time that, taken together, provide a comprehensive and novel approach to measuring transport and logistical performance. It should also be noted that it is not the primary intent of the TTLC to arrive at a ranking of country performance, as it is geared towards assessing the country's own evolution in reducing transport and logistic costs.

2. TTLC FRAMEWORK

ANALYTICAL FRAMEWORK

The TTLC captures both the **direct and indirect costs** of importing and exporting freight.[6] The operational definitions used in the TTLC are as follows:

Direct costs are defined as the costs incurred by an importer or exporter to complete an import or export process through a given point of entry or exit.[7] Direct costs include expenses associated with documentation compliance, trucking and terminal handling fees and other charges required to clear goods, excluding import or export duties and tariffs. As opposed to indirect costs, directs costs are time-invariant (i.e. they are not affected by transit time and/or delays).

Indirect costs are defined as costs related to time, which include long lead times, delays and time variability. These include idle trucking costs, penalties for late deliveries, demurrage and detention charges, extra storage and inventory costs, and lost orders. The inclusion of indirect costs in the analysis is a unique and central component of the TTLC methodology.

Lead time is defined as the time between the initiation and completion of a supply chain process. It includes both the **transit and waiting time** of cargo during a given process. **Delays** are the extra time, in addition to regular lead times, required to complete a process. Delays are by nature unpredictable and can be the result of poor planning, system inefficiencies, traffic congestion or other external factors. **Time variability** relates to the frequency and magnitude of delays susceptible of shaping the behaviour or supply chain stakeholders. Chronic delays may lead importers to stock on extra inventory to prevent production stoppages and shortages or to expedite cargo well in advance to ensure it is delivered on time.

Direct costs, time and time variability are observed for the entire scope of the import or export supply chain. **Indirect costs** are estimated as a function of time and its variability; they are allocated across the supply chain according to the number of hours required to complete each process and weighted by the total number of hours required to complete all the processes relevant to the concerned indirect. For example, during the import process, demurrage fees can be charged only from the time spent between the moment a container has been discharged from the vessel to the moment the consignee has picked up the container at the port. Demurrage costs would therefore be allocated according to the hours to complete the border clearance, dwell time, and truck turnaround process, weighted by the total number of hours required to complete these three processes. This can be represented by the following equation:

$$X_{ij} = C_j \left(\frac{T_i}{\sum_{i=1}^{n} T_i} \right)$$

Where X_{ij} is the value of indirect cost j allocated to supply chain process i, C_j is the value of indirect cost j, T_i is the time required to complete supply chain process i. A linear relationship between indirect costs and time is assumed, meaning that the longer a process takes, the amount of indirect costs allocated to this process will be proportionately higher.

Figures 1 and 2 provide a diagrammatic overview of the TTLC framework for imports and exports, respectively. The figures display the processes analysed in the supply chain and the milestones delimiting each process. Each process can be further disaggregated into steps that can vary across countries. Figures 1 and 2 also map how the time required to complete each process contributes to specific categories of indirect costs.

The scope of the import supply chain spans from the start of the preparation of the import documentation to the return of the empty container to an inland depot, cf. Figure 1.

The scope of the export supply chain begins with the preparation of the export documentation and ends when the container has been loaded onto the vessel, cf. Figure 2.

The TTLC breaks down the scope of the import and export supply chains into discrete processes, defined by a set of activities occurring between fixed milestones and described in further detail in the following section. While the TTLC methodology is tailored to the specific logistics setup and practices of the country to which it is applied,[8] the processes included are consistent, allowing for cross-country comparability for a given process[9] and sector.

6. The TTLC was originally developed to measure the cost of moving containerised freight by sea, which is the process described in this methodological note. However, the methodology can be extended and modified to measure the total cost of transporting cargo by air and land freight. In such cases, the scope and concepts would need to be customised to properly reflect the processes, milestones and indirect costs associated with each transport mode. The survey instrument would also need to be adapted to the customised conceptual framework.
7. Point of entry/exit is defined as the gateway point of importation/exportation of goods into/out of the domestic market.
8. Example: At the port of Nhava Sheva (India), export containers are registered by customs at a parking plaza located outside the port premises. In this port-specific case, an additional set of questions were added to the survey to gather data on the time required to complete the container registration at the parking plaza, the relative frequency of physical inspections at registration, the time required for the container to reach the physical inspection site, the time required to complete the physical inspection of the container, and the time required to reach the port from the inspection site.
9. Except for inland transportation

FIGURE 1: SCOPE OF THE IMPORT SUPPLY CHAIN

FIGURE 2: SCOPE OF THE EXPORT SUPPLY CHAIN

Note: Indirect costs are accounted under each process denoted by a marker.

OPERATIONALISATION OF THE FRAMEWORK

Measurement of direct costs and time

1. The documentation process includes the time and fees incurred in obtaining, preparing, submitting and processing all paper and/or electronic documents required for the clearance of traded cargo at the country of origin for exports and the destination country for imports.

The required documents are usually those detailing the ownership and description of the cargo (e.g. cargo declaration, bill of lading, packaging lists, waybills, etc.), compliance with export/import requirements (e.g. permits, licenses, certificates, etc.) and other accompanying documents (e.g. commercial invoices, customs declaration, etc.).[10] The degree of harmonisation and digitisation of documentary requirements has a significant impact on the speed at which documents are exchanged and processed.

2. The ship inward process refers to the period between the arrival of the container-bearing vessel at the port breakwater and the completion of berthing. The time taken to complete this process mainly depends on vessel turnaround times at the port, which in turn are determined by the productivity level of container terminals. Other factors such as the availability of pilots, weather conditions and seasonal or weekly variations in vessel traffic may also influence time. Though turnaround times at the port negatively correlate with port efficiency, longer times do not necessarily mean that the port is less efficient. For instance, ship owners may choose to keep their ships longer in a port to purchase goods or services (UNCTAD 2019).

3. The discharge/loading process refers to the loading and unloading of the container from the vessel once shipping documentation is cleared and berthing is completed. The time taken to load and unload cargo is mainly determined by the size of the ship and the capacity and productivity of the container terminal, including the number of cranes available and the speed and efficiency at which they move.

4. The border clearance process refers to the cost and time to complete all procedures necessary to comply with a country's customs regulations and meet the requirements of the relevant public agencies for cargo to enter/exit the market. The border clearance process may include additional activities such as physical inspections and scanning. For both import and export processes, containers arriving at the border can be relegated to different processing channels by authorities, for instance, they may be exempt or selected for scanning or physical inspection. If selected for inspection, they may remain at the terminal or sent to a container freight station (CFS) or inland container depot (ICD).[11] If there are no customs agents onsite, agents typically need to travel to these sites to control the cargo, which can lengthen the time taken to complete the process and, consequently, increase costs.

Physical inspections may require a customs agent to open the container and inspect its content, either by taking a sample of the goods or partially stripping the container. The larger the share of the containers stripped, the longer the inspection process. Inspections may also include scanning; provided that the port has scanners on premise, the length of scanning procedures depends on the number of operational scanners available.

The efficiency and practices of inspection processes are additional contributing factors for delays. Higher inspection rates necessarily increase the average time required to clear cargo at the border. If cargo is selected for inspection, the number of agencies requiring inspection can also lengthen the process if it is performed in an uncoordinated manner, as the number of visits from different agents, which can arrive at various times or days, will be higher.

5. The truck turnaround process[12] for imports comprises the truck entering the port terminal (including queuing at the gate), picking up the cargo and exiting the facility through the gate into the domestic market. For exports, it begins when the truck carrying the cargo starts queuing at the gate to enter the port and ends when the container has been delivered at the terminal and the truck has exited the port.

The time spent by trucks entering, circulating and exiting the port can be influenced by both port performance, the size of the port and external factors (e.g. the time of day and number of vessel arrivals). Trucks that arrive at the port to retrieve an import container can also bear export cargo to be loaded onto a vessel at the same port, in which case the truck will take additional time to deliver the export cargo before picking up the import cargo.[13]

6. The inland transport process for imports starts when the container gates-out from the terminal and until is delivered to the stripping site. If the stripping site is a CFS/ICD, the process includes the time the container needs to wait to gate-in and circulate within the premises.

For exports, the process begins when the container is sealed and ends when it arrives at the border or customs-controlled area. This excludes the time waiting to be processed by customs, included in the border clearance process.

The travel time and costs for this process depend on the inland transport routes defined in the design of the TTLC, which, in turn, depend on the economic sectors of interest. Time and costs will then be a function of the travel distance, level of traffic congestion, type of cargo, infrastructure quality, weather patterns, and number and efficiency of checkpoints and weighbridges.

10. Import licenses and other documents with longer process duration are typically excluded from the analysis, unless directly affected by the analysed intervention and purposefully included in the process. At the design phase of the TTLC study, a list of documents required to import/export for the studied country is compiled to provide a point of reference for the respondents.
11. CFSs and ICDs are customs-controlled areas which are outside the port premise.
12. The turnaround process could be applicable to modes of inland transportation other than truck, e.g. train, barge, etc. This would need to be considered at the design phase of the TTLC to allow for the tailoring of the survey instrument.
13. By not accounting for land transport combining both the delivery and the reception of containers for a single trip, the framework potentially underestimates the efficiency gains from this procedure.

7. The stripping container process[14] corresponds to the unloading of a stuffed container. The process begins when the container arrives at the stripping site and ends when the container is fully stripped. The time taken to strip a container depends on the type, size and quantity of consignments. It also depends on the number of parcels in the shipment and workers assigned, or whether specialised machinery is required to carry out this task.

The stripping site can be at the premises of the importer (factory or distribution centre) or a CFS/ICD, which usually have the facilities and equipment to carry out this process. Import cargo can also be deconsolidated at a CFS/ICD to optimise the redistribution of the consignments. Depending on the travel time between the destination of the cargo and the port and opportunities for delivering the empty container at an inland depot, the importer can choose to strip the container at the terminal or at a CFS/ICD located close to the port to reduce costs.

8. The process of returning an empty container[15] corresponds to the transportation of the empty container from the stripping location to the empty container depot, beginning when the container is fully stripped and ending when the empty container is delivered to the shipping line depot.

The time recorded for this process depends on the travel distance between the stripping site and the container depot. Delays can occur depending on the level of road congestion, the quality of road infrastructure and weather conditions.

9. The stuffing container process[16] is the loading of the empty container at the stuffing site and begins when the empty container arrives at the stuffing site or warehouse docking station and is ready to be loaded and ends when it is fully stuffed.

The time taken to stuff a container depends on the type (fragile/non-fragile), size and quantity of consignments. It also depends on the number of workers assigned to stuff the container and whether the process is automated.

Similar to stripping, the stuffing site can be at the premises of the exporter or at a CFS/ICD. If a CFS/ICD is used, it is usually because the shipment is less than a container load (LCL) and the cargo needs to be consolidated.

10. The empty container retrieving process[17] refers to retrieving and transporting of the container from the empty container depot to the stuffing site. The process begins when the truck takes off to the container depot and ends when the empty container is delivered to the stuffing site.

Delays can occur during this process if empty containers are unavailable at the container depot, in which case truck drivers may need to wait at the depot for the empty container to arrive. The time recorded for this process also depends on the travel distance between the truck's point of departure, the container depot and the stuffing site. This process can also take longer depending on traffic congestion, the quality of road infrastructure and weather conditions.

Estimation of indirect costs

11. Demurrage costs are the compensation importers pay to the shipping lines when their containers are held inside the terminal, port or depot beyond the agreed amount of non-chargeable time. Since demurrage fees are a competitive factor, they vary greatly between shipping lines, not because shipping lines' daily rates differ significantly, but because important clients are often able to negotiate longer free time.

Exporters can also incur demurrage costs if a container misses its scheduled vessel and is rolled to a new vessel. Demurrage charges would apply after the agreed amount of non-chargeable time has expired until the container has been loaded on board the next vessel. In the case of bulk cargo, demurrage fees are incurred when the cargo fails to be loaded and discharged beyond the pre- agreed time.

Demurrage charges depend on the type of container (e.g. dry or refrigerated), and the number of days it is in custody beyond the agreed free time. Unsurprisingly, the costs of holding a dry container are lower, because both the number of free days allowed for dry containers is higher and charges are considerably lower.

Demurrage costs are estimated from a triangulation of sources. First, the reported likelihood that importers and freight forwarders will incur demurrage costs on their shipment, the average number of demurrage days charged, and the daily demurrage fee at the corresponding price level. Second, if available, data from shipping lines on their annual demurrage charges and income. Third, the reported average delays, variation in delays and the number of free/chargeable days published by the shipping lines.

12. Detention costs are the compensation paid to the shipping lines when a container is held outside the terminal, port or depot beyond the agreed amount of non-chargeable time. Exporters can also incur detention costs if an empty container has been picked up for stuffing, and the stuffed container is returned to the port or terminal after the agreed amount of non-chargeable time.

Similar to demurrage, detention fees can vary according to the negotiation capacity of clients. In cases where respondents report detention costs separately from demurrage, the methodology to estimate demurrage costs is also applied to detention costs.

13. Storage costs are those incurred from storing containers at the port, ICD, CFS or bonded warehouses. Storage charges depend of the type of container stored (dry or refrigerated) and the number of days a container is in storage after the agreed non-chargeable time.

Importers can store cargo at CFS/ICD facilities if there is insufficient storage capacity in their premises or import duties are not paid. Exporters may need to use storage services if they miss the shipping cut-off and the scheduled vessel, for example due to unreliability of carrier services or blank sailings.

14. Concerns import process only
15. Concerns import process only
16. Concerns export process only
17. Concerns export process only

Storage costs are estimated from a triangulation of sources. First, the reported likelihood that containers will incur storage costs, the average number of storage days charged, and the daily storage fee at the corresponding price level. Second, if available, data from terminals on their annual income from storage and average number of storage days per container. Third, the reported time used for customs clearance and dwell time in the port, terminal or CFS and the number of free/chargeable days published by the terminals/ports.

14. Inventory costs are increased when supply chain reliability is low, as importers need to keep higher inventory to prevent interruptions in production and/or in the supply to customers. Some respondents report this cost directly, while others say it exists but are unable or unwilling to quantify it. Firms that do not keep inventory can incur costs that materialise in other forms such as interrupted production, delays in the delivery of goods and lost orders.

Information on inventory costs is obtained from two sources. First, companies' self-assessments of the extra inventory they need to prevent shortages; typically, only large companies can provide such information. Second, for those not able or willing to self-assess, costs are estimated based on the reported time of importing a container and several other data and assumptions. As transit time delays in previous studies have been documented to approximately follow a log-normal distribution, this distribution is used to assess the number of extra inventory days.[18] Using the Weighted Average Costs of Capital (WACC) and the reported value per container, it is possible to estimate the monetary cost of the extra inventory days companies hold to prevent out of stock. The cost is assessed based on the average and standard deviation values of their transit time, an assumption of log-normal distributed delays.

15. Penalties for late delivery are the costs incurred, usually by suppliers, for delivering a shipment late. Penalties for late delivery can materialise due to violation of contractual terms, or as lost income due to the container missing a deadline and the content being rejected by the buyer (e.g. perishables being rejected if the number of shelf-life days is exceeded).

These penalties are estimated using the reported amount spent on penalties for late delivery to customers in the past year and the reported share of this amount that can be directly attributed to containers being delivered late.

16. Lost orders costs are defined as the value of lost orders from customers that can be directly attributed to delays and long lead times. They are incurred when delays and unpredictability in the supply chain negatively affect a company's capacity to retain customers. These costs are estimated using the reported value of orders lost in the past year and the reported share of this value directly resulting from containers being delivered late.

17. Lost production costs can be incurred when manufacturers experience production stoppages due to delays. These costs are estimated using the reported value of sales lost due to production cuts in the past year and the reported share of production stoppages or cuts resulting from containers being delivered late.

18. Damage and spoilage costs correspond to losses from cargo damage and/or spoilage resulting from handling, above-average transit times and below-average transport conditions. For example, damage can occur from rough handling of the cargo and poor road conditions during transit. Spoilage typically pertains to perishable goods, such as food or agricultural produce, which are disproportionately affected by delays.

High inspection rates are also likely to increase these costs since they can involve multiple operations which increase the risk of rough handling and delays. During this procedure, a container may need to be moved from the stack to the customs inspection area, after which the cargo may need to be manually moved in and out of the container. In addition, physical inspections can also increase the transit time of the cargo, increasing the likelihood of spoilage.

These losses are estimated using the reported average frequency of damage or spoilage, the average share of cargo lost per container and the average value of the cargo.

19. Theft of cargo costs are the losses of cargo resulting from crime and theft. Theft of cargo can be problematic along transport corridors or areas vulnerable to hijacking. Long storage times in logistics facilities can also increase the likelihood of cargo being stolen through break-ins.

Losses from theft are estimated by using the reported average frequency of theft, the average share of cargo lost per container and the average value of the cargo.

20. Idle trucking costs are the extra costs resulting from trucks waiting at border posts, check points, weighbridges, container depots, rest periods, road congestion and other bottlenecks. These costs exclude truck detention charges and are derived from the average amount of time a truck spends waiting at main stopping points identified in the TTLC survey, and the standard trucking charges.

21. Shut-out charges are incurred when an export container is not loaded on its intended scheduled vessel. A container could miss its vessel if, for example, it is rejected by the carrier because of weight issues. These costs are estimated using the reported average frequency of shut-out charges due to delays cumulated during the export process, and the amount of the charges per container.

22. The cost of wasted work hours incurred is the additional labour cost that can be directly tied to inefficient or redundant procedures. These costs can be differentiated between the public and private sectors. For example, the additional cost of an employee dedicated to correcting the documentation. These additional costs are derived from targeted questions from the TTLC survey.

18. Log-normal distribution is found in Arvis et al. (2007).

3. TTLC SURVEY METHODOLOGY

Data collection through in-country surveys is a key process in the deployment of the TTLC. While data on direct costs are often publicly available, information on the length of and variation in lead times, which is necessary to estimate indirect costs, is not.

As track-and-trace technology becomes accessible and widely utilised, it should be possible to obtain real-time data on the location of containerised freight and more accurately assess transit times throughout the supply chain. At the current stage of technology deployment, however, surveys remain an essential tool to collect this kind of data.

This section highlights the key features of the TTLC survey methodology, including sample selection and size and survey administration, and addresses some of the survey's potential limitations.

SAMPLE SELECTION

In its most comprehensive form, the TTLC survey selects respondents according to the following criteria:

1. Trade flow[19]
2. Sector
3. International transport mode[20]
4. Shipment size[21]
5. Firm type[22]
6. Importer/exporter type (if firm type is importer or exporter)[23]
7. Firm size[24]
8. Port
9. Container terminal
10. Destination
11. Inland transport mode[25]

For each criterion, the number of attributes is restricted according to the desired scope of the study. Respondents are selected according to whether they fulfil at least one of the attributes for each criterion within the defined scope.

The sample selection process depends on the type of TTLC implemented. The TTLC can be used either as a diagnostic tool (i.e. to identify trade bottlenecks and barriers) or as an impact assessment tool (i.e. to quantify the impact of specific trade facilitation projects).

If the TTLC is used as a diagnostic tool, the sample frame is primarily determined by the sectoral makeup of the economy. Once the relevant trade flows (1) and sectors (2) are identified, an assessment of the container throughput by port and terminal and the location of production and consumption determine the international transport modes (2), ports (8), container terminals (9), final destinations (10) and inland transport modes (11) to be covered.

However, when the TTLC is used as an impact assessment tool, it is tailored to the design of the intervention, i.e. target sectors and associated ports (8), terminals (9), destinations (10) and inland transport modes (11) will be those potentially affected by the project whose impact is to be assessed.

To cover the full scope of the supply chains, as defined in Section 2, the TTLC survey is administered to importers, exporters, clearing and forwarding agents, trucking companies, shipping lines and terminal operators.

Multinational, large and small companies each face particular challenges in the supply chain due to differences in access to information, technology and skills and bargaining power, among others. This is particularly true of importers, exporters and freight forwarders. To capture these disparities, at least one-third of importing/exporting companies included in the sample are large, one-third are small and medium, and the remaining one-third is determined by the structure of the economy in line with the share of GDP by company size.[26]

The ports/trade corridor(s) considered in the TTLC will depend on the scope established in the design phase. When multiple ports or routes are covered, aggregated results will be calculated following the method highlighted in Section 4.

19. Import, export
20. Sea, air, land. In the context of the Alliance, the TTLC has been more frequently used for maritime freight.
21. Full container load (FCL), less than a container load (LCL), bulk, etc.
22. Importer, exporter, clearing and forwarding agent, terminal operator, shipping line, trucking company
23. Re-seller of final goods on domestic market, importer of production inputs, re-exporter of imported goods or exporter of final goods or inputs to production
24. Small and medium enterprise (SME), large company, multinational enterprise (MNE)
25. Road, rail, water. In the context of the Alliance, the TTLC has been typically applied to road transport.
26. This is generally the case if the TTLC is deployed as a diagnostic tool. In the case of impact assessment targeted at a particular sector, the share of companies of different sizes may be different, as the selection of respondents will be primarily dependent on the profile of companies that constitute the analysed sector.

Finally, the TTLC can be tailored to accommodate landlocked countries. When goods are transported over land, landlocked countries need to rely on transport and logistics infrastructure in neighbouring countries. In such cases, the scope of the supply chain can be extended to include the time and direct costs incurred in the country through which the cargo transits. The indirect costs associated with the additional processes occurring in the transit country would be estimated as a function of the time necessary to enter and exit said country.

Naturally, the wider the coverage of the TTLC – e.g. the number of ports, terminals and sectors – the larger will be the required sample to obtain robust results.

SURVEY ADMINISTRATION

Once the sample frame has been established, respondents are identified and selected non-randomly through the network of the Alliance[27] and its business partners. For importing or exporting firms, the interviews are targeted at logistics managers with the best knowledge of logistical operations to ensure that a maximum of modules is covered with the most accurate time and cost estimates.[28]

SAMPLE SIZE

For most, if not all TTLC deployments, a common challenge would be to determine the true size of the studied population; the reason being that this information is typically not known or collected. In the usual case where the size of the population is unknown or infinite, the minimum sample size n_o can be estimated using the following equation (Cochrane, 1963):

$$n_o = \frac{Z^2 pq}{e^2}$$

Where e is the desired margin of error, Z is the critical value for a given confidence level, p is the proportion of attributes in the population[29], and q is ($1-p$). When the population is restricted to a smaller size, the minimum sample size can be adjusted using the equation below:

$$n = \frac{n_o}{1 + \frac{(n_o - 1)}{N}}$$

Although the sampling criteria in the TTLC would naturally restrict the size of the population, a higher margin of error and a lower confidence interval may be tolerated to accommodate for smaller sample sizes. Figure 4a illustrates the minimum sample size for a given population, using a 90% confidence interval and a 10% margin of error. With these parameters, the minimum sample size given a very large population would tend to 67 observations. This number would tend to 115 observations if the margin of error would instead be established at 7.5%, with the confidence interval remaining at 90% (Figure 4b)

Nonetheless, a certain level of homogeneity can be assumed across firms given the stratification criteria established in Section 3. Since they operate under similar logistical environments, it is expected that firms belonging to the same selection pool would experience lower variance in transit times and cost.

SURVEY INSTRUMENT

The collection of data is based on a digital questionnaire, whose structure is informed by the TTLC analytical framework and the specific processes followed by the country/project to which the methodology is applied.[30]

Detailed data on direct costs and lead time are collected, in addition to information on their variation within each process and sub-process of the supply chain. Since not all processes are applicable to all types of respondent, the questionnaire is also tailored to the respondents' role in the supply chain and the trade flow for their business. Stakeholders are therefore administered different subsets of the full questionnaire, though some processes may overlap between stakeholders. For example, both importers and clearing and forwarding agents may be surveyed on the container stripping process.

FIGURE 4A: MINIMUM SAMPLE SIZE GIVEN A 90% CONFIDENCE INTERVAL AND 10% MARGIN OF ERROR

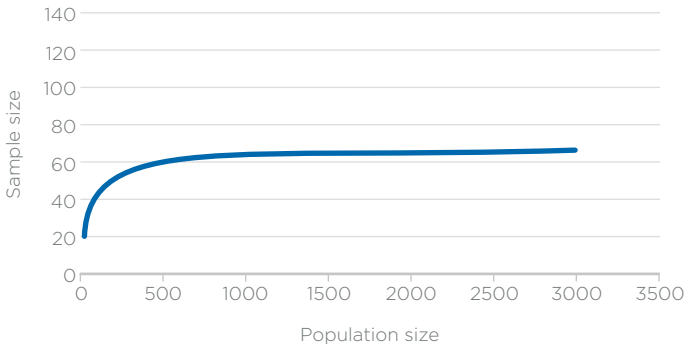
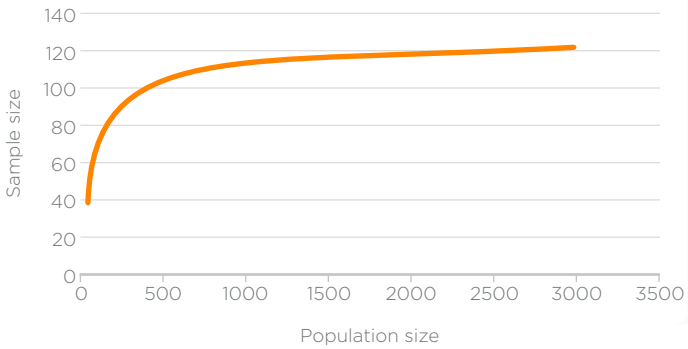


FIGURE 4B: MINIMUM SAMPLE SIZE GIVEN A 90% CONFIDENCE INTERVAL AND 7.5% MARGIN OF ERROR



27. The Alliance network is typically activated for setting up the first round of interviews aimed at testing and refining the survey instrument to the selected local import and export supply chains.
28. Refer to Section 4 for a full description of the stages in the TTLC implementation.
29. A proportion p of 0.5 is often used in determining a more conservative sample size.
30. As explained in Section 2, the scope of the supply chains tends to differ across countries. These differences are identified during the inception phase of the TTLC through desk research and semi-structured interviews with key local stakeholders, and the questionnaire is revised and adapted to reflect these country-specific features.

As units of measurement must be uniform across surveys, some responses must be converted by the surveyor and validated by the respondents. For questions relating to costs, the surveyor is required to convert the value to the requested currency unit using the average exchange rate of the previous month to partially address currency volatility and time inconsistencies associated to the recall period.[31] For questions related to time, responses are recorded based on number of hours.[32] For questions on average time or cost, if the respondent offers a range, the surveyor may record the mean.

Finally, qualitative data are also collected systematically during the interview process, which are subsequently consolidated and used to aid in the interpretation of results.

SURVEY LIMITATIONS

The reliability and validity of survey-based methodologies such as the TTLC may be affected by several factors such as those listed below. Measures have been taken to address these potential sources of bias to the greatest extent possible.

Survey fatigue
Even though respondents are only asked a subset of the full questionnaire, the survey can last between 45 and 90 minutes, posing a risk of survey-taking fatigue. A strategy to partially mitigate this risk is to carefully prepare the respondent for the duration and complexity of the survey beforehand and to highlight the importance of the data collected and the potential benefits they may generate to the respondent's business.

Perception bias
The data collected are based on recall, which may lead to inaccurate responses. Bias of this type can be reflected in higher variance in the data. However, since data targeted by the TTLC has a built-in high variance that is unrelated to issues with recall, it is necessary to collect a high enough number of data points to ensure variance converts to a stable level.

Reluctance
Respondents may be reluctant to share detailed information on the occurrence or magnitude of costs that result from sensitive processes, such as unreceipted payments. Low response rates or undervaluation may lead to underestimation of costs. The TTLC partially addresses such issues by ensuring that responses remain strictly confidential.

Non-populated strata
The sampling methodology used for the TTLC may also be a source of bias. Smaller companies that are outside of the extended network of the Alliance may be underrepresented in the sample. This may lead to an underestimation of the costs of trade if local SMEs typically have less resources and capital invested in supply chain management and technologies compared to larger companies. An analysis of the sample composition may provide additional insights on the robustness of the results.

Omissions
Lack of understanding and knowledge of a targeted supply chain in a given country can result in omissions of questions addressing important barriers, times and costs and consequently, lead to underestimation of the real lead times and costs. This type of bias is alleviated by desk research, collection of existing data and in-depth interviews with relevant stakeholders during the first round of interviews, cf. survey administration, in order to adapt the TTLC questionnaire as accurately as possible to reflect the process of the specific supply chain under analysis.

31. Assuming the respondent provides an answer based on the recollection of the experiences of the previous month
32. For example, if the respondent reports a process to be taking two days, this answer would be recorded as 48 hours.

4. COMPUTATION OF THE TTLC RESULTS

DATA COMPUTATION AND AGGREGATION

The TTLC results are computed by adding the time and costs required to complete all the supply chain processes highlighted in the framework. The Appendix provides a standardised list of indicators – sourced from survey questions and secondary data – that are used to compute time and cost for each process. The level of granularity and scope of the questions are generally adapted to reflect country-specific features in the supply chain and project requirements.

The varying scope of the TTLC raises potential challenges with regards to data aggregation when reporting the overall results. For a given product, the costs of importing or exporting can vary within the same country depending on the point of entry or exit, the transport corridors and the ports through which the goods transit. Ports, for instance, can be managed by different terminal operators proposing different fee structures and operating with varying levels of efficiency.

Time and costs also tend to vary across products. These may need to be transported in refrigerated vs dry containers, which are usually subject to different fee structures. Additionally, certain products are more frequently selected for physical inspection by customs, which can slow down the import or export process and increase costs.

In cases where the scope of the TTLC allows for a number of attributes for each selection criteria (e.g. port, terminal, sector, transport mode, etc.), the results are aggregated using weighted averages. Aggregation is typically applied for goods traded in comparable loading units (containerised vs bulk goods) and transport methods (maritime vs air freight).

DATA MANAGEMENT AND IMPUTATION

The method used to detect outliers depends on the number of non-missing responses for a given survey question. Outliers are flagged when values are greater (or lower) than two and three standard deviations from the mean. Once flagged, outliers are analysed and treated on a case-by-case basis. Additional characteristics within- and across- respondents are then considered to assess whether the data should be excluded or corrected. Any subsequent modifications to the database are tracked and annotated.

When the number of responses for a given survey question is too low to assess outliers based on deviations from the sample mean, data are instead inspected visually for anomalies. In cases where data for an indicator are missing or deemed unreliable, they can be imputed with compatible external data or with estimates derived from anecdotal evidence and validated by peer industry experts. Such instances would be reported in the technical documents supporting the TTLC results summary to ensure transparency.

5. TTLC IMPLEMENTATION

The implementation of the TTLC can be divided into four distinct phases: inception, data collection, data analysis and reporting. Each phase entails a set of activities that are summarised in this section. Completing a TTLC takes an average of four to six months (longer in a few complex cases) depending on the type of TTLC being implemented (diagnostic or impact assessment), the complexity of the supply chain, and the level of experience of the implementing staff.

PHASE 1 – INCEPTION

The first phase of the TTLC is dedicated to defining the scope of the study and the sampling strategy that will guide data collection activities. Based on findings from desk and field assessments, the researchers adapt the survey instrument that will be deployed in phase 2 of the implementation process.

Setting the scope

At the beginning, the researcher is required to determine the purpose and the basic assumptions of the TTLC study. Whether it is implemented as a diagnostic or an impact assessment tool will influence the overall design of the study. If the purpose is to measure impact, the sampling strategy and the development of key performance indicators integrated in the survey instrument will need to be adapted to the scope of the project in close coordination with the project manager.

It is recommended to develop a concept note for the study as a reference document for internal and/or external use in close consultation with relevant trade facilitation experts in/from the country concerned. The document should briefly highlight the background of the study and its sampling strategy. It should also specify the direction of the trade flow considered, the targeted products according to their HS2 code and rationale for their selection, the targeted ports of entry/exit and their relevant terminals, the main inland transport corridors given the selected ports and traded products, and the loading option/modes of the transported cargo (e.g. 20ft, 40ft containers, bulk, etc.). Establishing these basic assumptions will facilitate the development of the sample frame for the data collection and guide the objectives of the scoping mission.

Scoping mission

The first objective of the scoping mission is to adapt the TTLC to the local context, i.e. piece together the logical sequences of the supply chain and map the relevant indirect costs to inform the design and content of the survey instrument.

While some information on the export and import processes for a given country is publicly available, an initial round of interviews with local experts and key stakeholders (importers, exporters, freight forwarders, terminal operators, customs and other border agencies as dictated by the local context) is useful to complement or validate the information collected previously through desk-based research. Interviews with importers and exporters are typically conducted with the logistics specialist or manager, but might require a first introductory meeting with senior management. These initial interviews follow a semi-structured format, guided by a set of pre-determined questions and topics. Questions about the import and export processes are open-ended to allow the interviewer to ask follow-up questions to further investigate new information.

A second objective of the scoping mission is to gather initial estimates of transit times across the supply chain and understand how and why these times can vary. This will allow the researcher to exploit already existing logistics data sets and tracking statistics, and better evaluate the quality of the data collected at the onset of the survey activities. During the field visit, the researchers should also gather qualitative data on the performance of the supply chain to facilitate the interpretation of results during the data analysis phase.

Site visits to key supply chain facilities such as ports, terminals, factories, CFS/ICDs and other clearing facilities should be planned to provide a practical understanding of the sequence of activities and assess the quality of infrastructure. By the end of the scoping mission, the researcher should be capable of pinpointing potential bottlenecks and inefficiencies in the domestic supply chain.

A third objective of the scoping mission is to engage with key local stakeholders (e.g. business associations, relevant government entities, terminal operators, etc.) to facilitate access to the interviewees for the data collection activities and, potentially, to request access to non-public quantitative data from cooperative stakeholders that could be used for the computation and/or triangulations of results.

PHASE 2 – DATA COLLECTION

The second phase of the TTLC involves all activities related to the data collection process. This phase includes the preparation of the survey instrument, the recruitment of a survey team to administer the survey and the execution of the data collection itself.

Adapting the survey instrument

Based on the findings from the desk research and the scoping mission, the structure and content of the survey instrument are adapted to reflect the context of the country under analysis, and in case of impact assessment, to be fully in line with the project's scope and specifications. The researcher (in consultation with the project manager in the case of an impact assessment) should determine the level of detail of the questions while remaining mindful about how it will impact the duration of the interview.

Assembling a survey team

Typically, a surveyor or small survey team (typically two to five members) is recruited in the country of study to administer the adapted TTLC survey. The surveyors are tasked with both scheduling the interviews with the respondents defined in the sample frame and administering the survey in the field.

Before the first surveys are administered, the team is carefully instructed on survey ethics and the background of the study to effectively communicate its relevance to the respondents and ensure their full participation. The team is also thoroughly briefed on the concepts measured in each section of the survey to minimise the possibility of misinterpreting the questions and responses. The team is further briefed, as needed, on the technical terminology used in the survey and on managing unit conversions during the interview to minimise data inconsistencies.

Conducting the data collection

Interviews follow a structured format meaning that respondents have specific, closed-ended questions to answer. These questions concern the average, maximum, and minimum time and costs required to complete each step of the domestic import and export processes. The questions also aim to estimate the value of the indirect costs identified in phase 1 of the study.

Each interview lasts between 45 and 90 minutes. The duration typically varies depending on the type of stakeholder (e.g. shipper, importer/exporter, freight forwarder, etc.), and the overall level of knowledge of the respondent on logistical activities. Interviewers are expected to take note of relevant observations in a logbook, independent from the questionnaire.

The interviewer begins each interview by introducing the background and purpose of the study and its relevance to the respondent. The interviewers should then confirm with the respondent whether they agree with continuing the interview, while ensuring confidentiality. At this point, the interviewer can begin administering the survey.

At the end of the survey, the respondent can choose to completely anonymise the information shared during the interview.

PHASE 3 – DATA ANALYSIS

The structured interviews provide detailed information on the lead times and costs for all steps of the supply chain. The raw data are carefully inspected for outliers and coding errors. Average transit time and costs by process are then computed for each product type. More details about the computation of the results are detailed in the Appendix.

The results are triangulated with data from external sources (e.g. national logistics datasets, time release studies done with/through the customs administration, local port/sectorial tracking data using time stamps, indicators from World Bank's Trading across Borders dataset[33]) and subsequently shared with in-country experts and project partners, if applicable, for validation. Additional semi-structured interviews with domestic supply chain experts can be organised after finalising the results to shed further light on the factors driving transit times and costs.

The qualitative data gathered during the initial field visit and the logbook provided by the survey team should help the researchers with the interpretation and the cross-referencing of results. Inconsistencies can be investigated further by following up with respondents.

PHASE 4 – REPORTING

The final step in the implementation process is the dissemination of the TTLC results.

The results are presented in aggregated form to prevent direct inferences to the respondents.[34] These are meant to provide insights on the performance of the supply chain, allowing stakeholders to identify which areas of intervention could potentially generate the most impact on cost reduction in the specific country for the sectors/modes/ports of entry/exit under consideration.

If the TTLC is used as a diagnostic tool, the results are presented at an in-country stakeholder workshop to provide a holistic perspective on the performance of the supply chain. If used as an impact assessment, the initial TTLC survey is used as a baseline and must be complemented by a follow-up survey to be implemented at the end of project implementation (or at a time determined sufficient to observe results).

33. Typically, time and cost indicators for border and documentary compliance
34. TTLC country datasets remain the propriety of the Alliance and are not shared with third parties.

TABLE 2: OVERVIEW OF TTLC IMPLEMENTATION ACTIVITIES

PHASE	ACTIVITIES	ESTIMATED NUMBER OF WORKING DAYS (RANGE)
1	**INCEPTION PHASE**	**18 - 29**
	Define TTLC research scope	1 - 2
	Draft concept note	2 - 3
	Design sample frame	1 - 2
	Gather data from secondary sources	2 - 3
	Field visit	
	Schedule meetings with key stakeholders	3 - 5
	Schedule site visits	1 - 2
	Conduct interviews	3 - 5
	Review survey instrument	5 - 7
2	**DATA COLLECTION**	**46 - 64**
	Procurement of survey team (incl. assessment, interviews)	3 - 5
	Draft contracts	1 - 1
	Train survey team (including preparation)	2 - 3
	Schedule meetings for interviews	10 - 15
	Data collection (75 interviews at 2.5 interviews/day)	30 - 40
3	**DATA ANALYSIS**	**13.5 - 20**
	Quantitative data	
	Data cleaning	1 - 2
	Identify questions to be used in the analysis	2 - 3
	Data processing	5 - 8
	Generate data outputs (tables graphs)	2 - 3
	Qualitative data	
	Consolidate interview notes, field observations	1 - 2
	Analyse qualitative data	2 - 3
	Disseminate preliminary results for validation	0.5 - 1
4	**REPORTING**	**3 - 5**
	Draft analysis and conclusions	2 - 3
	Presentation of results	1 - 2
	TOTAL	**80.5 - 118**

APPENDIX:
TTLC COMPUTATION STRUCTURE

The computation structure of the TTLC maps the processes and sub-processes measured in the supply chain. It also displays the individual indicators used for the computation of each concept.

Given the varying supply chain structures across countries, the model presented in this section provides a list of core processes and indicators measured in the TTLC, which can be extended or adapted according to the country-specific procedures and the level of detail desired by the researchers.

This section provides an overview of the main indicators use to calculate:

1. **IMPORT TIME**
2. **EXPORT TIME**
3. **IMPORT COSTS (DIRECT AND INDIRECT)**
4. **EXPORT COSTS (DIRECT AND INDIRECT)**

1. IMPORT TIME

CODE	VARIABLE	UNIT
	TRANSIT TIME	**Hours**
1	**DOCUMENTATION COMPLIANCE PROCESS (UNTIL DISCHARGE)**	**Hours**
1.1	**Manifest submission**	**Hours/shipment**
1.11	Time prior to submission of manifest	Hours/shipment
1.2	**Documentation compliance time**	**Hours/shipment**
1.21	Time for obtaining documentation	Hours/shipment
1.22	Time for preparing documentation	Hours/shipment
1.23	Time for submitting documentation	Hours/shipment
1.24	Time for processing documentation	Hours/shipment
1.3	**Classification and valuation issues**	**Hours/shipment**
1.31	Additional time for solving classification and valuation issues	Hours/shipment
1.32	Relative frequency of classification and valuation issues	Percent
2	**SHIP INWARD PROCESS**	**Hours**
2.1	**Ship inward clearance time**	**Hours**
3	**DISCHARGE PROCESS**	**Hours**
3.1	**Terminal handling**	**Hours**
3.11	Unloading time	Hours
3.2	**Administrative operations**	**Hours**
3.21	Payment of handling fee	Minutes
3.22	Release by shipping line	Minutes
4	**BORDER CLEARANCE PROCESS**	
4.1	**Border clearance operations**	**Hours**
4.11	Transport from sea terminal to stacking yard/CFS/ICD/other depot	Hours
4.12	Arrival of cargo to filing of import declaration	Hours
4.13	Payment of customs duty	Hours
4.14	Payment of duty to registration of documents	Hours
4.15	Registration of documents to final customs clearance	Hours
4.2	**Physical inspection**	**Hours**
4.21	Physical inspection time	Hours
4.22	Relative frequency of physical inspections	Percent
4.3	**Scanning**	**Hours**
4.31	Scanning time	Hours
4.32	Relative frequency of scanning	Percent

CODE	VARIABLE	UNIT
5	DWELL TIME	Hours
5.1	Container dwell time	Days/loading unit
6	INLAND TRANSPORT PROCESS	Hours
6.1	Time slot for container collection	Hours
6.11	Waiting time for pick-up	Hours
6.2	Inland transport time	Hours
6.21	Driving to sea port to pick up import container	Minutes
6.22	Waiting to gate-in to terminal at sea port	Minutes
6.23	Gating into port	Minutes
6.24	Waiting to gate-in to terminal	Minutes
6.25	Gating into terminal and delivering container	Minutes
6.26	Waiting while customs exit control	Minutes
6.27	Gating out of terminal	Minutes
6.28	Gating out of port	Minutes
6.29	Transporting import container to ICD/CFS/free zone	Minutes
6.3	Transporting import container to final destination	Minutes
6.31	Waiting while container is being stripped	Minutes
6.32	Delivering empty container at depot	Minutes

2. EXPORT TIME

CODE	VARIABLE	UNIT
	TRANSIT TIME	Hours
1	DOCUMENTATION COMPLIANCE PROCESS (UNTIL DISCHARGE)	Hours
1.1	Documentation compliance time	Hours/shipment
1.11	Time for obtaining documentation	Hours/shipment
1.12	Time for preparing documentation	Hours/shipment
1.13	Time for submitting documentation	Hours/shipment
1.14	Time for processing documentation	Hours/shipment
2	BORDER CLEARANCE PROCESS	Hours
2.1	Container sealing (if not self-sealing)	Hours
2.11	Time required to seal the container	Hours
2.2	Documentation review	Hours
2.21	Relative frequency of documentation review	Hours
2.22	Documentation review time	Hours

CODE	VARIABLE	UNIT
2.3	**Physical inspection**	**Hours**
2.31	Physical inspection time	Hours
2.32	Relative frequency of physical inspections	Percent
2.4	**Scanning**	**Hours**
2.41	Scanning time	Hours
2.42	Relative frequency of scanning	Percent
3	**INLAND TRANSPORT PROCESS**	**Hours**
3.1	**Weighing process**	**Hours**
3.11	Time required to weigh a container empty	Minutes
3.12	Time required to weigh a container full	Minutes
3.13	Time required to weigh a truck empty	Minutes
3.14	Time required to weigh a container full	Minutes
3.2	**Inland transport time**	**Hours**
3.21	Driving to depot for picking up empty container	Minutes
3.22	Waiting at the depot for delivery of empty container	Minutes
3.23	Driving to stuffing site	Minutes
3.24	Waiting while container is being stuffed	Minutes
3.25	Waiting while customs assesses of export declaration	Minutes
3.26	Waiting while container is being sealed	Minutes
3.27	Waiting while stuffed container is being loaded onto truck	Minutes
3.28	Transporting stuffed container to sea port	Minutes
3.29	Waiting to gate-in to sea port	Minutes
3.3	**Gating into sea port**	**Minutes**
3.31	Waiting to gate-in to terminal	Minutes
3.32	Gating into terminal and delivering container	Minutes
3.33	Waiting while customs exit control	Minutes
3.34	Gating out of terminal	Minutes
3.35	Gating out of port	Minutes
4	**CONTAINER LOADING PROCESS**	**Hours**
4.1	**Retrieving container from the stack**	**Hours**
4.2	**Loading container on the vessel**	**Minutes**

3. IMPORT COSTS (DIRECT & INDIRECT)

CODE	VARIABLE	UNIT
A	**DIRECT COST**	**USD/loading unit**
1	**DOCUMENTATION COMPLIANCE PROCESS (UNTIL DISCHARGE)**	**USD/loading unit**
1.1	**Manifest submission costs**	**USD/shipment**
1.11	Administrative fees	USD/shipment
1.12	Unreceipted payments	USD/shipment
1.13	Other fees	USD/shipment
1.2	**Manifest amendments costs**	**USD/shipment**
1.21	Relative frequency of manifest amendments	Percent
1.22	Administrative fees	USD/shipment
1.23	Unreceipted payments	USD/shipment
1.24	Other fees	USD/shipment
1.3	**Documentation costs**	**USD/shipment**
1.31	Cost of documentation	USD/shipment
1.4	**Labour costs of documentation compliance**	**USD/shipment**
1.41	Average hourly labour costs	USD/hour
1.42	Time for obtaining documentation	Hours/shipment
1.43	Time for preparing documentation	Hours/shipment
1.44	Time for submitting documentation	Hours/shipment
2	**SHIP INWARD PROCESS**	**USD/loading unit**
n.a.	n.a.	n.a.
3	**DISCHARGE PROCESS**	USD/loading unit
3.1	**Terminal charges**	**USD/loading unit**
3.11	Terminal handling charges	USD/loading unit
3.12	Delivery fee	USD/loading unit
3.13	Inspection charge - move container to inspection area	USD/loading unit
3.14	Inspection charge - stripping/stuffing container	USD/loading unit
3.15	Reefer plug (if relevant)	USD/day
3.16	Weighing bridge fee	USD/loading unit
3.2	**Shipping line charges**	**USD/loading unit**
3.21	Documentation release fee	USD/loading unit
3.22	Port additional charges	USD/loading unit
3.23	Other fees	USD/loading unit
3.24	Port charges	USD/loading unit

CODE	VARIABLE	UNIT
4	BORDER CLEARANCE PROCESS	
4.1	**Border clearance costs**	**USD/loading unit**
4.11	Border clearance costs (excl. inspections, scanning, classification issues)	USD/loading unit
4.2	**Physical inspection costs**	**USD/loading unit**
4.21	Relative frequency of physical inspections	USD/loading unit
4.22	Inspection fees - inspecting agencies	USD/loading unit
4.23	Unreceipted payments - inspecting agencies	USD/loading unit
4.24	Other fees - inspecting agencies	USD/loading unit
4.25	Inspection fees - terminal	USD/loading unit
4.26	Unreceipted payments - terminal	USD/loading unit
4.27	Other fees - terminal	USD/loading unit
4.3	**Scanning costs**	**USD/loading unit**
4.31	Relative frequency of scanning	USD/loading unit
4.32	Scanning fees - inspecting agencies	USD/loading unit
4.33	Unreceipted payments - inspecting agencies	USD/loading unit
4.34	Other fees - inspecting agencies	USD/loading unit
4.35	Scanning fees - terminal	USD/loading unit
4.36	Unreceipted payments - terminal	USD/loading unit
4.37	Other fees - terminal	USD/loading unit
4.4	**Classification and valuation issue**	**USD/loading unit**
4.41	Relative frequency of valuation and classifications	USD/loading unit
4.42	Cost of solving the issue	USD/loading unit
5	INLAND TRANSPORT	USD/loading unit
5.1	**Transportation charges and fees**	
5.11	Inland transport	USD/loading unit
5.12	Empty container delivery	USD/loading unit
6	CONTAINER STRIPPING	USD/loading unit
6.1	**Container stripping costs**	**USD/loading unit**
6.11a	Handling fees (if done by CFA)	USD/loading unit
6.11b	Labour costs (if done by importer/exporter)	USD/hour
6.12	Unreceipted payments	USD/loading unit
6.13	Other fees	USD/loading unit
B	INDIRECT COST	USD/loading unit
1	DEMURRAGE AND DETENTION COSTS (REPORTED SEPARATE)	USD/loading unit
1.1	**Demurrage costs**	**USD/loading unit**
1.11	Relative frequency of demurrage charges	Percent

CODE	VARIABLE	UNIT
1.12	Number of days charged	Days/loading unit
1.13	Daily demurrage rate (period 1)	USD/loading unit/day
1.14	Daily demurrage rate (period 2)	USD/loading unit/day
1.2	**Detention costs**	**USD/loading unit**
1.21	Frequency of detention	Percent
1.22	Number of days charged	Days
1.23	Daily detention rate (period 1)	USD/loading unit/day
1.24	Daily detention rate (period 2)	USD/loading unit/day
2	**STORAGE COSTS**	**USD/loading unit**
2.1	**Terminal storage costs**	**USD/loading unit**
2.11	Share of shipments cleared/stored in container terminal	Percent
2.12	Frequency of storage	Percent
2.13	Number of days charged	Days
2.14	Daily storage rate at terminal (period 1)	USD/loading unit/day
2.15	Daily storage rate at terminal (period 2)	USD/loading unit/day
2.2	**Free zone warehouse/ICD/CFS storage costs**	**USD/loading unit**
2.21	Share of shipments cleared/stored in container terminal	Percent
2.22	Frequency of storage	Percent
2.23	Days charged storage	Days
2.24	Daily storage costs at inland clearance facility (period 1)	USD/loading unit/day
2.25	Daily storage costs at inland clearance facility (period 2)	USD/loading unit/day
3	**INVENTORY COSTS**	**USD/loading unit**
3.1	**Number of days of additional inventory**	**Days**
3.2	**Average number of days of delay**	**Days**
3.3	**Value of the content of the container**	**USD/loading unit**
4	**BREAKAGE AND SPOILAGE COSTS**	**USD/loading unit**
4.1	**Relative frequency of breakage and spoilage**	**Percent**
4.2	**Percentage lost cargo value**	**Percent**
4.3	**Value of the content of the container**	**USD/loading unit**
5	**THEFT OF CARGO COSTS**	**USD/loading unit**
5.1	**Relative frequency of incidences of theft**	**Percent**
5.2	**Share of cargo lost from container**	**Percent**
5.3	**Value of the content of the container**	**USD/loading unit**
6	**LOST ORDERS**	**USD/loading unit**
n.a.	*The indicators used to estimate the value lost orders vary significantly depending on the country and products assessed.	USD/loading unit

CODE	VARIABLE	UNIT
7	LOST PRODUCTION	USD/loading unit
n.a.	*The indicators used to estimate the value of lost production vary significantly depending on the country and products assessed.	USD/loading unit
8	PENALTIES FOR LATE DELIVERY	USD/loading unit
n.a.	*The indicators used to estimate penalties vary significantly depending on the country and products assessed.	USD/loading unit

4. EXPORT COSTS (DIRECT & INDIRECT)

CODE	VARIABLE	UNIT
A	DIRECT COST	USD/loading unit
1	DOCUMENTATION COMPLIANCE PROCESS (UNTIL DISCHARGE)	USD/loading unit
1.1	Cost of documentation	USD/shipment
1.11	Cost of documentation	USD/shipment
1.2	Labour costs of documentation compliance	USD/shipment
1.21	Average hourly labour costs	USD/shipment
1.22	Time for obtaining documentation	USD/shipment
1.23	Time for preparing documentation	USD/shipment
1.24	Time for submitting documentation	USD/shipment
2	CONTAINER STUFFING PROCESS	USD/loading unit
2.1	Container stuffing costs	USD/loading unit
2.11a	Handling fees	USD/loading unit
2.11b	Labour costs (if done by importer/exporter)	USD/hour
2.12	Unreceipted payments	USD/loading unit
2.13	Other fees	USD/loading unit
3	BORDER CLEARANCE PROCESS	USD/loading unit
3.1	Container sealing	USD/loading unit
3.11	Cost of sealing a container	USD/loading unit
3.2	Documentation review	USD/loading unit
3.21	Relative frequency of documentation review	Percent
3.22	Cost of documentation review	USD/loading unit
3.23	Unreceipted payments	USD/loading unit
3.24	Other fees	USD/loading unit

CODE	VARIABLE	UNIT
3.3	**Physical inspection costs**	**USD/loading unit**
3.31	Relative frequency of physical inspections	Percent
3.32	Inspection fees - inspecting agencies	USD/loading unit
3.33	Unreceipted payments - inspecting agencies	USD/loading unit
3.34	Other fees - inspecting agencies	USD/loading unit
3.35	Inspection fees - terminal	USD/loading unit
3.36	Unreceipted payments - terminal	USD/loading unit
3.37	Other fees - terminal	USD/loading unit
3.4	**Scanning costs**	**USD/loading unit**
3.41	Relative frequency of scanning	Percent
3.42	Scanning fees - inspecting agencies	USD/loading unit
3.43	Unreceipted payments - inspecting agencies	USD/loading unit
3.44	Other fees - inspecting agencies	USD/loading unit
3.45	Scanning fees - terminal	USD/loading unit
3.46	Unreceipted payments - terminal	USD/loading unit
3.47	Other fees - terminal	USD/loading unit
4	**INLAND TRANSPORT PROCESS**	**USD/loading unit**
4.1	**Inland transport costs**	**USD/loading unit**
4.11	Total inland transport costs	USD/loading unit
4.2	**Weighing**	**USD/loading unit**
4.21	Costs of weighing a container empty	USD/loading unit
4.22	Costs of weighing a container full	USD/loading unit
4.23	Costs of weighing a truck empty	USD/loading unit
4.24	Costs of weighing a container full	USD/loading unit
5	**CONTAINER LOADING PROCESS**	**USD/loading unit**
5.1	**Terminal charges**	**USD/loading unit**
5.11	Terminal handling charges	USD/loading unit
B	**INDIRECT COST**	**USD/loading unit**
1	**BREAKAGE AND SPOILAGE COSTS**	**USD/loading unit**
1.11	Relative frequency of breakage and spoilage	Percent
1.12	Share of cargo lost per container	Percent
1.13	Value of container content	USD/loading unit
2	**THEFT OF CARGO COSTS**	**USD/loading unit**
2.11	Relative frequency of theft	Percent
2.12	Share of cargo lost per container	Percent
2.13	Value of container content	USD/loading unit

CODE	VARIABLE	UNIT
3	**LOST ORDERS**	**USD**
n.a.	*The indicators used to estimate this vary depending on the country and products assessed.	Percent
4	**PENALTIES FOR LATE DELIVERY**	**USD**
n.a.	*The indicators used to estimate this vary depending on the country and products assessed.	USD
5	**LATE GATE-IN TO TERMINAL**	**USD**
5.1	**Shut out costs**	**USD/loading unit**
5.11	Relative frequency of containers that are shutout	Percent
5.12	Shut-out charges	USD/loading unit
5.2	**Missing scheduled vessel costs**	**USD/loading unit**
5.21	Relative frequency of missed vessels	Percent
5.22	Waiting time in terminal before next vessel	Days
5.23	Days of ground rent or storage charged	Days
5.24	Daily ground rate or storage costs (period 1)	USD/loading unit/day
5.25	Daily ground rate or storage costs (period 2)	USD/loading unit/day
5.3	**Additional demurrage costs**	**USD/loading unit**
5.31	Extra demurrage days	Days
5.32	Demurrage per day cost	USD/loading unit/day
5.4	**Additional detention costs**	**USD/loading unit**
5.41	Extra Detention days	Days
5.42	Detention per day cost	USD/loading unit/day

REFERENCES

Alessandria, G., Kaboski, J. P., & Midrigan, V. (2010). Inventories, Lumpy Trade, and Large Devaluations. The American Economic Review, 100(5), 2304-2339.

Arvis, J.-F., Raballand, G., & Marteau, J.-F. (2007). The Cost of Being Landlocked: Logistics Costs and Supply Chain Reliability. Washington, D.C.: The World Bank.

Carballo, J., Graziano, A., Schaur, G., & Volpe-Martincus, C. (2014). The Heterogeneous Costs of Port-of-Entry Delays. Washington D.C.: Inter-American Development Bank.

Cochrane, W. (1963). Sampling Techniques, 2nd Edition. New York: John Wiley and Sons, Inc.

Djankov, S., Freund, C., & Pham, C. S. (2010). Trading on Time. The Review of Economics and Statistics, 92(1), 166-173.

Frankel, E. (1999). "The Economics of Total Trans-ocean Supply Chain Management. International Journal of Maritime Economics, 1(1), 61-69.

Freund, C., & Rocha, N. (2010). What Constrains Africa's Exports? Washington D.C.: The World Bank.

Guasch, J. L., & Kogan, J. (2003). Just-in-Case Inventories. Washington D.C.: The World Bank.

Harrigan, J., & Venables, A. J. (2004). Timeliness, Trade and Agglomeration. Cambridge MA: National Bureau of Economic Research.

Hummels, D. (2017). Calculating Tariff Equivalents for Time in Trade. United States Agency for International Development.

Hummels, D., & Schaur, G. (2013). Time as a Trade Barrier. American Economic Review, 103(7), 2935-2959.

Portugal-Perez, A., & WIlson, J. S. (2009). Why trade facilitation matters to Africa. World Trade Review, 8(03), 379-416.

UNCTAD. (2016). Trade Facilitation and Development: Driving trade competitiveness, border agency effectiveness and strenghtened governance. Geneva: United Nations.

UNCTAD. (2019). Review of Maritime Transport 2019. Geneva: United Nations.

Volpe Martincus, C. (2016). Out of the Border Labyrinth: An Assessment of Trade Facilitation Initiatives in Latin America and the Caribbean. Washington D.C.: Inter-American Development Bank.

Wilmsmeier, G., Hoffmann, J., & Sanchez, R. J. (2006). The Impact of Port Characteristics on International Maritime Transport Costs. Research in Transportation Economics, 16(1), 117-140.

World Trade Organization. (2014). World Trade Report 2014. Trade and Development: Recent Trends and the Role of the WTO. Geneva: World Trade Organization.

World Trade Organization. (2015). World Trade Report 2015. Speeding up trade: Benefits and Challenges of implementing the WTO Trade Facilitation Agreement. Geneva: World Trade Organization.