

Insights paper: Exchange of logistics GHG emission data

The status quo, challenges, future necessities, and potentials across the supply chain

Amsterdam, July 2021



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About Smart Freight Centre

Smart Freight Centre (SFC) is a global non-profit organization dedicated to an efficient and zero emission freight sector. We cover all freight and only freight. SFC works with the Global Logistics Emissions Council (GLEC) and other stakeholders to drive transparency and industry action – contributing to Paris Climate Agreement targets and Sustainable Development Goals.

Our role is to guide companies on their journey to zero emission logistics, advocate for supportive policy and programs, and raise awareness. Our goal is that 100+ multinationals reduce at least 30% of their logistics emissions by 2030 compared to 2015 and reach net-zero emissions by 2050.

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Executive Summary

Over 100 multinationals are now using the GLEC Framework to calculate and report logistics emissions across the multi-modal supply chain. However, less than 20% of 2,600 surveyed companies that report to CDP disclose emissions arising from own or outsourced freight transportation and logistics. A key reason is that many shippers and LSPs have difficulties getting access to reliable data from their suppliers (carriers).

The Data Access for Logistics Emissions Accounting and Reporting (“Data Access”) project aims to support shippers, LSPs, and carriers by improving data access, exchange, and IT integration. The project started in January 2021 and is carried out as a project under the Global Logistics Emissions Council (GLEC) that is managed by Smart Freight Centre. This paper summarizes the findings of the first project phase. By creating awareness of these insights, we seek to increase joint action and momentum across the industry to improve the calculation and reporting of logistics emissions.

It is recognized that, by definition, global freight transport chains involve many companies to ship a consignment from A to B, ranging from owner-drivers and larger carriers, through intermediate 3PLs (of which there may be multiple tiers), to the procurement departments of the freight buyer. Each supply chain consists of multiple stakeholders and associated ICT systems that each collect and hold parts of the relevant data to make accurate GHG emission calculations. The integration and exchange of the required information is a prerequisite in the move towards more accurate calculation and reporting of GHG emissions and to enable and facilitate performance monitoring and decision making.

Figure 1 - Three perspectives on the challenge of the current lack of data exchange



Through interviews with various stakeholders, the following 5 insights on the status quo of GHG emission calculation reporting were gathered, highlighting the necessity for improved data-exchange guidance and standardization:

- 1. Each party calculates and reports GHG emissions but the exchange of values and the use of any exchanged values is limited.** This results in duplicity of calculations, differences in assumptions and input values used, and differences in reported emissions.
- 2. It is not just about the granularity of reporting but about using the right emission intensity granularity.** Everyone is seeking to move beyond annual reporting to enable performance monitoring and facilitate decision making; however, the accuracy of the data is to a large extent determined by the granularity of the emission intensity factor used.
- 3. The majority of systems in use by freight buyers use default and modeled data and cannot cope with primary data yet.** Although it is planned by all parties to move towards primary data directly from the supply chain, this is not yet implemented nor does a system exist where companies can reliably exchange these values that can cope with all modes and the sheer number of stakeholders involved in a supply chain.
- 4. Clear parameters and guidance are key to standardize any kind of exchange, independent of data type or use case.** Due to the absence of clear guidance, companies are not capturing the necessary information in their systems and subsequently calculate with partial information.
- 5. GLEC/ISO certified calculations by carriers or audited 3rd party intermediates will be needed to accept primary data.** Primary data poses new challenges towards the verification and validation of the accuracy of the methodology and the input data; third party assurance will be required for nearly all organizations to accept and start utilizing this informal reporting and decision making.

These insights will form the base input to phase 2 which will develop the required guidance and associated protocols to enable the data exchange across the supply chain, building upon existing standards.

1 Introduction

This insights paper outlines the current status quo and challenges concerning the exchange of information across supply chains to calculate and report logistics greenhouse gas (GHG) emissions. This paper concludes the first phase of the *Data Access for Logistics Emissions Accounting and Reporting project* ('Data Access project') carried out by Smart Freight Centre in consultation with GLEC Members and Partners.

1.1 Background

Over 100 multinationals are now using the GLEC Framework to calculate and report logistics emissions across the multi-modal supply chain. However, less than 20% of 2,600 surveyed companies that report to CDP disclose emissions arising from own or outsourced freight transportation and logistics.

A key reason is that many shippers and Logistics Service Providers (LSPs) have difficulties getting access to reliable data from their suppliers (carriers) and capturing these in their IT systems. Many carriers lack resources to collect the required data, often because their fuel and transport management systems don't track all the required parameters, or their IT systems aren't connected with each other. In addition, shippers and LSPs face the challenge to integrate and verify the data from a multitude of stakeholders within their system. These challenges were identified early on by the [LEARN initiative](#) as a key barrier for businesses to implement the GLEC Framework. The solution remains the same: Imagine if the IT systems of different stakeholders were better connected and everyone was capturing the right parameters to support emission calculations, emission calculations could be carried out more seamlessly. If this would be supplemented with a common and neutral data exchange protocol, sharing the necessary data between carriers, LSPs, shippers, and other users, calculating, reporting, and in turn performance monitoring and decision making based on emissions would be much easier.

The Data Access project aims to support shippers, LSPs, and carriers by improving data access, exchange, and IT integration. The project started in January 2021 and is carried out as a project under the Global Logistics Emissions Council (GLEC) that is managed by Smart Freight Centre.

This project is financially supported by a foundation.

1.2 Approach

The insights presented in this paper were obtained during phase 1 of the Data Access project between January and June 2021.

Phase 1	Phase 2 (July – December 2021)	Phase 3 (2022)
Status review: IT systems and logistics GHG emissions	Development of data exchange guidance and data exchange protocol	Test case studies Launch of exchange guidance

Activities Phase 1

- Initial conversations with various GLEC partners to finetune the project approach and general outline in January.
- Virtual kick-off workshop in February, attended by several different GLEC partners (Shippers, LSPs, IT providers, carriers). The workshop was used to shape the project's focus and identify the current challenges regarding GHG emission reporting and data exchange.
- 8 interviews with shippers, LSPs, and carriers have been subsequently held to discuss in detail how companies are calculating and reporting their GHG logistics emissions, what IT systems and solutions they use, for which use case, and what challenges they currently face regarding the data exchange.
- 7 interviews with IT providers in the field of GHG logistics emission calculation and reporting have been held to understand their current and future solutions, the status quo of data exchange possibilities, and their view on the industry and its current challenges.
- The insights gathered from the GLEC partners (see 4.2) were analyzed and discussed with the project group in a webinar in April 2021.

In the next phase of the project, a data exchange guideline, and data exchange protocol (see 4.1) will be developed based on the insights of this paper and in close collaboration with the project working group.

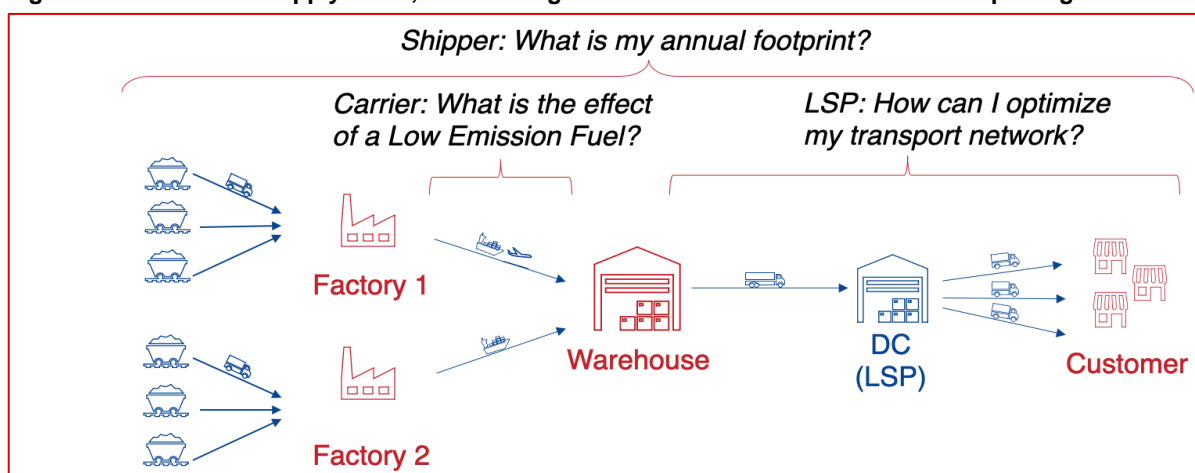
1.3 Drivers

In recent years the importance of logistics-related GHG emission accounting has increased steadily across all industries and supply chains. This increase can be attributed to three main drivers (see Figure 2), all of which highlight the importance of further improvements in data gathering and exchange processes.

1. An increasing number of companies are calculating and reporting their **annual GHG footprint** for reporting purposes to clients and external stakeholders. For shippers, it is becoming a mandatory practice as part of their Corporate Social Responsibility (CSR) processes. For LSPs and carriers, it is starting to become a part of their service offering.
2. GHG emissions are on the rise, getting an accurate picture is required to allow the **measurement of the progress** of reducing these emissions. Reduction targets and commitments (e.g. Science Based Targets initiative) demand from companies to have a precise calculating and reporting setup that tracks the impact of their optimization and reduction measures across their supply chain.
3. **Low emission fuels**, such as biofuels, require a more detailed understanding of the source of the fuel to correctly calculate and report their emissions. Carriers that make use of zero and low emission fuels and buyers of freight that invest in them want to ensure they can claim the resulting emission reduction benefits.

The majority of multinational shippers outsource their logistics and are reliant on other organizations (e.g. LSPs and carriers) to carry out the transport. Calculating the emissions and understanding them in detail due to any of the above drivers is therefore heavily reliant on exchanging this information across the supply chain. This increased interest as well as technological advancements have sparked a rise in IT service providers to focus on this topic and offer solutions for all parties involved.

Figure 2 - Generalized supply chain, showcasing different drivers for GHG emission reporting



1.4 Challenges

Although these drivers have led to a steady increase in the importance of the topic in recent times, the core challenge is not a new one, as already pointed out in the 2017 LEARN project:

“The challenge of several companies (is): how to integrate the collection, processing, and reporting of data needed to calculate fuel use and emissions into the existing TMS and broader IT and business systems and processes?”¹

This core challenge can be assessed from three perspectives: (i) multiple stakeholders, (ii) data collection, and (iii) ICT integration. This allows to understand what elements future guidance needs to focus on (see Figure 3 on the next page).

¹ Learn Project, 2017 ([https://nucms.nl/tpl/learn/upload/GLEC%20fw%20challenge%205%20%20Using%20results%20for%20decisions%20-%20online%20\(1\).pdf](https://nucms.nl/tpl/learn/upload/GLEC%20fw%20challenge%205%20%20Using%20results%20for%20decisions%20-%20online%20(1).pdf))

Figure 3 - Perspectives to understand the elements for emission calculations within a supply chain



Multiple stakeholders

Multiple parties are involved in almost every freight and logistics process. Especially global freight transportation is making use of several different transport modes, logistics service providers, and associated carriers that have additional subcontracted relationships with each other. On a shipment level, multiple parties are involved. Each party is responsible for a certain aspect of the transport, and with that also holding a part of the GHG emission relevant, party-specific information. On a company level, one multinational buyer of freight can have thousands of direct and indirect suppliers for logistics activities, while a carrier has multiple clients, often for the same transport. Despite the pure complexity of managing the different stakeholders, this 1:n and n:1 relationship between all parties introduces several challenges regarding data validation, standardization, automation and trust.

Data collection

The lack of actual data collection at a company level and across the logistics chain is currently the main reason why data is missing for precise GHG emission reporting and calculations (see Figure 4). This is due to several factors, including unawareness of which data should be collected, missing capabilities to capture the data in the IT systems as well as missing incentives for companies to collect the data in the first place.

ICT Integration

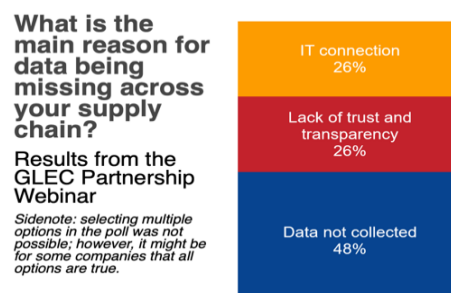
Data that is needed for GHG emission reporting needs to be captured, stored, and exchanged through several different IT systems that need to be designed to process such data and provide interfaces to one and another so that the relevant data can flow across the different parties in the supply chain. Additional details are described in section 1.5.

Additional challenges identified

As part of the Data Access project's phase 1, the following sub-challenges were identified by the GLEC partners, highlighting the complexity and multifaceted nature of the issue even more:

Auditability and verifiability of data is a challenge; need for a verification instrument •Need to follow the same GHG quantification standards and ensure comparability •**Accuracy of data** is a challenge: **different solutions exist** to calculate GHG, such as from **modeling, default, primary**, to reach the required level of accuracy. •Different indices are used: •as shipper, we need emissions per tonne-km •as carrier we have emissions of fuel consumption only •Ability to allocate emissions if carriers carry multiple goods from multiple shippers •**Ability to allocate emissions** if multiple fuels are being used(e.g. bio-LNG and LNG) •**Lack of understanding what information is required** for GHG calculations •Information from subcontractors does not flow in the shippers systems •Data is not registered in IT systems (i.e. fuel type,...) •Data and field structures of different **IT applications are not compatible**: multiple servers per source can have different field structures •Linking/connectivity of telematics with the TMS systems at carrier level •**Lack of standardized structure and language** for exchange of information •**Too many suppliers/actors in the supply chain** to work with, all with different situations on size, fleet, etc. making it very complex •Carriers are not willing to provide fuel data to stay independent in the choice of how they do their business •Shippers need to explain what is driving their needs and what information is required from their carriers i.e. focus their attention on what matters instead of demanding all information. **Many small carriers in the market** are difficult to incentivize to share primary data - Data is not exchanged due to lack of trust •Too many providers of telematics little or no standardized XML •**Lack of visibility** of fuel consumption and empty miles

Figure 4 - Main reason for data missing across supply chains



1.5 IT Landscape

Companies have a variety of existing systems (Table 1) that are used for the overall management of the company and its logistic processes. Carriers and logistics service providers make use of a TMS to collect data from trucks or vessels and manage their operations. This is often combined with more complex IT systems and processes for data collection, reporting, and decision-making. On a carrier level, fleet management systems and onboard devices can be in use to capture additional information. WMS systems can be used if needed for warehouse operations.

Large LSPs and shippers, that outsource logistics services, are especially reliant on a mix of IT systems. Here ERP systems, VMS systems as well as TMS systems can be in use simultaneously. All the systems can contain information that is relevant regarding the calculation of shipment or business-level logistics-related GHG emissions (see Table 1).

Internally, most of the time the different systems are connected with each other, making sure a company's own processes are running smoothly across the systems, while external interfaces and general compatibility depend heavily on the size of the company and the system (provider) used. Due to technical advancements (Cloud-based software, digital platforms, APIs) in recent years the level of data integration and exchange between systems is improving, offering great potential across the supply chain.

Figure 5 - IT Landscape for logistics-related processes

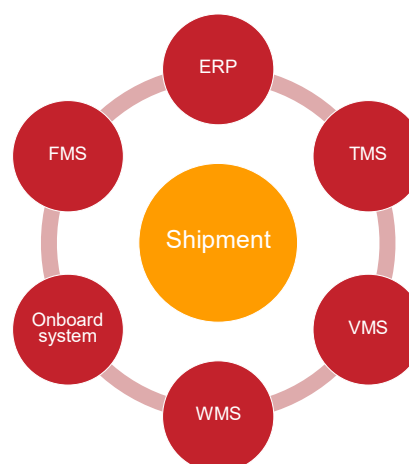


Table 1 - Systems overview

System	Process	User
TMS (Transport Management System)	System used to manage logistics processes, shipment movements, and transport operations including procurement, execution, and monitoring. Core shipment and transport data are stored here.	Carrier, LSPs, Shipper
WMS (Warehouse Management System)	System used to manage warehouse and cargo handling operations.	Carrier, LSPs, Shipper
VMS (Vendor Management System)	System used to manage suppliers incl. account information, procurement, contracting.	LSPs, Shipper
ERP (Enterprise Resource Planning) Software	System used to manage core company processes. These can include planning, purchasing, logistics, sales, marketing, finance, and HR.	LSPs, Shipper
Onboard System / Telematics	Build-in devices in vehicles, that capture and monitor vehicle characteristics (e.g., fuel consumption, speed, (GPS))	Carrier
FMS (Fleet Management Software)	System used by fleet managers to manage fleet operations incl. vehicle maintenance, fuel consumption, and costs.	Carrier
Calculation tool	Calculation tool or file (Excel) used to calculate GHG emissions based on the input of above systems.	Carrier, LSPs, Shipper
Other	Especially smaller carriers use spreadsheets and analog tools to manage shipment data, transport operations, truck dispatch, and monitoring.	Carrier

1.6 GHG Emission calculations

GHG emissions should always be calculated in units of CO₂e for all relevant life cycle phases of the energy source (Well-to-Wheel) and reported for the respective Scopes (Scope 1, 2 & 3). The main metric used to measure transport activity is the t-km (tonne-kilometer) and emission intensity is therefore expressed as CO₂e/t-km. Fuel consumption and emissions can be calculated based on different types of input data (see Table 2).

However, the actual calculation requires a detailed insight into the emissions from a particular transport, the allocation of the emissions from the transport to a single or multiple shipments, and subsequent reporting of these emissions. This is addressed in detail in the GLEC Framework².

The data requirements will be considered in phase 2 in the subsequent data exchange guidance and protocol.

Table 2 - Input data types (simplified)

Primary Data	Detailed Modeling	Default Data
Actual carrier information, such as from fuel receipts and telematics systems as well as aggregated values that reflect fuel or emission intensity for a year's worth of vehicle movements.	Modeled data takes into account emission-relevant transport parameters in order to model fuel use and emissions if primary data is not fully available. There are two modeling approaches: bottom-up energy-based, and top-down activity-based.	Industry average figures using assumptions of standard vehicle efficiency, load factor, and empty running.
Example: A carrier's reported total emissions or average emissions per tonne-km.	Example: Several SFC accredited modeling tools	Example: GLEC default emissions factors, life cycle databases, or specific legislation.

² The GLEC Framework covers the principles and accounting methods concerning the calculation and allocation of emissions from logistics. Please refer to: <https://www.smartfreightcentre.org/en/how-to-implement-items/what-is-glec-framework/58/>

2 Insights

This section summarizes the five main insights, resulting from the research and interviews. The insights highlight the current status quo and crucial considerations and aspects that need to be addressed going forward. By creating awareness of these insights, we seek to increase joint action and momentum across the industry.

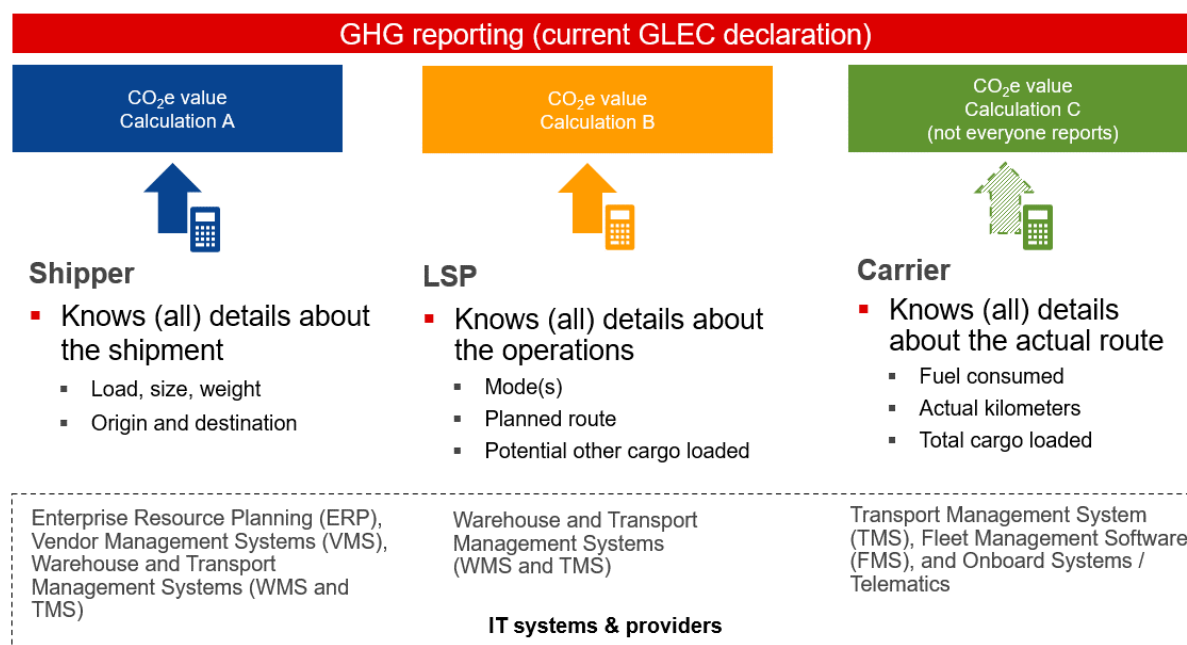
2.1 Insight 1. Each party calculates and reports GHG emissions but the exchange of values and use of exchanged values is limited

All interviewed companies are calculating logistics-related GHG emissions. The interviews and latest industry surveys in Europe show that a large portion of shippers and LSPs are measuring their GHG emissions for internal and external use³, while on the carrier side large parts of the market are not yet capable to calculate logistics GHG emissions⁴.

For most cases, in which companies are calculating GHG emissions from their logistics operations, they are using the shipment data available to them in their own systems for their calculations but are not utilizing any GHG emission data coming from their partners within their supply chain, for example:

- Carriers might be able to calculate emissions and report GHG emissions as absolute and intensity values based on the primary data they can obtain from their systems, but for now, this data is not utilized for subsequent reporting by the LSP or shipper.
- LSPs instead go ahead and combine the data they have on the shipment from the shipper (e.g. weight, origin & destination), with the data they have on the routing (transport modes, legs) and possibly carrier information (Vessel, Flight ID, Vehicle type) to model and calculate emissions for a shipment themselves. The output is shared with the shippers.
- Shippers however also seem to calculate the emissions for the same shipment by themselves, using their goods or shipment data and limited data on routings to combine with default or modeled emission intensity values.

Figure 6 - Overview of different stakeholders and their available data parameters (best case)



³ McKinnon, Alan & Petersen, Moritz (2021): Measuring Industry's Temperature: An Environmental Progress Report on European Logistics. Hamburg: Center for Sustainable Logistics and Supply Chains at Kühne Logistics University.

⁴ Toelke, M. and McKinnon, A.C. (2021) Decarbonizing the operations of small and medium-sized road carriers in Europe. Smart Freight Centre (Amsterdam) and Kühne Logistics University (Hamburg)

This results in three different calculations for the same shipment, that all differ from each other, depending on the information and the granularity of information known to the party. An alternative approach has been proposed in which third-party intermediaries are used to gather the data from carriers and prepare for shippers. This reduces the redundancies in the calculation and ensures the use of actual carrier data on the freight buyers' side, but these cases have been limited in their number and focused on road freight due to the complexity caused by the number of parties involved and lack of market demand.

Going forward, it will be key to exchange the required information based on clear documentation about the scope and definitions of the information exchanged and use it to improve the accuracy and reliability of the reported emissions and to enable other use cases as well.

2.2 Insight 2. It is not just about the granularity of reporting but also about the input types used and the emission intensity granularity

There are three use cases identified for utilizing the results of a GHG logistics emission calculation: (i) (annual) reporting, (ii) decision making and optimization, and (iii) performance monitoring. Each use case has specific requirements concerning the level of (dis-)aggregation of reporting as well as the underlying calculation and required input data. The core metric for the underlying calculation is the emission intensity factor (CO₂e/t-km). This factor needs to correspond to the use case at hand.

The input data through which the emission intensity factor is calculated can, and in specific cases should, be based on aggregated or disaggregated data, even when applied to a consignment level. Depending on the information available, the requirements (disaggregated, aggregated) are also applicable for other primary data that is used to calculate the emission intensity factor (e.g. fuel consumption, utilization rates, empty running).

Specifically, per use case, the following applies (see also Table 3):

- **(Annual) Reporting:** An aggregated transport service category, client, or mode emission intensity together with the total volume of shipments is sufficient to obtain a reasonable understanding of the annual carbon footprint. This is currently the most observed use-case and relies heavily on the use of default and modeled aggregated intensities. The GLEC Declaration can be used as a standard way of reporting the output of this level of GHG emissions.
- **Decision making and optimization:** A more detailed understanding of the emission footprint specific to the decision at hand is required. This use-case requires using historic data in comparison with a reference scenario to forecast future impact. It requires historic aggregated emission intensity data (e.g., by trade lane or transport service category), preferably based on primary data, to enable decisions estimating the expected carrier's relative performance, so avoiding decisions that are based on a specific consignment (to avoid outliers). This approach is mainly forward-looking, potentially as part of a freight tendering phase, which will, by definition, require some form of understanding if the historic data will hold true for the future. This use-case seems to be the next step for many freight buyers and is currently either in place or planned across all interviewed companies. In the future, the optimization will also become possible in real-time on a shipment or consignment level according to multiple IT providers, given that enough data is gathered from all parties.

Table 3 - Overview of use cases and their requirements

Use case	Reporting (Public, client, Government)	Decision Making and optimization	Performance monitoring
Perspective	Backward-looking	Forward-looking	Backward-looking
Frequency	Monthly or annual	As per the decision	As per the decision
Input type	Modeling and default provide a good indication; primary is preferred	Modeling is required to make future-oriented decisions but improves with a higher degree of primary input data	Primary data is required
Reporting aggregation level	<ul style="list-style-type: none"> ▪ Organization level ▪ Mode level ▪ Client level 	<ul style="list-style-type: none"> ▪ As per the decision ▪ Tradelane level ▪ Client level ▪ Carrier level 	<ul style="list-style-type: none"> ▪ Tradelane level ▪ Carrier level ▪ Shipment level ▪ Consignment level
Emission aggregation level	Aggregated emission intensity	Aggregated emission intensity	Emission intensity specific to the consignment is preferred
Exchange of data required?	Defaults might do, but should be improved by utilizing supply chain details	Requires supply chain details	Requires a high level of supply chain details

- Performance monitoring:** To track actual GHG emission reductions and the effect of certain measures on a specific trade lane, transport service category, or even consignment, a high degree of detail is required. In these cases, the actual emission intensity per shipment can become crucial as GHG emissions derived from aggregated values will not be accurate enough to offer the desired insights and measure the effects in a reliable way. This approach is becoming more and more important – given the importance of tracking the results of emission reduction strategies – but also demands the greatest amount of (primary) data. The advancements in data exchange possibilities, real-time visibility, and tracking of a shipment or consignment are enabling this use case. It will be important that this approach still considers the empty running and roundtrip effects in accordance with the GLEC Framework.

The LEARN project created a GLEC Decision Making and Validation Matrix (see Appendix A) to help companies understand what type of input data is appropriate for the different use cases. This is referenced here and will be updated during the next phase of the data access project.

2.3 Insight 3. The majority of systems in use by freight buyers use default and modeled data, and cannot cope with primary data yet

Several freight buyers have built their own in-house tools and excel spreadsheets, combining the shipment data available in their systems with the applicable default values or own modeled values to determine GHG emissions on a shipment, trade lane, or country level. None of the participants had a TMS or ERP system in use that calculated the emissions for reporting directly.

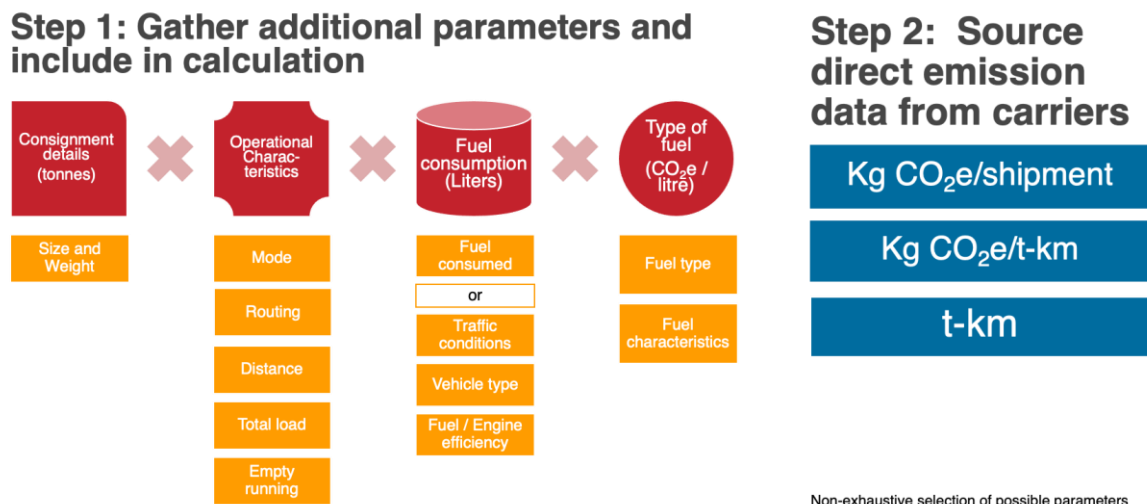
Alternatively, a common practice is the use of an external calculation tool, that can be connected through APIs or CSV data uploads to the companies' TMS or ERP systems. Over the course of recent years, companies have set up their operating systems to be able to exchange data with these tools, utilizing the available shipment input data in their systems as much as possible.

In both cases, most freight buyers are utilizing default and/or modeled fuel consumption and emission intensity data for their GHG logistics emission calculations and do not use primary input data from their supply chain. The quality and detail of the input data to calculate the emissions vary greatly among companies. While some utilize a wide range of different shipment parameters (origin, destination, routing, weight, utilization, transport modes, vehicle types, etc) others are currently limited to the shipment's (estimated) weight, origin, and destination only.

The availability of input data is often linked to the parameters included and available in the organization's TMS or ERP system and the interfaces to other systems of the organization. This leads to varying degrees of accuracy of the calculated emissions as additional assumptions must be made.

Due to the lack of primary data being exchanged across the supply chain, current freight buyer's systems have been tailored towards the use of modeled and default data. As a result, most systems are not capable to cope with primary data directly or lack crucial parameters for more accurate calculations. Here the external tool providers can function as an intermediary to capture primary data from the supply chain or make more accurate assumptions. This is a possibility that still has a lot of potential for several companies.

Figure 7 - Two-step process towards more precise GHG emission calculations for freight buyers



However, for any primary information to be used by freight buyers, it needs to be captured and made available by the carrier. Previous research by Smart Freight Centre⁵ and through these interviews suggests that, currently, only a limited number of carriers can supply their clients with accurate GHG emission data. While the calculation of an overall GHG emission footprint is rather simple and understood; the breakdown of the emissions to a client, trade lane, or shipment level is rather complicated in practice, since multiple values such as fuel consumption, cargo weights, and distances need to be combined at a carrier level to calculate and allocate the emissions correctly. Even if the understanding of the calculations is in place, these values are often not captured automatically in the company processes and systems or combining them requires exchange of data between in-house tools (telematics, FMS & TMS), which creates additional challenges, especially for small and medium-sized carriers. This issue also continues to get only limited attention from the system providers.

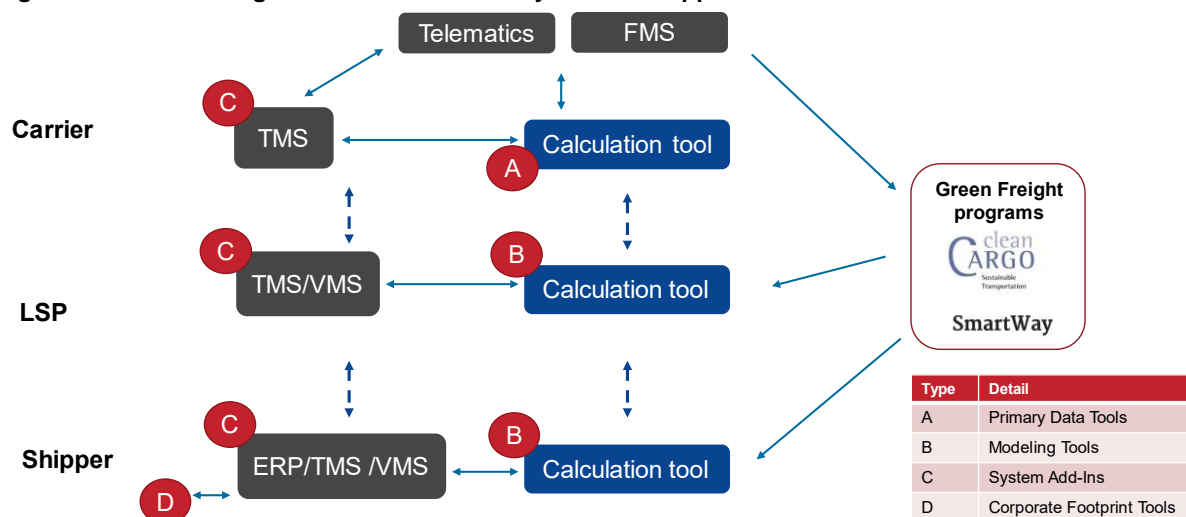
In the future, freight buyers need to advance their systems and operations to gather and capture additional shipment data in their systems to refine their modeling approach in the short and mid-term, while on the other hand collaborate with their suppliers to enable primary data flows and advance their systems to handle this primary data in the mid-and long-term.

2.4 Insight 4. Clear parameters and guidance are key to standardize any kind of exchange, independent of data type or use case

Information is exchanged throughout the supply chain, such as required origin and destination. However, not all the required information is exchanged to calculate the GHG emissions. The information required to be exchanged depends on the use case. The systems in place do not yet always capture the correct data nor is the information exchanged covering all the right input parameters.

- At a carrier level, the important exchange of data must be ensured between the TMS, the telematics, and possibly the fleet management software to produce not just overall fuel consumption and GHG emission values but also GHG emission intensities and granular breakdowns connected to distances traveled and shipment data.
- At the LSP level, either the direct carrier data is captured directly in one of the own applications, or shipment data from the own TMS system must be matched with fleet data from the VMS or intensity values from available external sources (e.g., green freight programs values, GLEC Framework default values) to model GHG emissions.
- The same is true on a shipper level, where shipment data must be pulled together from e.g., TMS, ERP, and VMS systems to then be combined with intensity values from available external sources. It also needs to correctly share the shipment details (e.g., weight)

Figure 8 - Data exchange flows and intermediary external support



⁵ Toelke, M. and McKinnon, A.C. (2021) Decarbonizing the operations of small and medium-sized road carriers in Europe. Smart Freight Centre (Amsterdam) and Kühne Logistics University (Hamburg)

All the systems have their ways to exchange data and, depending on the system type and provider, do so in an automated way already. What is missing for all of them, is clear guidance, including set parameters, on what kind of information needs to be exchanged to ensure proper GHG emission reporting across the supply chain. There are various solution providers, that support companies with tools for all the different possibilities (see Figure 8). It will be crucial that these different solutions also make use of standardized parameters to ensure compatibility across all parties.

During the interview phase, the concept of a neutral, intermediary platform, that collects, validates, and then processes the necessary data from carriers for freight buyers was raised multiple times, especially for the road freight market. The key reason for it is the necessity for a scalable solution that offers large shippers and LSP the possibility to capture primary data from thousands of carriers in an automated, standardized way in the future. While this concept is highly relevant, it is outside of the current scope of this project. However, the intended guidance on data exchange will also be applicable for such a future platform.

2.5 Insight 5. GLEC/ISO certified calculations by carriers or audited 3rd party intermediates will be needed to accept primary data

The initial survey among the participants showed that the lack of trust and transparency is a key issue when it comes to exchanging GHG emission-related information. This was confirmed in the interviews as well. Trust is necessary regarding the methodology used as well as in the input data used for the calculation in the first place.

Trust is multi-layered in this case. On the one hand, buyers of freight must be able to trust the quality and accuracy of the primary data that they receive from their carriers. Some form of assurance process is required to ensure the captured and calculated data is in accordance with industry standards like the GLEC Framework and the forthcoming ISO standard. The current use of modeled and default data gives freight buyers a reliable and standardized way to calculate since they control the data within their organization and do not rely on information provided by carriers. To move towards wide-scale acceptance of primary carrier data, this issue must be solved. On the other hand, carriers also need to be able to trust their clients that the data provided is not used for other purposes, especially when it includes information that can inform the client about the efficiency and costs of the carrier’s operation (e.g. fuel consumption, empty running rates, utilization rates).

Table 4 summarizes initial assurance possibilities, ranging from sense checks, benchmarking to certifications and audit processes.

Currently, the first cases have been observed in which the calculation methodology is assured through the usage of accredited tool providers (e.g., SFC Accreditation program) and the accuracy of the data inputs is verified through an additional external assurance provider periodically directly at the carrier level. The accredited tools also ensure sensitive data from carriers, e.g., fuel consumption is not shared directly with the shippers and LSPs, but only the resulting GHG emission values are shared. This mechanism tackles all described layers of trust mentioned above.

The guidance will need to address the topic of mutual acceptance of the data and set out the required assurance practices to enable direct carrier-client exchange of primary data.

Table 4 - Overview of possible data and methodology assurance options

	Freight Supplier (Carrier)	Freight Buyers	Tools and Platforms
Methodology	Calculations are certified against ISO 14083 / GLEC Framework	Contractual agreements with carriers about the usage of a certain methodology	Methodologies of tools, programs, and platforms are certified against ISO 14083 / GLEC Framework
Data	Annual audit of data in/outputs and methodology	Sense check with the support of carrier fleet data and benchmarking	Guarantee of data integrity and data protection

The idea of a Blockchain-based data transfer, without any intermediary platforms has also been raised as part of the research. Here, a promising first concept by the Zaragoza Logistics Center has been discussed, but also requires additional research that goes beyond the scope of this paper. It is definitely another sign that technological advancements can potentially help to overcome challenges that have been present in the industry for a while. Needless to say, that also blockchain applications will need clear guidance on what kind of data parameters should be shared.

3 Additional considerations

3.1 Mode-specific insights

Naturally, every transportation mode needs a slightly different approach when it comes to the calculation, reporting, and sharing of GHG emission-related data. The data exchange guidance will, therefore, most likely, cover each mode-specific considerations and data requirements.

Road freight seems to be the hardest sector to manage due to its highly fragmented nature at global level and a large amount of small and micro-sized carriers. On the other hand, especially advancements in the technical equipment of heavy-duty trucks allow for more real-time tracking and could enable easier access to actual fuel consumption, routing, utilization, and empty running information compared to other modes. The biggest challenge will be to get a critical number of carriers onboard and making sure the captured journey data can be matched with the shipment data.

Within air and maritime freight, the carrier market is comparatively small and made up of mainly large multinational companies. For both modes, industry initiatives (Clean Cargo and the Sustainable Air Freight Alliance) are in place to exchange GHG emission data between the different stakeholders, making access to (aggregated) primary data easier. On the other hand, real-time monitoring, and access to primary data on a vessel or airplane level is not yet in large scale use for GHG emission reporting.

For freight transported by rail and inland waterways the collection of primary data is hard to come by and technological advancements have been limited so far.

Finally, for depots and terminals, the collection of their emissions is not yet standard practice and will need to be addressed as it will become a requirement in the forthcoming international standard ISO14083.

3.2 Motivation & Incentives

An additional insight that materialized during the research and was confirmed by an overwhelming majority of the participants, is the crucial role of the market in requesting emission information from suppliers in general. To put it provocatively: if buyers of freight are not asking for emission-related information, the market does not develop into an increased state of awareness and action.

Carriers of all sizes and modes are driven in general by client demands. When it comes to the need for emission calculation and reporting, there are various reasons for carriers to do it, but one of the driving factors is the demand of clients⁶. When the reliance by shippers and LSPs on default and modeled data leads to a lack of engagement with their carriers to obtain primary data, this can limit the degree to which carriers start making first steps towards collecting and reporting GHG emissions and to subsequently take reduction measures. This demand will also be required to incentivize carrier-focused system providers (TMS, telematics, etc) to improve their systems accordingly.

Therefore, it will be important that carriers are motivated and incentivized to start calculating and reporting their emissions. This can be done through various methods, for example through mandatory reporting requirements in freight tenders and supplier contracts or financial incentives. This requires many freight procurement processes to be adjusted, which currently is a major challenge for freight buyers. Also, awarding longer freight contracts or freight volumes to carriers that can show GHG emission reductions based on solid calculations can have a positive effect on the engagement of carriers, even if the actual emission data is not yet utilized by the freight buyer for its reporting. Different mechanisms will need to be put in place, tailored to the supply chain and contract type at hand.

Intermediary platforms, which have been mentioned before, offer additional analyses e.g., for fuel consumption and empty running optimizations to carriers, offering valuable insights as another motivation for carriers to start. It will be crucial that some sort of incentive is in place for carriers for the uptake of capturing primary data throughout the supply chain.

Identifying potential incentives will be considered in phase 2.

⁶ Toelke, M. and McKinnon, A.C. (2021) Decarbonizing the operations of small and medium-sized road carriers in Europe. Smart Freight Centre (Amsterdam) and Kühne Logistics University (Hamburg)

3.3 Initiatives and existing standards

Various guidance, specifications and standards have been published in recent years on the topic of logistics GHG emission reporting and the exchange of data. Regarding calculation, the GLEC Framework is the accepted industry standard for logistics GHG emissions across all modes, while the GLEC Declaration provides a template for the reporting of GHG emission values.

The list below highlights some of the publications, that build on the GLEC Framework and already introduce additional guidance regarding the transfer of relevant data across the supply chain. These publications, alongside others, have been reviewed as part of the first phase of the Data Access project and will be taken into consideration for the future development of the data exchange guidance and protocol.

DIN SPEC 91224:2017-03: Cross-company accounting of transport-related emissions – Collection and transmission of relevant data.

This specification provides a template for GHG emissions-related data transfer and gives implementation recommendations for road freight transport. The focus is on standardizing the cross-company exchange of relevant data and information for accounting for transport-related emissions. This concerns both the interface between logistics service providers and the carriers they employ, as well as the interface between logistics service providers and the contracting shipper. Building on the GLEC Framework, the SPEC is tailored towards logistics service providers, but the provided parameters and templates can be used by all parties across the supply chain.

AFNOR SPEC X43-072: GHG performance of e-commerce deliveries: sharing of data between players, operational implementation of calculations, and monitoring of indicators

This specification provides guidance on calculating emissions from e-commerce last-mile truck deliveries, but it can be applied more generally to European road-freight GHG emission calculation as well. It builds on the GLEC Framework and offers additional guidance on calculating and modeling emissions at an item level through the dynamic adjustment of calculation parameters, depending on the availability of primary data. The AFNOR SPEC provides an overview of the necessary data parameters needed for these calculations.

It also introduces a data quality index, based on the source of the main parameters (fuel consumption, empty running factor, load factor), offering an actionable way to benchmark the quality of carrier data. The concept of such an index has also been discussed within the phase 1 interviews and further discussions will be necessary to see if and how it could be integrated into the data exchange guidance. Moreover, the AFNOR specification also strongly recommends the usage of third-party intermediaries to manage the data gathering, calculation, and reporting process between carriers and freight buyers.

ISO/CD 14083: Quantification and reporting of greenhouse gas emissions arising from operations of transport chains

The ISO 14083 standard that is under development recognizes the role that organizations at different positions within the supply chain have in the calculation and reporting of a full picture of the GHG emissions from transport. As well as providing a methodology for calculating the emissions from each element of a transport chain, ISO 14083 provides a template for the information that should be presented by the transport operator to their client, whether that is an integrator of transport services (e.g., an LSP in the freight sector or a package holiday provider in the passenger sector) or the final client. Hence the provisions of ISO 14083's reporting template will become relevant to those organizations who wish to comply with the standard and use electronic data transfer within their corporate systems. These provisions will be incorporated in the future development of the data exchange guidance.

4 Next steps: Guidance and Data Exchange protocol

4.1 Phase 2: Guidance & data exchange protocol

This paper has highlighted the insights gained through extensive market research and interview process on the topic of logistics-related GHG emissions exchange across the supply chain. It has identified a variety of challenges as well as the status quo of the market regarding the exchange between parties and IT systems.

Currently, the individual parties in the supply chain (shipper, LSP, carrier) are still mainly approaching the reporting and calculation topic in a siloed manner. However, a variety of future use-cases demand a more collaborative approach and advancements on the IT system side offer new opportunities.

Irrespective of the use case, the data input types, or the level of IT integration and system exchange, it has become clear that a holistic, practical guidance is needed on what data should be gathered and how this data should be shared between different organizations within a supply chain and their associated IT systems (FMS, TMS, ERP) to calculate and report emissions in conformance with the GLEC Framework. Steps to implement these guidelines will especially consider the needs of shippers, LSPs, carriers, and IT solution providers and address how best to overcome potential trust issues.

In addition, further research is necessary on the topics of data security, data validity, and potential incentives to motivate the supply chain to exchange and collect the required primary data.

Therefore, in the second phase of this project, the development of this guidance, taking into account the presented insights, is the key focus. This guidance will be developed with the GLEC Project Working Group and will include the development of a data exchange protocol, that can be applied to the identified different use cases, data input types and all transport modes, building on existing standards and frameworks.

4.2 Participants and contributors

We are grateful for the participants and contributions from:

- AEMS
- Amazon
- Appanion
- CLECAT
- DP DHL
- DSV-Panalpina
- EcoTransIT
- European Shippers Council
- GEFCO
- Geodis
- GreenRouter
- Heineken
- Kuehne+Nagel
- MIXMOVE
- Nestle
- P&G
- PepsiCo
- Planetly
- Scania
- Sovereign Speed
- The Dow Chemical Company
- TK Blue
- Tracks
- Transporeon
- Unilever
- Volkswagen
- Zaragoza Logistics Center

If your company is interested in joining phase 2 of the project, please get in contact with us.

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Annex A. GLEC Decision Making and Validation Matrix

Figure 9 - GLEC Decision Making and Validation Matrix

		CATEGORY	DEFAULT	MODELLED	ACTUAL			
					Aggregated annual	Disaggregated	Program	
Reporting & tracking	Scope 1	Total emissions	X	X	+	±	X	
	Scope 3	Total emissions	±	+	+	±	+	
	Scope 1	Emissions intensity (KPI)	X	X	+	+	X	
	Scope 3	Emissions intensity	±	+	+	±	+	
Decision making	Carrier		Before implementation	Before implementation (and some cases after)	Baseline & after implementation check		Baseline & after implementation check	
		Operational	Driver training	X	X	±	+	X
			Routing per leg	X	+	±	+	X
			Consolidation	±	+	±	+	±
			Vehicle size	±	+	+	±	+
			...					
		Telematics			+	+	±	
		Fuel switch	+	+	+	+	±	
		Vehicle purchase	±	+		±		
		...						
	Customer	Mode switch	+	+	+	+	+	
		Supply chain remodelling	±	+				
		Purchasing (change of carriers)		±	+	±	+	
		Horizontal collaboration		+	+	±		
		...						
	3rd party	Infrastructure Investment	±	+				

Source: Learn Project, 2017 ([http://www.nucms.nl/tpl/learn/upload/GLEC%20fw%20challenge%205%20-%20Using%20results%20for%20decisions%20-%20online%20\(1\).pdf](http://www.nucms.nl/tpl/learn/upload/GLEC%20fw%20challenge%205%20-%20Using%20results%20for%20decisions%20-%20online%20(1).pdf))

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