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TRADE AND COMPLIANCE COST MODEL IN THE INTERNATIONAL SUPPLY CHAIN

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Abstract

Trade costs for international supply chain are huge, even in the absence of formal barriers. It is necessary for all the stakeholders, both private and public organizations, to support an effective and efficient border compliance process. Very little trade cost model research has been done at the level of an individual company. Furthermore, customs-related compliance costs are only one of the many aspects in existing trade cost models, such as e.g. the well-known model of Anderson and van Wincoop, and hence not broken down into the constituent components that become crucial when individual companies want to assess specific business processes. Company level and compliance specific trade cost models are needed when individual companies want to assess their own specific costs of compliance in their international supply chains, and how they could benefit from IT-enabled trade facilitation, such as the data pipeline, to reduce these costs. Hence, we argue, based on a case study conducted by the CORE project, that it is essential to actively conduct further research into what are company level compliance costs. In this paper, we present the first outline of a Company Level Compliance Cost (CLCC) model and show how it can be applied by individual companies to assess costs. The CLCC model can be seen as a tool that can be used by companies to make their trade and compliance costs explicit. This is a key step in the further articulation of potential benefits and value proposition of IT-enabled trade facilitation solutions for specific actors in the chain, which is crucial for the further adoption and upscaling of IT-enabled trade facilitation innovations.

1. INTRODUCTION

Conducting effective and efficient border compliance procedures by border inspection agencies such as customs and phytosanitary inspection is necessary for addressing safety and security concerns, as well as for promoting a country's competitiveness in international trade. While private organizations demand an efficient process to minimize logistic costs (since they perceive border compliance process as a barrier to their efficient goods' flow), government border agencies, as public organizations, have the interest in checking for safety and security. That often requires lengthy procedures and lead to increased administrative burden for companies. To overcome these barriers, governments develop various approaches to facilitate trade. One widely used approach is to develop IT solutions that enable trade facilitation[1]. In this paper, we use one example of such IT innovation, the so-called *Data Pipeline* which is a kind of worldwide Internet for logistics that can be used to exchange data across the international supply chain. Although IT

[1] See for an overview of these IT innovations for trade facilitation http://tfig.unece.org/

innovations such as the integrated data pipeline seem to offer promising solutions for achieving the above-mentioned goals, unfortunately, there is no trade and compliance cost model at the level of single organization that can be used to do the cost-benefit evaluation of IT-enabled trade facilitation.

Van Stijn, et.al. (2011) offered four kinds of innovations for IT-enabled trade facilitation to help stakeholders achieve visibility, credibility, reliability, and transparency. These are:

- Realization of sustainable, cost-efficient supply chains by establishing shared knowledge between seller and buyer in order to allow a better real-time data management and traceability.
- Optimization of logistics and terminal operations through synchro-modality.
- Acquiring of an Authorized Economic Operator (AEO) or Trusted Trader status in order to demonstrate that a supply chain partner is trustworthy and complies with regulations.
- Improvement in coordinated border management, facilitation and supervision, as well as further development of a public-private partnership with businesses involved in international supply chain operations.

In this paper, we use the *Data Pipeline* concept as an IT innovation method to achieve these objectives. The *Data Pipeline* is a kind of worldwide Internet for logistics that can be used to exchange data across the international supply chain (van Stijn et al., 2012; Hesketh, 2009, 2010). For example, container tracking information captured via container tracking and monitoring technologies can be shared with authorized parties along the supply chain real-time via the data pipeline. The data pipeline can also be used by *trusted traders* to provide more accurate and timely cargo import/export declaration data to customs administrations (van Stijn, et.al. 2012). Other border management reforms also allow improving the coordination within the logistic stakeholder. Examples include Coordinated Border Management, One Stop Border Posts, or Singe Window.

In consideration of the need for information gathering and sharing, any IT innovation that would reduce administrative burdens and at the same time would enhance safety and security in global supply chains would need to bring concrete benefit to the main stakeholders in order for the innovation to be further adopted by them, because companies have to make costs to implement their part of these IT innovations; such as building interfaces from their own information systems to a data pipeline. One way to articulate the benefits could be to develop a cost model for the trade and compliance to make costs in the current situation explicit. This would provide the basis to further investigate the trade facilitation offered by specific IT-innovations and the possible cost saving. Therefore, a study of the trade and compliance cost is essential for making explicit the costs that actors experience and for articulating the potential benefits for them of IT innovations they have to implement for trade facilitation.

One of the most widely-cited studies on trade costs analysis is the study of Anderson and van Wincoop (2004). The authors argue that the trade costs are comprised of various components, such as transportation, border-related compliance costs, and the profit margin taken by retailer/wholesaler. Anderson and van Wincoop, and similar studies from OECD and UN on trade cost models are typically based on macroeconomic research at the aggregated level of general trade data statistics at the country level and are widely used as instruments to assess cost/benefits aspects of trade facilitation initiatives. The results of this research are typically very useful input for trade facilitation policy decision makers, but it is less useful for individual company decision making on whether or not to invest in IT innovations to implement trade facilitation initiatives. Very little trade cost model research has been done at the level of an individual company. Furthermore, customs-related compliance costs are only one of the many aspects of trade cost models such as Anderson and van Wincoop. These models are typically not decomposed into the constituent components that become crucial when individual companies want to assess specific business processes. Both limitations of the current mainstream research on trade cost models are partially addressed in the research of Grainger, who published various articles on compliance cost models at the company level, decomposed to a business process level (e.g. Grainger, 2011, 2013, 2014a/b/c). Company level and compliance specific trade cost models are needed when individual companies want to know their own specific costs of compliance in their international supply chains, and how they could benefit from IT-enabled trade facilitation, such as the data pipeline, to reduce these costs. Hence, we argue that it is essential to actively pursue further research related to Company Level Compliance Costs (CLCC).

In this paper, we develop an initial *Company Level Compliance Cost* (CLCC) model by consolidating insights from the models of Anderson and van Wincoop (2004), the Grainger study, as well as other research on trade and compliance costs. Based on a case study conducted in the research project CORE[2], by examining cost data that was collected in relation to three perishables shipments from Kenya to the Netherlands, we demonstrate how the CLCC can be applied and we further refine and extend the initial CLCC model to a refined CLCC model based on the case findings.

2. METHODOLOGY

The research in this paper is based on a design science research method. The design process is a sequence of expert activities that produces an innovative product/artefact by addressing the research through the artefact's building and evaluation to identify the business need (Hevner, et al. 2004). In design science research, there are two basic activities involved; the artefact building, and the artefact evaluation (March & Smith, 1995). The artefact in this research refers to the CLCC model.

The model building started with the exploitation of the main literature studies of trade cost by Anderson and van Wincoop, and the compliance cost study by Grainger. In parallel, we reviewed other related literature and we used project reports to enrich our understanding of the subject. As a result, we developed a consolidated model, the CLCC model which allows for a detailed break-down of trade and compliance cost at a company level.

Subsequently, we demonstrated how the CLCC model can be applied by using a case study (Yin, 2009). The case study was conducted in the context of the CORE project and concerned the import of perishables from Kenya to the Netherlands. The CLCC analysis was performed by using cost data that was collected by following in detail three shipments in that trade lane. Based on the case findings we further enhanced and enriched the CLCC model.

Rigor and relevance are also key when conducting design science research (see Figure 1 below, which is based on Hevner, et al. (2004, p.80) and was adapted for our research). To ensure the rigor, we used existing literature and knowledge base when constructing the CLCC model. The consolidated CLCC model can be seen as our addition to the knowledge base. Regarding relevance, our research was motivated by the need identified in the international trade domain and we apply the model to the environment by using a case study.

[2] For more info see http://www.coreproject.eu/

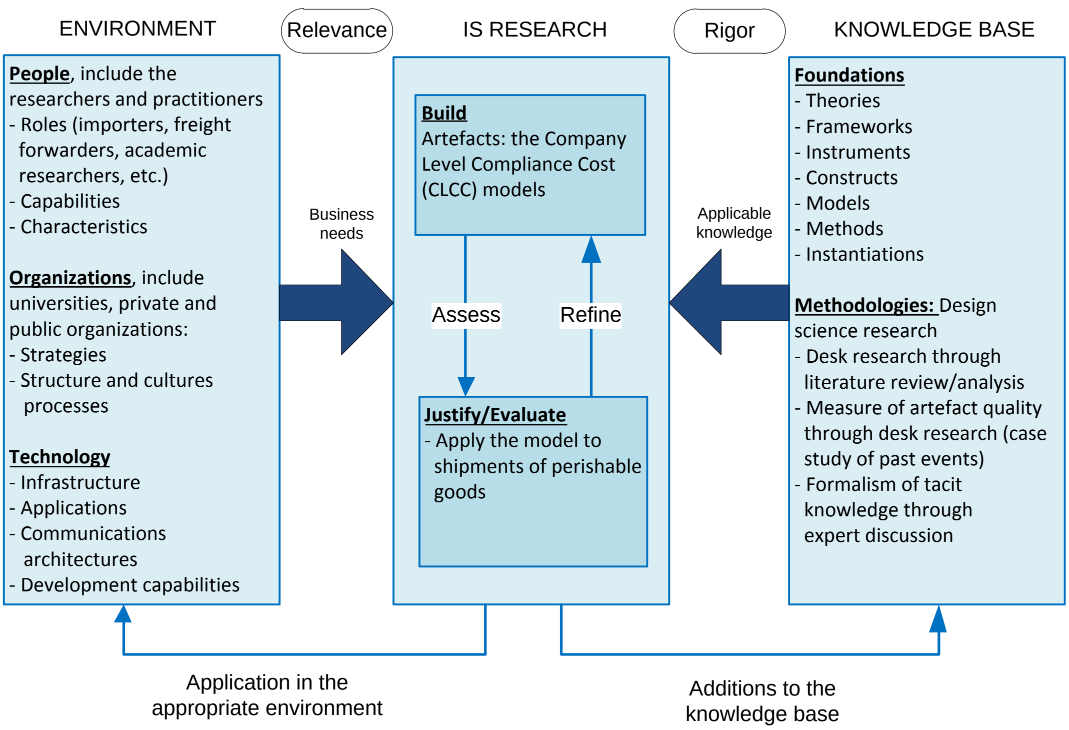

Figure 1. Information system framework according to Hevner, et al. (2004, p.80) which has been modified based on this research need

3. THE TRADE COST MODEL

Trade costs are translated as the expenses at all stages of the export and import process, starting from the information gathering about the market condition of foreign market to the final payment receive (Portugal-Perez & Wilson, 2008). Trade costs are large, even with the absence of formal barriers. Trade costs in average equal to 170% of the production costs and consist of three cost components: transportation costs (21%), border-related barrier costs (44%), and the retails/wholesales profit (55%) (Anderson & van Wincoop, 2004). It is summarized in the Figure 2 below.

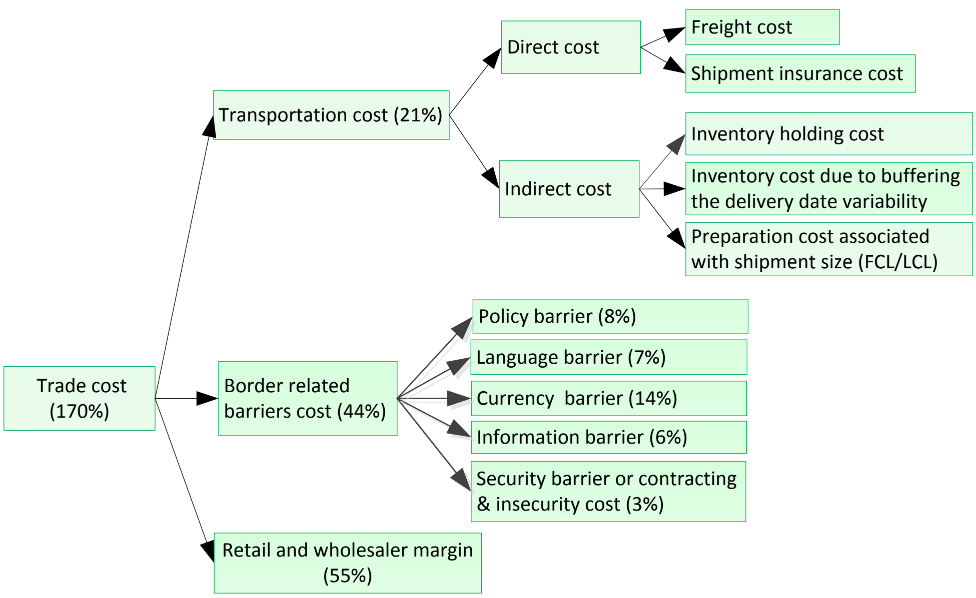

Figure 2. The visualization of the trade cost model that was developed by author based on trade cost categories identified by Anderson and van Wincoop

We use the Anderson and van Wincoop's study as a starting classification of trade costs. In sections 3.1, 3.2, and 3.3 we further discuss the transportation, border-related barriers, and retail/wholesale costs respectively and we review additional literature that examines these costs. In section 3.4 (Figure 3) we expand the initial cost classification of Anderson and van Wincoop (2004) to incorporate other cost categories identified in literature.

3.1 Transportation costs

Based on general cost distinction, *transportation cost* is divided into two sub-categories: *direct* and *indirect costs* (see Figure 2). All of the information on the percentage of the cost contribution are cited from the trade cost study by Anderson and van Wincoop (2004).

3.1.1 Direct transportation costs

Direct transportation costs address the expenses related to the *freight cost* (both *international* and *domestic*), the *shipment insurance*, and the *mode interchanges* (Ministry of Transport, 2010). In some cases, if the cargo is selected for inspection, the *intra-terminal transportation cost* is added as the expense to bring the cargo from container stacking yard to the inspection area and the return. In the peak season with high demands, when the vessel's spaces, containers availability, or truck slots are limited, transport companies sometimes apply an additional *slot or equipment booking cost* as the commitment to avoid last minutes cancellation.

Aside from the freight cost, there are the *detention and demurrage costs* to consider in an international transport. They are applicable for any shipment using the container longer than the agreed free-time, either outside the port (detention charge) or inside the port (demurrage charge).

The *domestic/inland transportation costs* occur both at the origin and at the destination. Other than the domestic freight cost, an *overtime cost* might also apply as another additional cost when the trucks have to wait for the loading/unloading process more than allowed time, typically 2 hours (Sefco, 2011).

3.1.2 Indirect transportation costs

The *indirect costs* refer to the costs of holding goods in transit (time value of goods), *inventory cost due to buffering the delivery date variability*, and *preparation cost associated with the shipment size* (the cost to sacrifice the time when shippers postpone the shipment to build a Full Container Load). Hummels (2011) translated the *inventory holding cost* as the capital cost of goods in transit and the cost in holding for larger inventory at the final destination. He also suggested considering the depreciation cost that refers to the mismatch between what the manufacturer produces and what the consumer desires to purchase weeks or months later.

3.2 Border-related barrier costs

Border-related barrier costs are presented as the expenses spent due to the policy, language, currency, information, and security barriers.

3.2.1 Policy barrier

The *policy barrier* contributes at around 8% from the production cost based on evidence from tariff and non-tariff barriers (Anderson & van Wincoop, 2004). This policy barrier refers to the regulatory policy. All of these five areas represent the tariff and non-tariff measurement costs. The valuation of 8% comes from the Anderson and van Wincoop's survey done in several countries, including US, Canada, and some European countries, and is categorized into five areas: revenue collection, safety and security, environment and health, consumer protection, and trade policy.

Tariff is the import duties levied by Customs administrations according to the official trade tariff publication in the specific country (Grainger, 2014b). The tariff barrier becomes a less important barrier, proofed by a steady reduction in the tariff rate world widely (Moise & Bris, 2013). In the period of 1960 to 1995, the average import tariff falls from 8.6% to 3.2% (Hummel, 2007). Therefore, though tariff still becomes the most widely used policy instrument to restrict the trade by Customs agency, there has been a declining trend to their relative importance (Hoekman & Nicita, 2011).

Unlike the tariff barrier, the *non-tariff barrier* is high and increasing due to the effect of antidumping policy and the effects. The non-tariff costs address the expenses other than import/export duty which is incurred due to quota restriction, customs compliance procedure, embargo, import licensing, export subsidy, sanction, levies, currency devaluation, foreign exchange control, etc. (COMESA-EAC-SADC., 2017).

Therefore, the tariff cost is more about the revenue collection. While the non-tariff measurements are all barriers or obstacles to the international trade other than the import and export tariff/levy duty, not limited to the rest four areas of safety and security, environment and health, consumer protection, and trade policy.

3.2.2 Language barrier

International trade involves additional task related to the *language barrier*, such as the foreign market research, communication to the foreign counterparties (including the documents translation), and some other challenges in marketing the product to the foreign consumers (Molnar, 2013). These activities share the barrier to the trade due to the different language use. Consequently, organizations often need to pay the labor higher to acquire a certain language skill.

3.2.3 Currency barrier

The *currency barrier* cost covers the expenses involved in exchanging currencies and hedging the currency risks. Normally, a buyer that uses foreign currency will absorb the exchange cost from each transaction made. There is less exchange rate volatility in a stable economic condition, reducing the risk for the actors in holding the bilateral trade. Therefore, a fixed exchange rate can promote the trade by itself.

3.2.4 Information cost

Petropoulou (2005) classified the *information barrier* as the expense that covers the search and communication activities between international trade partners that affect the way in which the trade is organized. The information barrier cost might relate to the expense spent in the searching effort to find the international suppliers or customers. This searching cost is low when the business practices, competitiveness level, product/service quality and delivery reliability are well known by the trading partners. The search process and communication activities between international trade partners, especially if it relates to the shipment, can be partly cut down by applying data pipeline.

3.2.5 Security (or contractual and insecurity) cost

The contracting cost addresses the expenses due to writing contracts and enforcing them, or the self-insuring cost of unenforced contracts. It is translated as the effort established to reduce the uncertainty toward the trade itself. Nordas and Piermartini (2004) divided the *security barrier cost* into two dimensions: the *direct monetary outlay*, and *the time* that represents the indirect monetary outlay (which responses to the time in adopting the just-in-time process to support the establishment of a strong international supply network through right contract agreement in achieving a reliable process).

3.3 Retail/wholesale profit

Profit allocation can take up at average 55% or higher over the production cost, with at least 40% irrespectively for the poor or rich country. More specifically, the percentage goes at 68% for the US, 53% for Germany, and 50% for The Netherlands (Anderson & van Wincoop, 2004). However, this cost composition will not be explained in detail in this research.

3.4 The extended version of the trade cost model of the Anderson and van Wincoop (2004)

The model represented in Figure 3 below builds on the basic trade cost classification by Anderson and van Wincoop (2004) but captures also additional cost elements as identified in section 3.1, 3.2 and 3.3 of this paper[3].

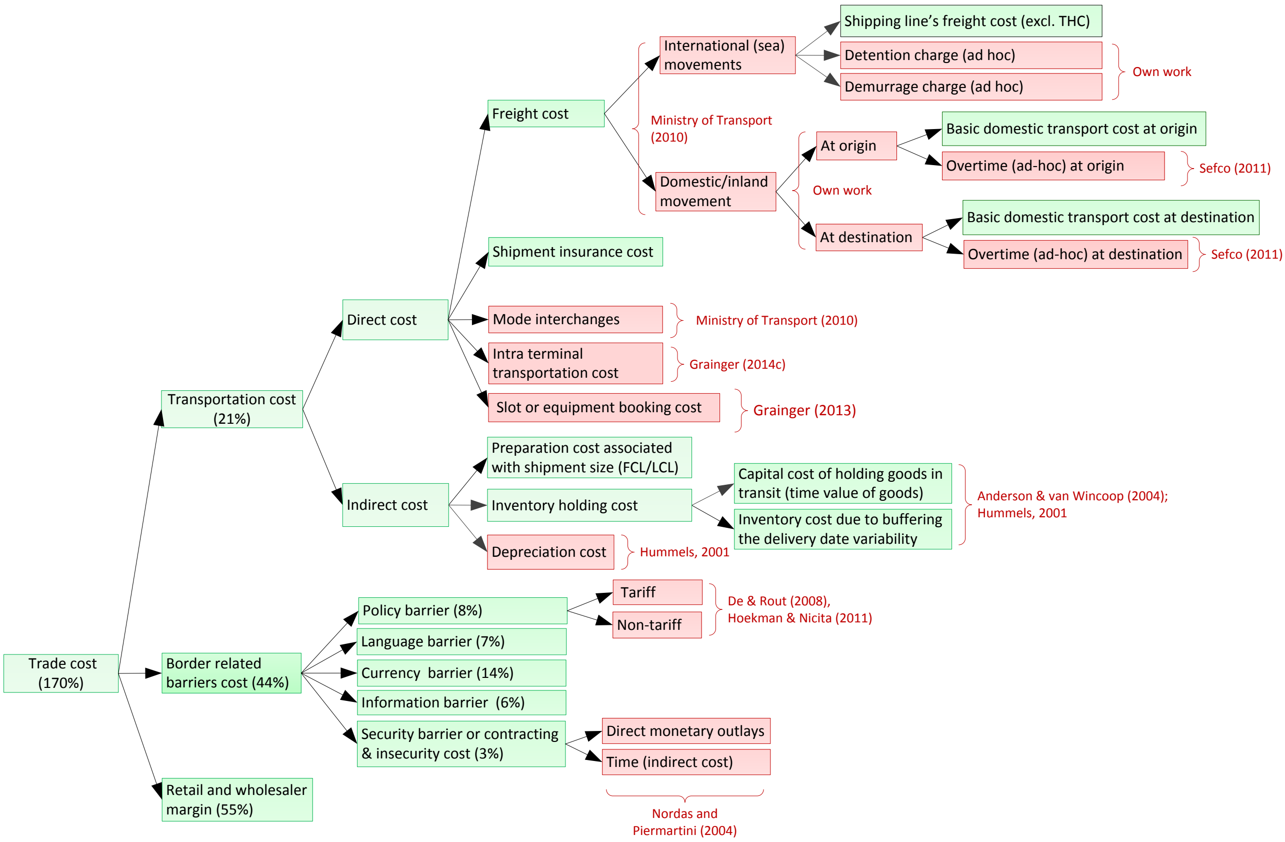

Figure 3. The extended version of the trade cost model of the Anderson and van Wincoop (2004), with author contribution in expanding the cost categorization from other literature as shown in red color

While the model presented in Figure 3 already provides rich insights from a macroeconomic perspective into the types of trade costs, it remains very limited when it comes to capturing and making explicit compliance costs at a company level. To further zoom-in on the compliance costs, we build upon a series of studies of Grainger (see Section 4 below), as these studies do provide further insights into cost categories related to compliance.

4. THE IMPORT COMPLIANCE COST MODEL

The second step to enrich the initial trade cost model of Anderson and van Wincoop is to extend it with components of Grainger's import compliance cost model that is based on his empirical case study about meat import to the UK. He proposed that the import compliance costs consist of a) *the initial set-up and approval (authorization) cost*; b) *the transactional cost*, and (c) *the inspection cost (Grainger, 2013)*. Additionally, (d) *post clearance costs* also exist after the goods have passed the border (Grainger, 2014c). We only take import compliance costs into account, because these costs are typically much higher than the export compliance costs (Walkenhorst & Yasui, 2003).

4.1 The initial set-up and approval (authorization) cost

The initial set-up and approval (authorization) cost refer to the necessary activities that need to be done (often require one-off payment) to make importers (and the agents) eligible for the compliance procedures. It can be a *direct cost* (e.g. to prepare the block guarantee[4], annual system subscription, and registration to the counterparties), and *indirect cost*. The indirect costs

[3] References to studies from which the additional cost categories were derived are provided in Figure 3.

[4] an example of Customs guarantee that can be used for a number of transactions up to the guarantee's value

are presented to provide the secondary effects of the direct costs, like the expense of staff training before they are able to use the system, and other expenses needed to set-up their facility to be ready to adapt the IT system, including setting up their bank account or another financial platform for payments.

The initial set-up and approval (authorization) costs are also applicable to the government agencies as the trade facilitator. These costs are translated into the investment needed to provide suitable facilities so that the border agencies can perform the necessary activities of their duties, including the expense of the building construction, maintenance of a dedicated office, and providing inspection facility both for physical inspection and facility to conduct the *x*-rays scanning (Grainger, 2014b).

4.2 The transactional costs

Grainger (2014b, p.477) defined the *transactional costs* as "those costs incurred by the port (or its Port Community System provider) in collecting regulatory-relevant information that is not normally required for physical handling and commercial operations alone". More specifically, it is transactional in nature to clear the cargo through the port and other government agencies (Grainger, 2014c). So, the *transactional costs* are applicable for all shipment without exception. These costs are distinguished into *direct* and *indirect* costs.

4.2.1 Direct transactional cost

Directly incurred transactional costs are the expenses associated with supplying information and documents to the related parties/authorities. Grainger (2014c) divided the direct transactional costs into four sub-components based on the party who collects the money.

1) *Charged by agents*: costs include but not limited to the initial document checking by the agents, Direct Trader Input (DTI) charge (or often known as Electronic Data Interchange/EDI charge), agents' charges for preparing the customs entry on behalf of importers such as the Common Veterinary Entry Document (CVED) production cost, dock/port levy charge for customs inspection irrespective whether the container will be inspected or not.

2) *Charged by shipping lines to the agents*: costs includes but not limited to the Terminal Handling Charge (THC), Lift-on Lift-off (LOLO) charge, demurrage fee (which normally has been predicted/forecasted by importer before), and other port' activities and equipment charges such as the additional fee for temperature monitoring and equipment use for reefer cargoes in transit.

3) *Charged by port operators*: costs including but not limited to the Border Inspection Posts (BIP) fee per container inspection, the International Ship and Port Facility Security (ISPS) security charges per container, infrastructure charge, port's Vehicle Booking System (VBS) charges, and port levy for the customs inspection.

4) *Charged by port health and other border inspection government agencies*, *including both customs and non-customs*. Customs agencies are typically responsible for collecting the tariff charge, and in some cases applying the Single Transaction Guarantee (STG). The non-customs agencies costs cover the expenses to comply with the non-customs agency rules, not limited to the phytosanitary and veterinary by Animal and Plant Health Inspection Service (APHIS), and other regulation by the Bureau of Alcohol, Tobacco and Firearms (BATF), Fish and Wildlife service (F&W), Food and Drug Administration (FDA), and others, depends on commodity

4.2.2 Indirect transactional cost

Grainger (2011) associated these costs with the issue of inadequate and/or discrepancy documentations, inspection facility congestion, insufficient staff especially outside office hour, and unforeseen emergency measures. Walkenhorst and Yasui (2003) defined these costs as the expenses due to procedural delay when the information exchange within the authorities works out of business expectation. Therefore, any disruption either to the process or the authorities' systems typically leads to either processing delays or the use of the paper document and/or manual processing thereof.

Naturally, companies spend more time and resource to handle paper documents. Such practice can slow down port's ability to turn around the shipments, increasing the dwell time that impacts to a longer customs clearance process. The border delay is associated with the environment uncertainty, additional handling costs (e.g. to keep on monitor the reefer temperature), storage cost (due to utilizing port, terminal/depot or inland container yard facilities), demurrage cost (which often has not been forecasted or expected by importer before), business opportunities and competitiveness losses (Grainger, 2011, 2014b). The border clearance delay may force importers to absorb higher transportation costs like to compensate the re-scheduling of domestic transportation (with sometimes subject to booking cancellation fee) and the overtime. If border delays take too long and impact the delivery timelines to the end customers, there would be additional *inventory holding costs*, as well as *depreciation costs*.

4.3 The inspection costs

Inspection costs are the additional expenses incurred when a shipment is selected for inspection or laboratory test (Grainger, 2014c). No such costs occur in cases when the goods were not selected for inspection. The *inspection costs* are also classified as *direct* and *indirect* costs.

4.3.1 Direct Inspection Costs

Direct inspection costs are the expenses incurred for the physical inspection, laboratory tests, the labor and handling fees to conduct specific border control activities (Grainger, 2014c). The inspection cost can be in a flat rate model (regardless whether the cargo needs inspection or not; it is included as the transactional cost). Another model is the cost model where the costs need to be paid *only* by the importer whose cargo is selected for physical inspection. The direct inspection cost is classified to three sub-categories of costs based on the activity.

First, the *inspection scanning related cost*. The scanning fee might cost €133.50 at the terminal, or €215 for the external scanning at Port of Rotterdam. ShipmentLink (2015) added a reference that the costs related to import customs scanning is around €170/container, with additional €25/container for the container scanning evidence request (scan attest), and another €85 for administrative cost if it is done externally.

Second, the *physical inspection cost*. It covers the inspection fee levied by customs and other government agencies to execute the laboratory test and examination. Additional cost might involve such as for container devanning/ revanning costs, and another cost to execute the physical inspection procedure such as the reefer's temperature adjustment, gas measuring, etc. (Grainger, 2014c).

Third, the *transport-related costs* to support the inspection activity, as a form of handling fee to conduct specific border control activities. Mostly, it refers to *the intra-terminal transportation cost* to bring the cargo to/from the inspection area. An *additional chassis rent* costs might apply if the inspection took more than one day (ShipmentLink, 2015).

4.3.2 Indirect inspection costs

Inspection processes often involve more than one border agencies. Thus, a good coordination is needed so that all processes can be done in the most effective and efficient way. With such dependencies between agencies, if there is poor coordination between them, there would be a possibility that the process leads to additional delays and inefficiencies. Similar to the indirect transaction cost, it can be concluded that there will be additional time and resource needed to complete the inspection such as to transfer the paper documents or to transmit the electronic document from one agency to another as part of the agencies' dependencies. Often, it involves painful back-and-forth communication to do coordination between the counterparties in relation to the inspection arrangement (Grainger, 2014b).

The inspection process can also be a barrier for the trade, especially if it takes the significantly long time to complete the inspection process. Since inspection is part of the border clearance procedure, a lengthy process might lead to delays due to the border clearance process. In the next stage, this could lead to a delivery delay to the customer with a similar impact as what occurs in the indirect transactional costs.

4.4 Post clearance cost

Other than the three main costs, *post clearance cost* might apply due to some additional activities such as document storage, use of duty suspending customs procedures, customs warehousing, and other special procedures. *Post clearance costs* refer to the compliance cost incurred as the subsequent costs when goods are leaving the ports (Grainger, 2014c). These costs deal with the expense for filing and storing documents for future auditing by external parties.

Before proceeding further there is additional cost category of hidden costs to consider, even though finding the empiric information is challenging. Other than direct and indirect costs, Moise and Bris (2013) presented the hidden costs as part of the cost classification in the trade transactional costs. They address the costs and risks due to the smuggling of informal trade, corruption practices that involve public and private organization, and bribery. Such hidden costs will occur more often when the compliance procedure is too complex, when there is a lack of efficient control, and involves more bureaucracies.

Corruption is one of the examples of hidden cost. Hors (2001) in the OECD report shared an example of a fraudulent corruption (one of the types of corruption other than routine corruption and criminal corruption) that occurs when the traders or agents ask for a “blind eye”, or an active collusion of the customs treatment so that there is a reduction in the fiscal obligation like the tariff to enlarge involved parties’ earning. Such collusive corruptions mostly occur to set an agreement since shipper has a tendency to under-report the value while bureaucratic tends to over-report the value.

4.4 The compliance cost model

The Import Compliance Cost Model is visualized in Figure 4 below (Figure 4 represents a simplified version, the full version is available in Annex A). The model presented in Figure 4 is an adaptation of basic compliance cost classifications from several of the studies of Grainger and is enriched by other studies (see the references provided next to the cost categories in Figure 4 or in Annex A for the full version).

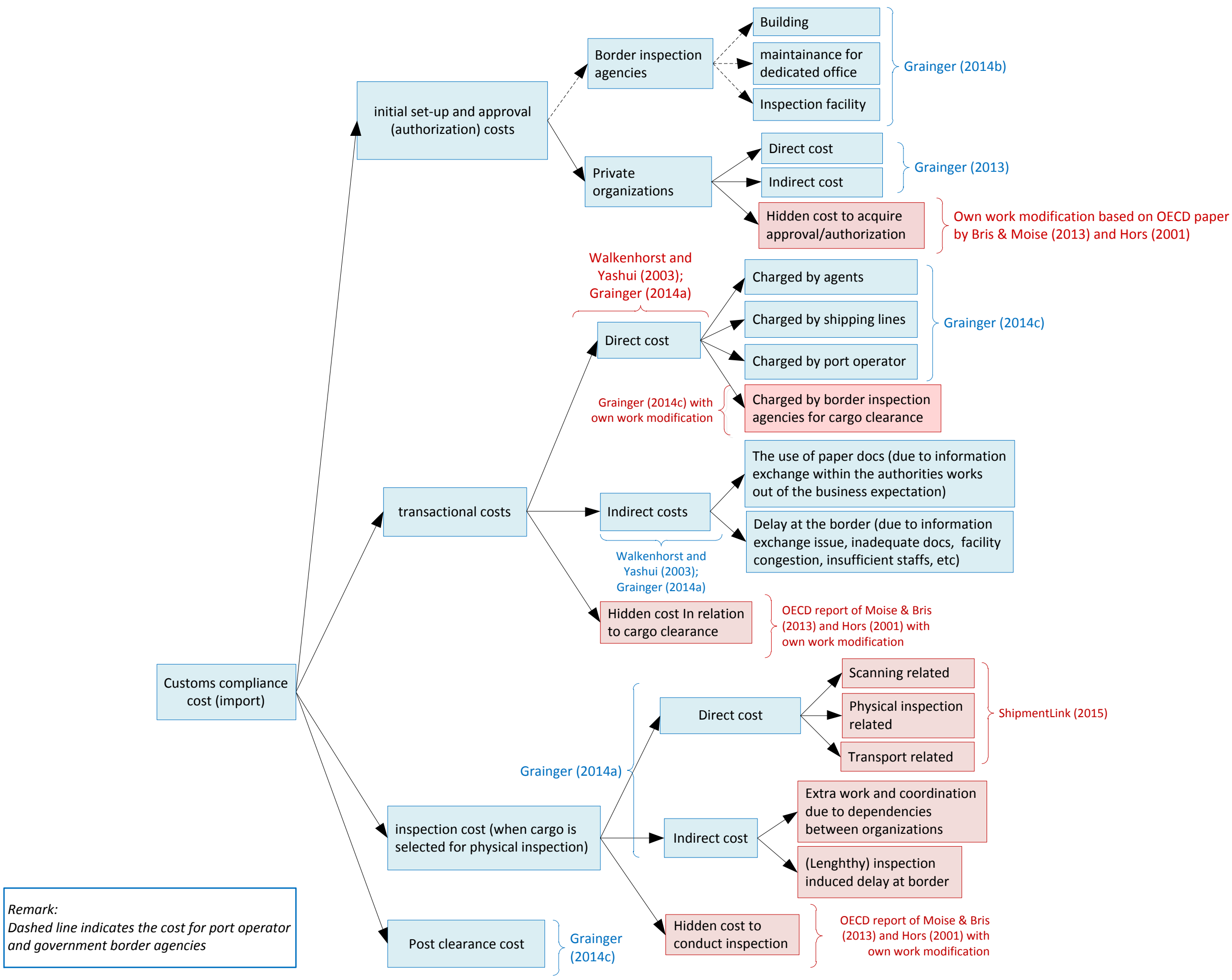

Figure 4. The extended model of import compliance cost based on Grainger

The model presented in Figure 4 is able to explain the compliance costs on a company level. These compliance costs can be seen, in terms of the terminology of Anderson & van Wincoop (2004), as *policy barrier to trade*. However, this model alone is not sufficient to address the total trade cost from point of origin to point of destination. Therefore, the import compliance cost model (Figure 4) is combined with the first trade cost model (Figure 3) to provide a more comprehensive view of the trade and compliance costs.

5. THE CONSOLIDATED MODEL: COMPANY LEVEL COMPLIANCE COST (CLCC) MODEL

The trade cost model (Figure 3) is limited in explaining the border related barriers, in particular to the *policy barriers*. The compliance cost model (Figure 4) on the other hand provides specific compliance-related cost constructs as a form of regulatory policy. As such the *policy barrier* can be seen as a linking concept which can allow inter-relating the two models. Moreover, the compliance model actually represents the border-related barriers, which are the synonym of the non-tariff costs (except the transactional cost by Customs which is part of tariff). If the *policy barrier* in the first trade cost model refers to the *tariff* and *non-tariff* measurement costs, thus it can be suggested that the concept of *compliance cost* (which can capture costs both at origin/export and at destination/import) is related to the concept of policy *barrier* in the trade cost model.

As a result, the Company Level Compliance Cost (CLCC) model that we developed is visualized as follows (with the full version presented in Annex B).

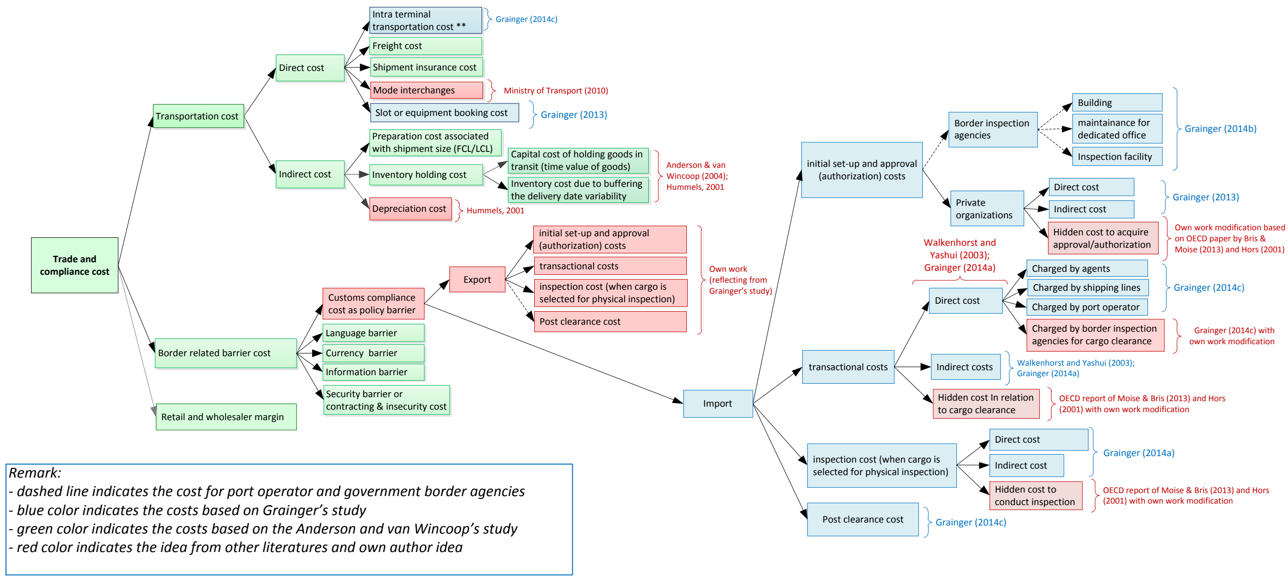

Figure 5. The Company Level Compliance Cost (CLCC) model (simplified version)

6. APPLYING THE CLCC MODEL TO A CASE STUDY RELATED TO IMPORT OF PERISHABLE GOODS FROM KENYA TO THE NETHERLANDS

In this section, we demonstrate how the CLCC model can be applied to a case study in the context of the CORE project. The case concerns import of perishables from Kenya to the Netherlands, where three shipments were followed in detail. Data was collected by the authors with active support from the perishable shippers, their freight forwarders and Dutch and Belgian Customs. The cost data collected from these shipments was used, first of all, to demonstrate how the CLCC model can be applied to capture and categorize the costs that were reported. Second, based on the case data extensions to the CLCC model were proposed to capture costs that were identified from the case but were not yet captured in the initial CLCC model. As such, the case study allowed to demonstrate the applicability of the model by using real-life examples and at the same time enabled us to extend and further develop the model.

In the remaining part of this section, we discuss the costs that were identified for each of the three shipments that were analyzed.

6.1 First shipment: vessel delay and no active alert of the change

In this case, the vessel was planned to arrive, i.e. Estimated Arrival Time (ETA), on 10 January 2016 evening at Antwerp port. However, the Actual Time of Arrival (ATA) deviated from planning and the ship arrived the next day 11 January 2016 at 16.00 pm. Unfortunately, this new ETA information was not proactively communicated; neither to the importer ABC nor to their freight forwarder. As a result, the truck that was arranged for January 11 early morning to pick up the container from Port of Antwerp for further Inland Move transportation to the Netherland could not pick up the container, even after waiting for two hours, as the trucking company was not informed about the vessel delay. The truck had to leave the port and had to come back again on the next day, on January 12 in the morning.

Furthermore, the container was selected for inspection. Therefore, after the container was unloaded in Antwerp port and completed the scanning process (by Belgian Customs), it was then transported by truck under NCTS transit arrangement to the importer's warehouse in the Netherlands to complete the actual customs import administration and final customs clearance conducted by Dutch customs. In this particular case, luckily there was no queue in the container scanning process at Belgium so that there was no additional waiting time as happens regularly.

First, there was €150 additional cost for the truck entering the port. This cost is categorized in the *Direct Transportation Cost* as the *freight* for the *domestic/inland movement at the destination* as the expense charged to the importer for the transportation service, the vehicle use, driver (normal) charge, handling, fuel, etc provided by the trucking company[5]. This cost confirms the applicability of the category Direct Transportation Cost in our Company Level Compliance Cost (CLCC) model.

Second, there was an extra cost of €250 for the truck waiting time as the truck company was not informed about the vessel one-day delay arrival. This cost can be categorized in the *direct transportation cost* as the additional *freight* cost for the *domestic/inland movement* at the *destination*, specifically as the *overtime* cost. This cost confirms the applicability of the term *Direct Transportation Cost* in our CLCC model.

Third, there were at least 30 e-mail messages and phone calls made to re-arrange the handling of the last minute's change, with a total value at around €200 (assuming an e-mail and/or phone calls takes 10 minutes with the time value of personnel costs of €40/hour). Thus there were extra costs to monetize the extra work for *communication and coordination to arrange/re-arrange transportation* due to very last minute transport arrangement change. It is then classified as *Indirect Transportation Cost*, and the initial CLCC model should be revised to cover this cost category.

The figure below shows how the CLCC model can be applied to capture the costs that were identified. In this case, three extra costs on top of the normal transport costs were reported. We used the CLCC model to capture these costs (see Figure 6). The red boxes in Figure 6 show the route that we followed to move from main cost categories to sub-categories in the CLCC model to more accurately classifying the costs encountered in the case, and the green balloons explain the actual cost measurements for this specific case.

In the case we also identified costs which we could not capture in our model, we, therefore, needed to extend the model. The revision is captured in the yellow box in the figure below, where *Communication and coordination to arrange transportation* is then added as a new category under Indirect costs in the CLCC model.

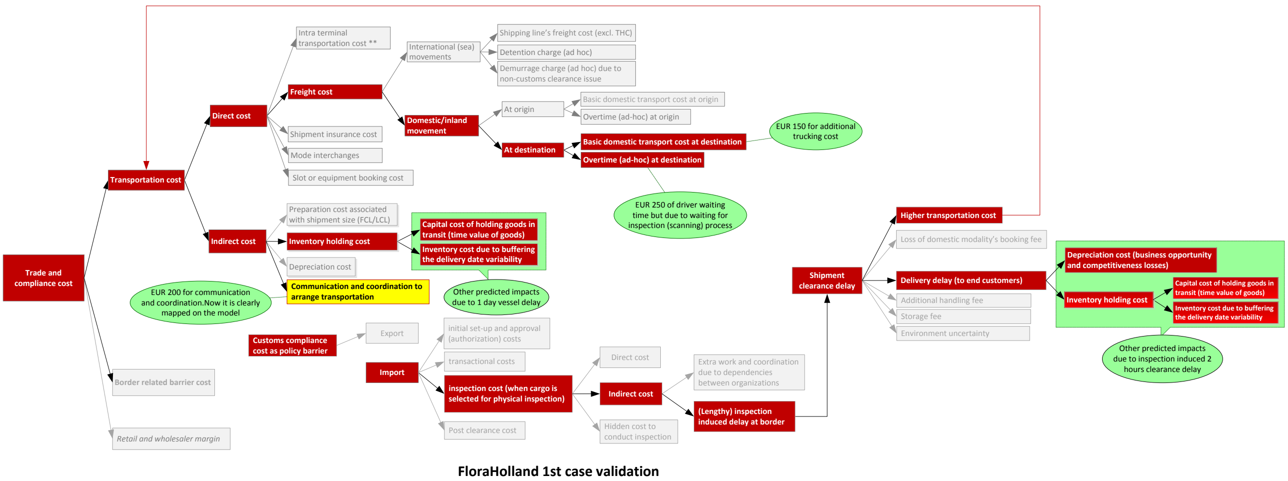

Figure 6. The mapping of the costs that are identified in the first shipment to the CLCC model[6]

6.2 Second shipment: delayed administrative procedure

This shipment was initially scheduled to arrive on Sunday, 7 February 2016 and a truck had been arranged to pick up the container on Monday, February 8th early morning since the importer needed the cargo immediately to meet the peak season demand related to one of the holidays. The particular vessel arrived one day earlier than the initial schedule date Saturday, February 6th.

On Monday morning, the shipment status indicated that the required arrangements (including needed documents) to transfer the phytosanitary inspections from Belgium to the Netherlands were not successfully met (we do not have detailed information of why this happened). As result,

[5] We use italicized capitals to indicate cost types that come from our Company Level Compliance Cost (CLCC) model
[6] Note: Due to the complexity of the model the figures are very large and hard to read on a printed copy. They are readable on an electronic version of the paper, as the images allow zoom-in.

the local office of the plant health inspectorate of Belgium (FAVV) had to give the highest priority to issue the transfer document, so that the container could be cleared from the port of Antwerp and transported by truck to the Netherlands. The truck had to wait for 6 hours before the cargo was ready for pick up after the FAVV issued the document and assigned the courier to collect it and deliver it to the transporter in the port of Antwerp. This waiting time is much longer than the initial time period that was estimated at only 3 hours to prepare these documents. As a result, there was a rescheduling activity involved at least 14 e-mails and/or phone calls, plus the 5-hour delivery delay to the importer's warehouse.

So first, there were 6 hours waiting time for the truck until the container could be cleared from Antwerp port. This cost can be categorized in the *direct transportation cost* as the additional *freight* cost for the *domestic/inland movement* at the *destination*, specifically as the *overtime* cost. This cost confirms the applicability of the term *Direct Transportation Cost* in our CLCC model.

Second, there were at least 14 e-mails and/or phone calls made, which total to around €93.33 extra cost. This communication was necessary to arrange the paper-based phytosanitary certificate, and in addition, there was the cost to send the document per courier post. However, the initial model has not explicitly covered these costs. Therefore, two new costs constructs of *'(back and forth) coordination in the document arrangement'* and *'courier cost'* to transport documents were added in the *indirect transactional cost* in consequent of the use of paper documents as the initial practice.

Third, there was a 5-hours container arrival delay at the importer's final destination. This shipment delivery delay to customers is mapped as the *shipment clearance delay* induced *delivery delay to end customer*. Even though there are no further impacts were mentioned in the CORE research, the CLCC model is able to predict several impacts due to the delivery delay such as the *depreciation cost (business opportunity and competitiveness losses),* and the *Inventory holding cost*. The Figure 7 below illustrates how the costs can be captured by using the CLCC model. The yellow boxes indicate the additional categories added to the model based on the insights from the second shipment.

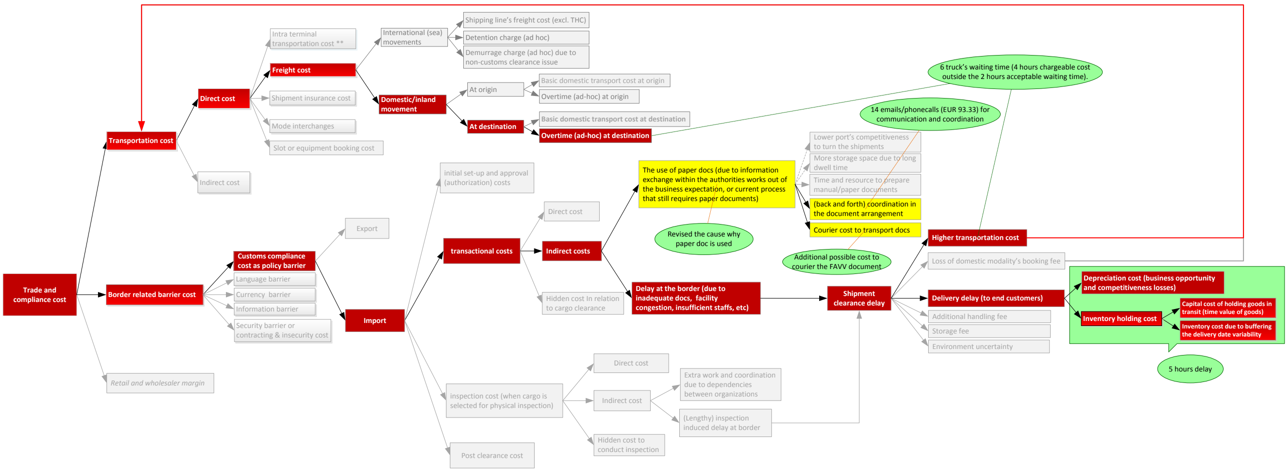

Figure 7. The mapping of the costs that are identified in the second shipment to the CLCC model

6.3 Third shipment: vessel delay and delivery delay

In the third case, a shipment of the perishable importer with Actual Time of Departure (ATD) from Mombasa on 17 March 2016 is examined. This shipment faced an arrival delay and was worsened by a further delivery delay due to customs' physical inspections at the Netherlands. The shipment was planned for arrival (ETA) at Antwerp on Sunday, April 10 at 14.00 pm. The truck for container pick-up at Antwerp port was planned on Monday morning of April 11 at 06.00 am. Unfortunately, there was a vessel delay that made the arrival changed to Monday, April 11 at 06.00 am. Therefore, the container picks up was rescheduled to the next day, Tuesday, April 12 at 06.00 am with new estimated arrival at the importer warehouse in the Netherlands on Tuesday at 11.00 am.

During the clearance process at Antwerp port, Belgian customs authority did not receive an inspection request from the UK customs (as the first EU port visited for that particular container), means the specific cargo has had the 'green light' on the ENS risk analysis. Therefore, the container clearance at Antwerp port went smoothly after the importer re-arranged the truck to the new date arrangement.

With such new arrangement, the truck successfully delivered the container with actual arrival at the importer warehouse at 10:00 am, one hour earlier than the revised estimation. The container was subsequently selected for physical inspection by Customs. The team for physical inspection was lined up. Subsequently, after some delay, the importer received a message from Customs that the inspection would not take place and the goods were cleared around four hours after arrival.

For this shipment, three types of costs are reported. First, a lot of e-mail messages and phone calls involved. Different to the first and second cases, this communication activity is classified as two different costs based on the activity area. For the container pick up date change, the *communication and coordination to arrange transportation* are classified as the *indirect transportation cost*. Meanwhile, the *back-and-forth communication and coordination to arrange inspection* falls under the *indirect inspection cost* as it is meant to conduct the inspection and applied for selected cargo only.

Second, there was 4.5-hour waiting time of staff at the importer's warehouse, leading to around €180 extra cost. Assigning certain staff to assist and stand by at the inspection process is categorized as an *indirect cost* for the perishable importer due to the inspection activity. Unfortunately, this extra expense of *additional organization internal cost (e.g. assign staff, rent inspection area, etc.)* has not been addressed in the initial model. Therefore, a revision is needed to the CLCC model.

Third, there was a delivery delay to the end customers for at least four hours delay due to the inspection arrangement which is part of *indirect inspection cost*. This 4-hours delay is on top of the other 1-day vessel arrival delay from the initial schedule. To address these two types of delay, the CLCC model offers one cost category of *shipment clearance delay*, either due to issue in the *transactional process* or *inspection planning*. The impact is focused to the *delivery delay to end customers* which can be the *business opportunity* and *competitiveness losses* (depreciation cost), or the *inventory holding cost*.

Figure 8 below demonstrates how the costs can be captured by using the CLCC model. The yellow box indicates the new concept that was added to the model based on the case data from this shipment.

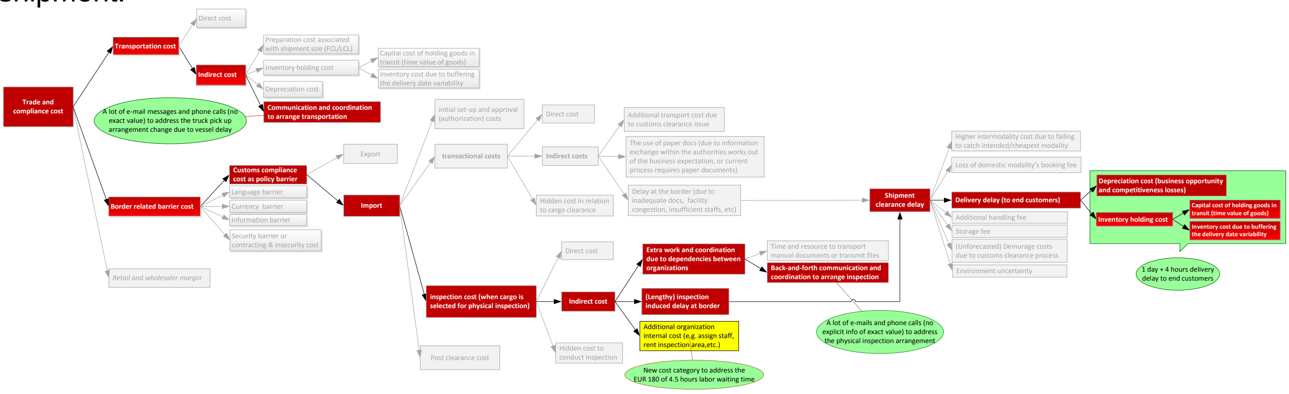

Figure 8. The mapping of the costs that are identified in the third shipment to the CLCC model

6.4 Revised CLCC model based on the case findings

Based on the case findings the CLCC model was revised and extended. The extended version of the CLCC model can be found in Annex C.

7. CONCLUSION

Based on a survey of the literature on trade and customs compliance models we combined the most suitable models in our Company Level Compliance Costs (CLCC) model; with the specific objective to develop a compliance cost model that is applicable to analyze compliance costs at the company level. Subsequently, we validated this model by applying it to a case study conducted in the context of the CORE project, by examining costs identified from three shipments. Cost data captured during these three shipments were used to demonstrate how the initial model can be applied to analyze the costs that occurred. The initial CLCC model was also further extended, based on data from the pilot shipments.

The CLCC model can be used as a framework to measure the cost and benefits of the introduction of data pipeline innovation at a company level. For example, we observed that lack of updated information regarding the Estimated Time of Arrival of the vessel or lack of information regarding the status of a Phyto-transfer document results in additional costs. The model can help key stakeholders such as shippers, freight forwarders, or the port authority to better assess what trade and compliance cost their organizations might incur, and then to assess how the application of supply chain data sharing IT innovations such as the *Data Pipeline* can help to reduce these costs. In this way, the model can foster the adoption of supply chain data sharing IT innovations such as the data pipeline. These supply chain data sharing IT innovations are the essence of trade facilitation solutions such as Port Community System, Single Window and Coordinated Border Management that can provide benefits for border inspection agencies to increase the effectiveness and efficiency of their revenue collection and security control, and they can provide benefits to trade for cost reductions, faster clearance, better supply chain predictability (U.N.E.C.E, 2005).

This research also has some limitations. First, the CLCC model was validated by three shipment cases, hence it has the basic limitations of case studies; namely that we do not have empirical evidence about the frequency of the delays that we observed. However, experts from the organizations that participated in the case studies confirmed that the delays we observed do occur quite frequently. Second, the model was developed based on a case study with specific plant products, hence the findings might not generalize to other commodities that have other inspection agencies at the border (e.g. electronics with dual-use inspections). Third, this model focuses on the compliance costs related to import only, and it does not address the compliance costs for export. In future research, we plan to conduct more case studies to overcome these limitations of the CLCC model.

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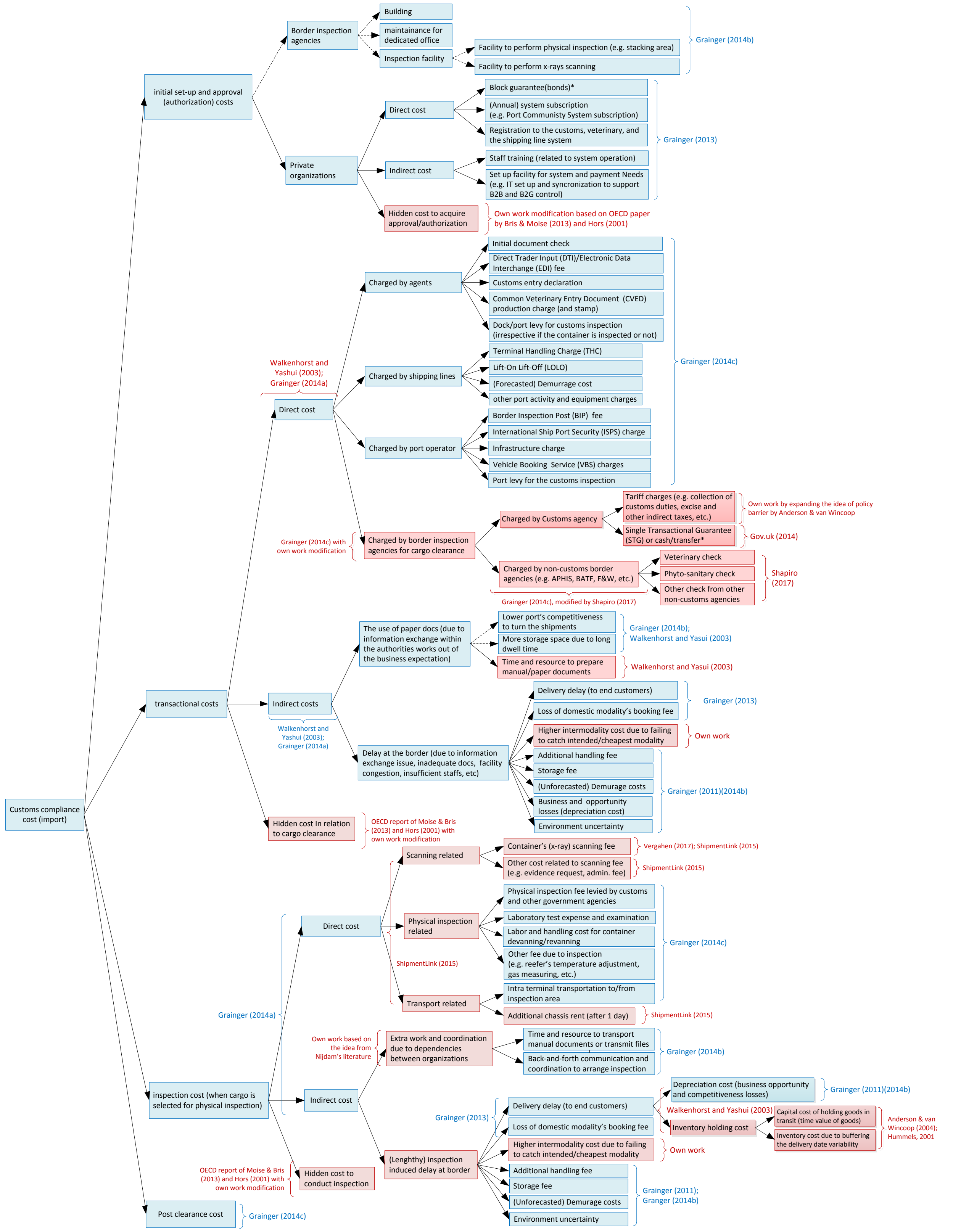
Annexes

Annex A



Remark:
- dashed line indicates the cost for port operator and government border agencies
- BATF = Bureau of Alcohol, Tobacco and Firearms
- F&W = Fish and Wildlife service
- FDA = Food and Drug Administration
*- *) cost is only applied to one of the costs with this asterisk mark, should not be double*

Figure 9. The full version of the extended model of import compliance cost developed by author based on Grainger

Annex B

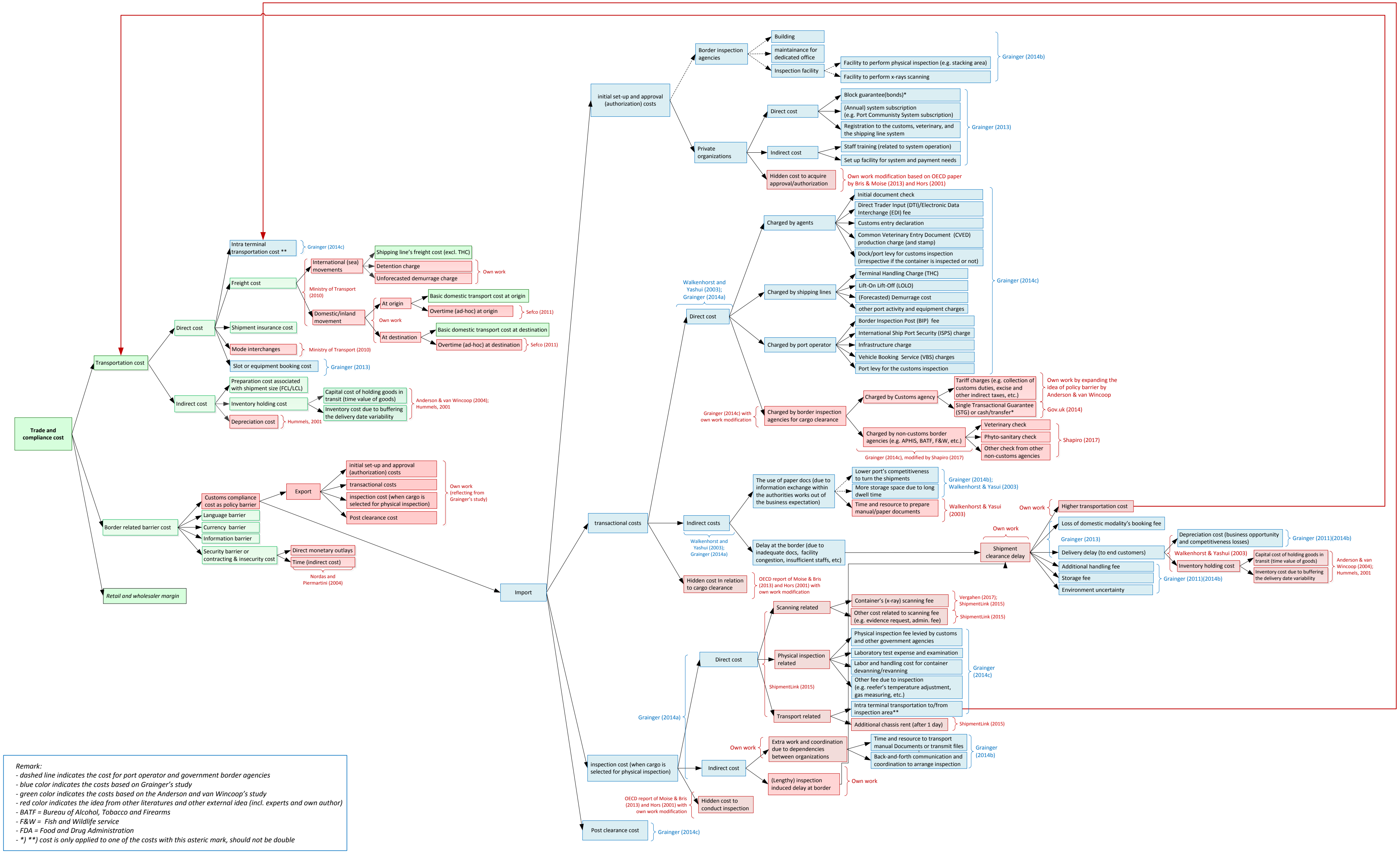


Figure 10. The Company Level Compliance Cost (CLCC) model (full version)

Annex C

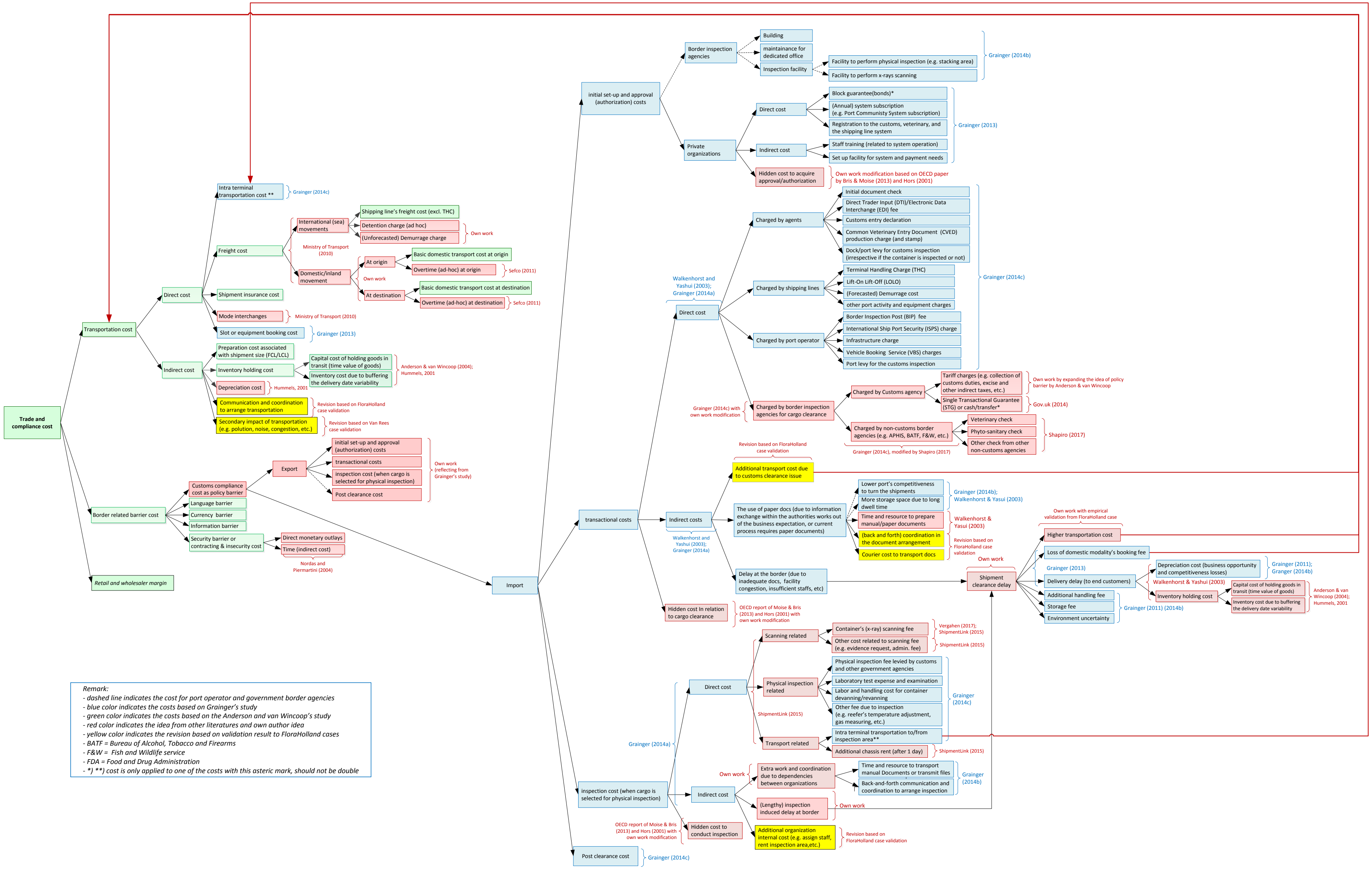


Figure 11. The revised CLCC model with the revision upon model application to the perishable shipments