Synthesis of Case Study Results: Applying a Carbon Accounting Framework in a Developing Country
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About Smart Freight Centre
Smart Freight Centre (SFC) was established in 2013 as a global non-profit organization and aims to make the global freight sector more environmentally sustainable and competitive. SFC works with industry and other stakeholders to remove market barriers to catalyze the uptake of solutions throughout industry that improve fuel efficiency, reduce emissions and lower operating costs.

SFC focuses on three approaches:
Drive industry leadership (“Smart Freight Leadership”) and take the development of effective green freight programs to a global level by making a connection between them to maximize cooperation and alignment
Create a universal and transparent way of calculating logistics emissions across the global supply chain through the Global Logistics Emissions Council (GLEC).
Catalyze the sector-wide adoption of proven and cost-effective technologies and solutions starting with a green tire package in China through SFC’s Green Trucks China project.

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About this document

This case study was led by Smart Freight Centre (SFC) in the Netherlands in partnership with the Thammasat Business School, Centre for Logistics Research in Thailand. Funding was provided by the World Bank Multi-Donor Sustainable Logistics Fund. With the intention of developing local capacity as well as communicating with international stakeholders, this report provides a high-level understanding of the state of logistics carbon emissions and their disclosure in Southeast Asia using local case studies as a guide. The focus is on how the emissions assessment was applied and the learnings of the case study companies as a tool for understanding how carbon accounting can be expanded in the region.
Overview of case studies

The purpose of this case study was to test and validate the Global Logistics Emissions Council (GLEC) Framework\(^1\) the leading carbon accounting methodology for the logistics sector, in Southeast Asia.

The team from Thammasat Business School, under the guidance of Smart Freight Centre, worked with local freight transport companies to understand the perspective of local companies on emissions accounting, and on sustainability in general. The following points summarize the key objectives:

- Generate GLEC Framework calculation outputs and compare process, data requirements and calculation outputs with current approaches
- Determine the effort needed to switch from current approaches to using the GLEC Framework
- Identify what can be done to further improve data quality by using the GLEC Framework
- Understand how the GLEC Framework can improve reporting and decision-making

The scope of the study is freight moving along the East-West Economic Corridor (EWEC) in Thailand, Laos and Vietnam. Like many areas in Southeast Asia, the EWEC is targeted for development in the coming years in order to advance trade with China, Japan and beyond.\(^2\)

The routes chosen in this study do not follow the EWEC exactly, but the transport chains of the participation companies encompass some segment of the EWEC route as shown in

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\(^1\) Global Logistics Emissions Council

\(^2\) The EWEC is targeted for development in the coming years in order to advance trade with China, Japan and beyond.
Figure 1. The shipments included trade within Southeast Asia, transport of goods to China, and the flow of exports to the major ports in Vietnam or Thailand.

Since carbon accounting and disclosure is a relatively new concept in the region, companies that participated in the case study received free training, an invitation to the GLEC Workshop in Bangkok, data templates and support in the analysis. Information on each case study is included in the following sections.

**Case Study #1: ICL International Co., Ltd.**

**About the company**

Founded in 2008, ICL International (ICLI) is a trucking company based in Mukdahan and Nakhon Phanom, Thailand. Their primary business is the transport of fresh fruit from Thailand to China. They specialize in cross border refrigerated transport in Greater Mekong Sub-region. They operate five container depots along their main trucking routes: Mukdahan and Nakhon Phanom, Thailand; Na Pao and Dan Savan, Lao PDR; Dong Dang, Vietnam. This is the first time ICLI has conducted a GHG emissions assessment.

**Selected routes**

In this study two common supply chains were considered. As the shipments were fresh fruits, temperature-controlled containers were used to maintain the quality of products along the routes. The fresh fruits were collected from Thailand and delivered via Lao PDR and Vietnam to You Yi Guan, Pingxiang in Guangxi Zhuang Autonomous Region, PRC China.

The transport chain had two parts. For the first segment, a Thai truck transported the cargo to the border of Lao PDR and Vietnam. Thai trucks are not allowed to enter Vietnam, unless they have obtained the necessary license under the GMS-CBTA. In this particular case, the container was transferred to a Vietnamese truck owned by a partner company and the cargo was delivered to its destination in China.

Two commonly used trade lanes were considered in this study:

**Route 1:** Nakhon Phanom – Chantaburi – Nakhon Phanom – Lang Khang – Dong Dang – You Yi Guan: this route is for the transportation of fresh mangosteen from Chantaburi

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1 The Greater Mekong Subregion Cross Border Transport Agreement (GMS-CBTA) allows for each signatory country to have 500 licenses for cross border transit transport. However, these trucks can only use the designated economic corridor such as the EWEC from point to point and cannot deviate from the designated routing.
(Thailand) to the customer’s warehouse in You Yi Guan, located in the southern area of China.

**Route 2**: Nakhon Phanom – Chiang Mai – Nakhon Phanom – Lang Khang – Dong Dang – You Yi Guan: this route is the transportation of fresh longans from Chiang Mai (Thailand) to the same destination as route 1 in China.

**Data collection**

The company has a well-established data tracking system. Required information such as fuel consumption, distance, transit time and cargo weight for each transport leg were precisely recorded into the system. Thus, it was not complicated to calculate carbon emissions according to GLEC Framework for activities operated directly by ICLI (scope 1). Data were more difficult to collect on shipments run by the subcontracted partner in Vietnam. This is a common scenario throughout the world, where emissions from the scope 3, or supply chain, partners are more difficult to quantify accurately using primary data as compared with direct (in-house) activities. As such, emissions were estimated using the GLEC Framework’s scope 3 guidance, an appropriate and valid choice leading a reasonable level of accuracy.

**Fleet Data**

The mode of transportation for all routes was an articulated truck with a 40ft hi-cube refrigerated container. ICLI has 79 tractor units in Thailand, an
example of which is shown in Figure 3. Of these, 47 were ISUZU GXZ 360 with a EURO III diesel engine. The other trucks were HINO QDR 500, also with a EURO III diesel engine. Because the cargo was fresh fruit, the generator-powered refrigerator plays a vital role. A diesel generator was installed on each truck, consuming around 4.5 liters of fuel per hour along the journey. The exact level of temperature control can vary according to the nature of the cargo.

![Generator powered refrigerator on truck](image)

**Figure 4 ICLI generators installed on truck**

**Shipment Data**

This case study focused on the movement of fresh produce (mangosteens and longans) from Thailand to China along two common shipment routes.

**Mangosteen shipment.** ICLI completed roughly 1700 shipments of Mangosteen at an average 20 tonnes per truckload during the study period. In one example, a shipment departed from a farm in Chantaburi, then travelled to the Lao border. This border crossing can take a considerable amount of time, during which the mangosteens must be constantly refrigerated. The shipment then proceeded to the Vietnamese border, when it again had to wait to cross from Na Pao, Lao to Cha Lo, Vietnam. At that point, the shipment was transferred to a Vietnamese truck, likely using diesel operated equipment, then transported to the border crossing at Dong Dang, Vietnam and You Yi Guan, China. At this point, the container was transferred again to a Chinese truck. Both the Thai and Vietnamese trucks returned to ICLI headquarters empty. For this shipment, the total roundtrip was just over 3000 kilometers.
A summary of the time taken for the various trip legs is shown in Figure 5, calculated using the Banomyong time model. The most significant delay can be seen at the border crossing with Lao, where the trucks waited 18 hours to cross. During that time, the trucks were able to plug their generators into electric power stations so diesel fuel burn was not required.

**Figure 5 Representation of the time taken to travel between the starting point and the Thai-Vietnam border**

**Longan shipment.** ICLI shipped roughly 1200 shipments of longans at 28 tonnes each during the study period. Shipments departed from Chang Mai, Thailand and traversed around a mountain range to the border crossing with Lao. On the return journey, trucks are able to take a shorter path across the mountains as the truck is better able to manage the hills on the reverse trip. The truck then proceeded to the same Vietnamese border crossing described above, where it switched to a Vietnamese truck, as above, and proceeded to the Chinese border. The Banomyong time model is shown in Figure 6.
Case Study #2: Lao Nissin SMT

About the company

Lao Nissin is a Japanese-Laotian company that is the biggest international logistics service provider in Lao PDR. They specialize in international border crossing for deliveries between Hanoi and Bangkok, increasing efficiency by allowing freight to travel between countries using one truck and driver for the entire trip.

They use Lao registered trucks only as Lao PDR have bilateral agreements with both Thailand and Vietnam related to exchange of traffic rights. This means that there is no need to change trucks for cross border transportation services between Thailand and Vietnam.

Selected routes

Two routes, covering various types of cargo, according to the following paths were chosen, as shown in Figure 7:

Route 1: Savannakhet – Cha Cheong Sao – Savannakhet: This route is the cross-border transportation of automotive parts between a factory in Savan-Seno Special Economic
Zone) Savan Seno SEZ (in Savannakhet, Lao PDR and a factory at Gateway Industrial Estate in Cha Cheong Sao province, Thailand.

Route 2: Savannakhet – Prachinburi – Savannakhet – Quang Tri – Savannakhet: This route is the cross-border transport of consumer goods (snacks) from a factory in Prachinburi, Thailand to a customer’s warehouse in Quang Tri, Vietnam.

Data collection
As the company is a joint venture between Lao and Japanese companies, a Japanese system has been adapted to the company. The Japanese data recording approach is very effective, and records all the necessary data of particular shipment such as fuel consumption, total distances, cargo weight, transit time and even driving behaviors of the driver. Consequently, the data were available and accurate for emission calculations using the GLEC Framework.

Fleet data
Lao Nissin SMT in Savannakhet branch has nine tractor units for carrying 45ft. containers as shown in Figure 8. All the tractor units are ISUZU EXZ51KLZ and have Euro II diesel engines.
Shipment data

The first route involved the transportation of auto parts, transported on pallets, between the factory in Savan Seno Special Economic Zone (Savan Seno SEZ) in Savannakhet, Lao PDR and the assembly plant in Gateway industrial estate in Cha Choeng Sao. In terms of total transit time and distance, the Banomyong time model is used to represent the relation between time and distance of the trip, as shown in Figure 9. Most of the transit time involves transportation while the vertical steepness of the graph represents non-moving activities such as the border crossing.

![Figure 9 Time model for the first route](image)

The second route involved the shipment of cartons of bakery goods. The route had many stops, which added to the shipment time but also potentially reduced efficiency.
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Synthesis of company feedback

Feedback from ICLI

During the data collection process, ICLI willingly provided every aspect of data needed for the emission calculation. They felt it was a good opportunity for the company to be the first Thai transport company to participate in a GLEC case study. The company is open for any application of the GLEC Framework that will increase their business potential. However, the company is unclear on how to use the results of the calculations. What is the impact of GLEC Framework implementation to the company? The answer is still needed for further development and implementation.

Feedback from Lao Nissin

Perhaps due to their association with Japanese multinational Nissin, Lao Nissin has had previous requests to calculate their carbon footprint. The company felt that this project was...
a good starting point for addressing the concerns of emissions in order to meet potential future requirements from the transport sector and country. It’s becoming evident that environmental issues are a critical issue that the company will no longer be able to avoid. However, in term of using results, Lao Nissin felt the same way as ICL International: the company would like to know what can be done with the result of calculation. What is the impact of using the GLEC Framework to the decision-making process in the company?

**Feedback from Other Companies Approached for the Case Study**

A number of other companies were approached to conduct the case study. Firstly, the GLEC Framework was proposed to the one of the biggest transport companies in Thailand, SCG Logistics. While the board was very interested in the study, they already use their own method of emission calculation. They were also hesitant to share emissions information publically.

Kerry Logistics was interested in the study and permitted us to do an emission calculation. As the selected transport chain is in the set-up stage, there were problems in the data collection process. The required data do not exist, the data would have to be back-calculated from other operational data which would have been quite complicated for the emission calculation.
Summary of results

Companies were assured that emissions data calculated during the case studies would remain anonymous. As such, specific information on fuel efficiency will not be disclosed here. The companies, however, were involved throughout the data collection and analysis and received a full report of the case study. The transport operations mimicked global trends in several ways; a summary is included below:

More data needed to achieve robust results. Due to time constraints of the case studies, the emissions calculations were limited to a small set of shipments; therefore, the results must be considered in this context. A more comprehensive study would be needed to complete a more detailed analysis, as well as to follow the guidelines within the GLEC Framework for calculating a fuel consumption factor based on a larger set of data. That said, the companies have shown the data availability and the skill to be able to extend the study to their full transport operations according to the methodology requirements.

Efficiency could be improved by reducing empty running. Empty backhauls, which lowers fuel efficiency, were typical, as is common in many sectors, and particularly in developing economies. Empty running is estimated to be at up to 50% worldwide, depending on the type of goods and overall balance of trade flows, which was observed here as well.

Local benchmarking needed. The results show a variation in fuel efficiency that points to a need for a set of industry average fuel consumption factors that better represent local conditions. For the shipments analyzed in this study, some showed fuel efficiency higher than global average values and others were lower than average. Refrigerated shipments used more fuel, as would be expected. While there was not enough data from this study to make a robust generalization about the region or company, further studies following the same approach would improve the broader understanding of the region and allow companies to benchmark their operations in the context of their local region.

Mapping time points to emissions saving potential. The inclusion of the time perspective was helpful for understanding where inefficiencies occurred within existing transport infrastructure. A clear area of inefficiency in the case studies was at the border crossings. Drivers waited long periods of time either in line at the checkpoint, or in some
cases, to wait for the checkpoint to open in order to cross. The ability to plug in refrigeration units (generators) to electricity sources in some locations reduced the combustion of fuel on-site – a benefit in terms of local air quality as well as GHG emissions. This is a positive strategy that should be expanded. Finding other mechanisms to streamline border crossings for companies would greatly improve efficiency as well as reduce costs.

**Research needed on local fuel production.** Another element that could add to uncertainty in results is the GHG emissions associated with local fuels. The GLEC Framework takes the full fuel life cycle into account, meaning emissions from fuel production, distribution and combustion are considered. While the emissions related to the combustion of fuels is rather generic, the upstream emissions from fuel production and distribution can vary depending where fuel is processed. For example, fuels produced in China have higher emissions than those produced in the EU or US, where environmental legislation is stricter.4 Fuel used in the study area are refined locally, therefore it may be a worthwhile effort to develop specific well-to-tank emissions factors for the most common fuels, particularly diesel, to improve the accuracy of the final result.
Conclusion

The case studies showed that, by and large, the case study companies were able to apply the GLEC Framework to assess their emissions. Data availability was not a barrier, at least for scope 1 calculations, and in fact was robust enough to follow the Black Carbon Methodology for Logistics, which requires a more detailed data than the GLEC Framework. For the supply chain (scope 3), data were difficult to obtain, which is a standard issue across sectors and geographies.

A clear hotspot in emissions at border crossings, where vehicles have to wait and/or transfer equipment to different trucks. This uses additional fuel and also increases the time of delivery. This is something that governments could seek to address in order to smooth logistics operations in general. The potential to move goods from trucks to trains was not considered in this study, but also has potential to be leveraged for emissions reduction and, possibly, efficiency.

Market pressure from customers is not yet felt through the supply chain, although there is the first sign that it may be coming. Benchmarking emissions against partners, such as through the Green Freight Asia eco-label, could be used to judge if internal operations are up to scratch or if they subcontractors should be encouraged to improve their operations / equipment. Understanding as to how the data can be used by carriers to answer future customer enquiries still has to be built. This could be further by governmental climate initiatives tied to the Paris Accords and air quality goals tied to black carbon emissions.

The link between carbon reporting and operational transport management and fuel is not apparent; it seems that although data are captured, analysis linked to fuel management measures is not normal practice. This could point to the need for additional training for truck fleet managers, such as the Smart Transport Management Training program that Smart Freight Centre is developing, which ties fuel management to emissions and builds out best practices for efficiency. Additionally, and perhaps more importantly, company senior management needs to understand how this can impact their business efficiency and better loading or increasing the frequency of back hauls would not only reduce overall emissions but generate extra revenue, and so is good for business.
In summary, case study companies showed an interest in emissions accounting and that the calculations can be made relatively easily using existing data. However, work still needs to be done to explain why this is a worthwhile process and how it can help business. There is a general lack of awareness about emissions from transport, and the need to decrease emissions in the context of global climate goals. As time goes on, these pieces will likely correct themselves; however, support from the government and NGOs would help to improve the pace of disclosure and emissions reduction.
References


