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The role of emission calculation in reducing logistics emissions

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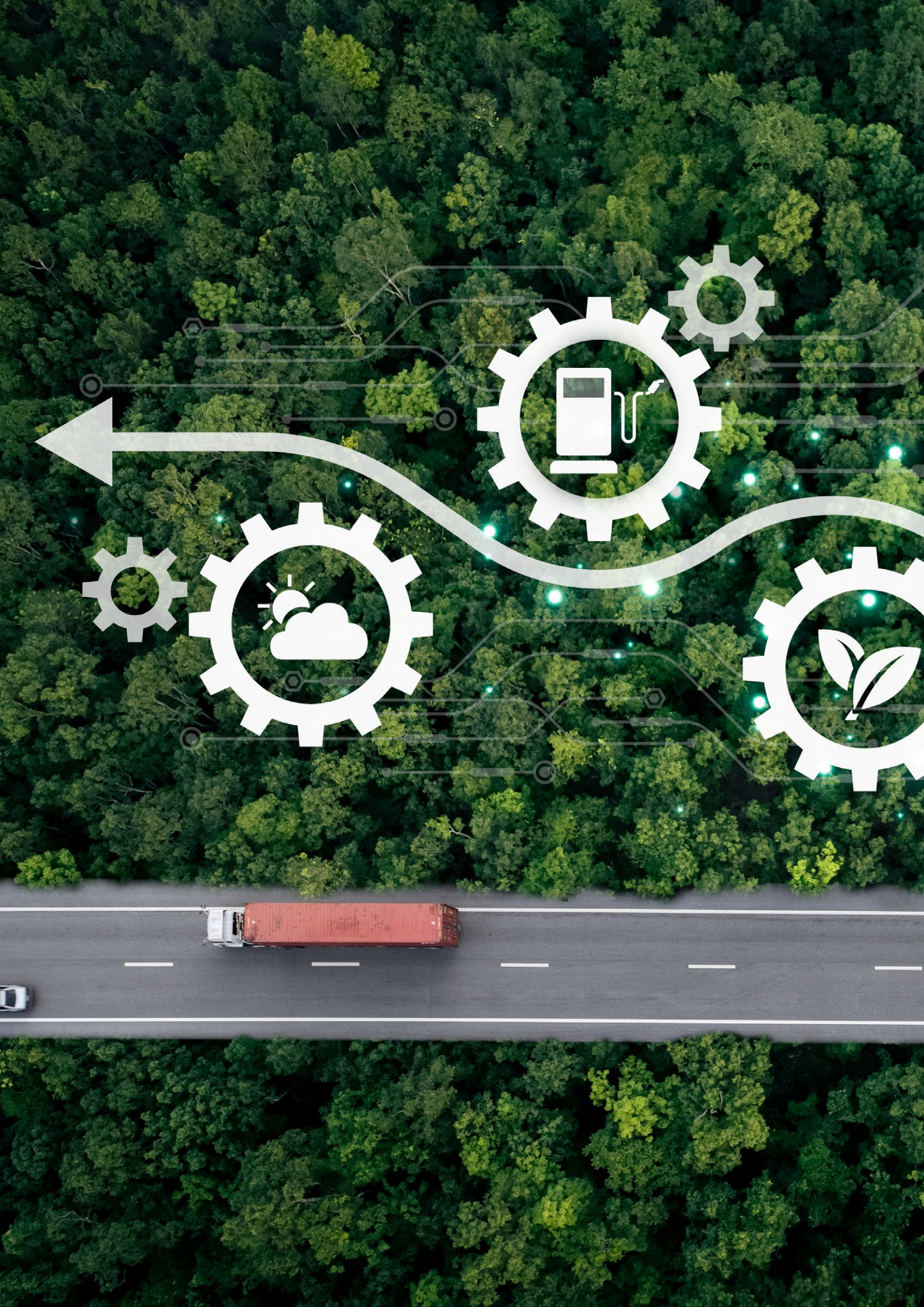

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Summary

The report highlights the significance of accurate emission calculation in the transportation sector, essential for meeting the ambitious reduction targets outlined in the EU's Green Deal. Despite efforts to adapt to evolving legislation, challenges persist in achieving transparency and consistency across different emission calculation frameworks, underscoring the need for collaborative solutions in logistics emissions calculation.

Transportation stands as a significant contributor to global greenhouse gas emissions, prompting the EU's commitment to substantial reductions by 2050 through its Green Deal initiative. Accurate emission calculation and reporting play pivotal roles in this endeavor, supported by a range of frameworks and standards.

Yet, ensuring transparency and consistency in emission calculations is vital for realizing sustainable long-term goals. Driven by the imperative to address decarbonization, logistics emissions calculation faces regulatory pressures as well as stakeholder expectations. While companies strive to adapt to evolving reporting legislation, challenges persist in harmonizing calculation methods and integrating fragmented data sources, hindering accuracy and comparability.

This report summarizes the role of emission calculations in supply chains, encompassing results from an interview study with logistics service providers; a study on emission calculations for a specific Nordic route; and a two-round eDelphi study with Finnish logistics industry experts. By identifying calculation frameworks and future emission calculation needs, the report aims to provide a comprehensive understanding of the role of emissions calculation for decarbonizing the logistics industry.

Introduction

Globally, emissions from transportation amount to approximately one quarter of greenhouse gas emissions (GHG; UN fact sheet on climate change, 2021). Reducing emissions has become a major area for policy interventions, with the ultimate goal to achieve climate neutrality. To this end, the reduction goals for Europe as outlined in the Green Deal are very ambitious: 90% of transport emissions need to be cut by 2050 (Directorate General for Climate Action). In the EU, transport accounts for some 28% of GHG emissions (McKinsey, 2020), with emission reporting governed by several directives and regulations (EU Emission Trading System including MRV reporting, CSRD Corporate Sustainability Reporting Directive).

Several frameworks for emission calculation exist, including IPCC (Intergovernmental Panel on Climate Change) Global Logistics Emissions Council GLEC Framework, CountEmissionsEU, Ecological Transport Information Tool EcoTransIT, with the most important calculation parameters being the amount and type of fuel, vehicle type, travel speed, and distance. Reliable and accurate emissions calculation becomes very important to organizations in estimating whether e.g. emissions have decreased or mid-term goals were achieved. Needs for accurate emission calculation have become relevant to large companies based in the EU as mandated in the Corporate Sustainability Reporting Directive (CSRD). By 2026, CSRD will extend to middle- and small-sized companies too, which own scarcer resources and capabilities but will need to become compliant.

The co-existence of different legislative requirements, calculation frameworks and specific methods for transportation modes are typical for the early stages of decarbonisation. In an evolutionary view, until the emergence of a dominant design (cf. Anderson & Tushman, 1990) several alternative or competitive designs must be available. The plethora of frameworks and requirements will converge in time and selection of a dominant design for emission calculation is likely to emerge. Currently, the case of emission calculation is on the expected trajectory, with the ISO standard 14083 for quantifying and reporting greenhouse gas emissions well underway. Nonetheless, the current situation is characterized by a lack of clarity and transparency in calculations.

Emission calculations – fit with contextual requirements

This section of the report is based on an interview study with eight logistics services providers conducted in fall of 2023 and qualitative analysis of the interview data.

The primary driver behind the need to calculate logistics emissions is the urgent need to reduce greenhouse gas emissions to mitigate climate change (Micheli et al. 2020). The overarching emission reduction objective translates into rather clear requirements for logistics service providers. However, they need to balance between short term cost implications and the longer term emission reduction goals.

The baseline requirements for emission calculation are set by effective regulation. On the one hand, there is regulation on emissions reporting; and on the other hand, there is regulation on emission reductions. Both of these impact current and future trajectories of emission calculation. In the EU-context, Corporate Social Responsibility Directive (CSRD) has come into force for large companies in 2024. In addition, there are numerous regulations for different transportation modes (such as the emission trading system for shipping or the EU regulation for heavy duty vehicle CO_2 emissions) with the underlying objective of reducing logistics emissions. In addition to the regulatory requirements, logistics operators face emission reduction and calculation requirements from various stakeholders such as their own customers. Together regulation and customer needs create a bundle of requirements emission calculations need to meet.

Interviewees from companies which need to comply with CSRD said that they were prepared to report logistics emissions even before it became obligatory. The logistics service providers interviewed emphasized that **customer demands are the most significant driver for emission calculation at the moment.** However, interviewees anticipated that tightening regulation further increases customers' demands for emission data and reductions. A related driver to emission calculation is the corporate level emission reduction goals and subsequent pressure to reduce them.

Emission calculation has not yet reached maturity, where there would be shared standards for data and calculation parameters. Currently, logistic providers use different parameters and calculation methods. Notable differences currently exist among logistics providers in practices related to the definition of e.g. transport-chain element data (especially route definition for the calculation and how well it corresponds to the actual route) or energy consumption for transport operation category.

Interviewees emphasized that the aspiration for data accuracy and the cost and effort of operationalizing calculations are two sides of the same coin. There is the tradeoff between detail and accuracy of the data and the feasibility of collecting it. **According to the interviewed logistics experts, one of the most critical challenges in effective emission calculation is the fragmentation of data in various systems.**

At the time of the interviews (fall 2023), most of the examined companies relied on *activity-based emission calculation*, that assigns a default value for greenhouse gas emissions of each transportation mode. This practice does not offer sufficient calculation accuracy to respond to customer needs and tightening regulation. In addition, at the time of the interviews, there was no comparability between the emissions reported by different actors. Rather, the usage of ***energy-based model would produce better comparability.***

Impact of the data on emission calculations

This section of the report presents a study which was done by calculating emissions for a specified route in the Nordics including both road and sea transportation. The calculations were done with averages proposed in the frameworks as well as actual primary data obtained from logistics service providers.

Logistics emission calculation is advisably based on standards to build commonly shared practices and ensure results can be reliably compared. Currently the ISO 14083 standard can be expected to become the gold standard. In the EU-context, it is also noteworthy that CountEmissionsEU, the common calculation framework proposed by the EU, utilizes the methodology established by the ISO 14083 standard. Another widely used framework is GLEC, which is also aligned with the ISO standard. Moreover, a relatively widely used means of calculating logistics emissions is the EcoTranIT software that is compatible with the ISO standard and the methodology follows the GLEC framework.

The emission calculation frameworks give formulae for calculating logistics emissions. The formulae allow using averages included in the frameworks or actual (primary) data. The results of the calculation differ significantly depending on the type of data used. According to the parallel calculations done in this study, the highest emission result is almost four times higher than the lowest emission result (calculated with GLEC, EcoTransIT and ISO 14083).

Load factor is a key parameter that can notably change the emission intensity of a single journey. In addition, the use of **fuel intensity default values versus actual fuel intensity** makes a considerable difference in emission results especially in road transport. EcoTransIT was found to offer a viable solution for emission calculation considering the prevailing data availability and different stakeholders emission calculation needs.

Importantly, the findings from this study highlight that there is notable variation in emission calculation results for specific route in shipping if calculated based on actual data on a daily basis. Ship emissions calculated with primary data vary a lot from one day to the next because **external conditions (in particular weather) influence fuel consumption.** In addition, the aforementioned load factor can significantly change the unit emissions for each journey. Emission calculations based on emission factors and fuel consumption of a journey **produce comparable and reliable results.** This way of calculating balances the variation between individual journeys and advances the feasibility of data collection.

An additional consideration is the inclusion of hub operations (especially ports). According to the ISO 14083 standard these should be included. However, in practice, the emissions from port operations (especially in Europe) are nearly insignificant when considering the total emissions of door-to-door transportation. Therefore, including actual data from port operations is not a priority in developing the emission data collection and calculations.

"Know your numbers - We have many different acceptable calculation bases. For customers, it's crucial to know what the framework behind the calculations is. This kind of transparency will move the industry forward and help create long-term partnerships. A public roadmap from logistics service providers that shows plans and next steps towards a more sustainable future will also help our customers make their logistics planning more sustainable."
Niina Kemppinen, Partner Network Manager at Wiima Logistics

Experts' prospects on emission reduction and calculation

This section of the report presents the eDelphi method study conducted in two consecutive. These rounds brought together Finnish logistics industry experts to evaluate future-oriented statements regarding the prospects for green logistics and CO_2 emission reductions for the year 2030. The eDelphi was conducted in Finnish with anonymity maintained throughout the response gathering process. Out of 97 invitations sent, 17 responses were received, resulting in a response rate of 17.5%.

Supply chain decarbonization – the Delphi experts' bird's eye view

Globally, decarbonization moves at different gears as there are geographical disparities regarding the interest in and implementation of emission reductions. In Western countries, especially in Europe, emission calculation is expected to become standard practice driven by the EU legislation. Outside of Europe, increasing customer demand for emission calculation is hoped to have global spill-over effects, leading to more systematic interest and implementation across continents.

Experts estimate that **competition in logistics will intensify due to net-zero targets.** New carbon-neutral logistics companies enter the industry, while established companies recalibrate towards carbon-neutrality goals. Experts note that as competition heats up with new players joining the logistics industry, the focus will extend beyond environmental issues, as it will reshuffle market shares. Conversely, small and agile startups might pose serious challenges to larger traditional companies. Such heightened competition **will necessitate increased cooperation,** particularly amongst small companies, which may lack the resources to scale independently or make significant investments. However, small operators can leverage various digital solutions to gain a competitive edge.

"Smaller companies may not have the resources to develop emissions accounting and invest in environmentally friendly technology in the same way larger companies can. On the other hand, various digital platforms might enable competition for smaller players too, so that the situation could evolve in both directions simultaneously", mentions one eDelphi panel expert.

Nonetheless, **gaining competitive advantage from emission calculation will likely favor "first-movers",** those who capitalize on the opportunity before it becomes mainstream. The experts found it important to recognize that not all companies are willing to adapt to these changes; some may prefer to exit the market instead. Additionally, resistance to change is amplified by both human and economic considerations, further staling decarbonization.

Customer needs shape demand for low-carbon emissions

Some experts highlighted that logistics companies hope their **customers will set requirements for green transportation.** While this is an important decision, it is by no means sufficient: customers must also be willing to pay for low-carbon or carbon-neutral transport solutions and services. The experts identified the biggest challenge to this being the availability of green fuels and their high price compared to traditional fuels. **Other experts point out that customers are already key drivers of green logistics and emission reduction efforts,** and their influence is only expected to grow. Some customers are already collaborating with service providers to reduce emissions, demonstrating their strong commitment to advance this issue. These customers are pioneers in the green transition, they seek out service providers who can meet their ambitious sustainability goals or at least show commitment to developing in that direction.

The manufacturing industry reflects the complexity of supply chains. First, logistics providers aim to serve different customer needs. Transportation services represent a fraction of the entire emissions of the value

chain. In the future, experts estimate that accurately measuring the emission impacts of a product's lifecycle will most likely motivate manufacturers to produce more sustainable products. However, not all manufacturers are expected to minimize emissions from their entire lifecycle, as this would increase costs. Assumably, cheaper logistic services will also have their own customer segment, making the premium pricing desirable only for niche customers. Therefore, emission reduction is related to logistic companies' value propositions and how they want to position themselves in the logistics industry.

Secondly, local manufacturing solutions´ impact on logistics remains unclear. In the long term, experts estimate that local manufacturing solutions such as 3D printing can reduce the need for transportation when 3D printed products can be produced closer to customers. Finally, automating short delivery distances could further reduce transportation costs by decreasing the reliance on labor. However, logistics automation will also demand specialized expertise, and human labor cannot be entirely eliminated, especially for handling exceptional situations. Therefore, human labor is expected to remain significant even in 2040. **This underscores the critical role of people in the logistics sector.**

"Many tasks can be automated and assigned to machines, but human involvement is crucial in supply chains, especially during exceptional situations", notes an expert in the eDelphi panel.

Organizational renewal in logistics - Momentum for standardization and transparency

For emission calculation to become more accurate, the establishment of a common measurement standard is required. There is momentum for standardized measurement practices. Yet, establishing such standards would likely require broader participation in emission calculations among logistics operators, potentially providing companies with a competitive edge. While standarization constitutes a shared viewpoint among experts, there is disagreement when it comes to the timeline for refining these measurements, which may stem from industry differences or varying levels of readiness among companies to implement these changes.

Currently, logistic providers employ diverse methods to communicate their emission reduction efforts. Experts argued that carbon-neutral operations do not inherently necessitate transparent practices but customers' need to monitor their emissions sets pressure on logistics providers. Furthermore, **transparency among operators in the supply chain is crucial for increasing accountability and boosting customer demand.** Transparency serves as the primary means for customers to evaluate the services they procure. Notably, the incentives for transparency largely originate from customers who seek to monitor their emissions. Despite its importance, transparency in measurement faces resistance, underscoring the need for collective efforts to promote consistency and transparency within the industry as well as in organizations.

"Achieving zero emissions is possible, but it requires significant investments from the company. The largest sources of emissions are the easiest to eliminate, but reducing the final 5-10% becomes the most challenging. Additionally, business travel impacts the company's total emissions, and it can be difficult to influence the personal value choices of individual employees", argues an expert in the eDelphi panel.

By large, experts see it as **unlikely that transportation emissions and energy costs will decrease adequately by 2030** to become sufficiently competitive. Several factors contribute to this outlook. Firstly, there is a growing customer preference for localized and locally produced goods. Secondly, the pace of innovation and development in fuels and vehicles is a significant concern. One expert noted that energy-efficient vehicles are not expected to become mainstream by 2030, indicating that significant advancements are anticipated in the longer term rather than the near future. Additionally, the slow pace at which companies can renew their fleet is a critical factor. Many companies have not yet devised their roadmaps or focused on addressing emission issues, further delaying the reduction of logistics emissions and energy costs.


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Conclusions & recommendations

Decarbonisation is a systemic challenge. Within it, new perspectives such as emission calculation are essential for transitioning to more sustainable practices; future development work is expected to focus on people, innovative processes, and adapting to change. Both at the individual and organizational level, the **sustainability transition requires new capabilities, such as collecting emission data, data analytics for emission calculation-driven, and building new business models around emission reductions.** Digital technologies will become a key enabler of such capabilities, leveraging data both within supply chains and potentially across them. Particularly the supply chain as locus of investigation is relevant: from customers' perspective, value is created in the entire chain, not only at the level of a particular mode of transportation. It is therefore crucial that different logistics providers are willing to collaborate towards reducing emissions and seek to provide customers with reliable monitoring tools.

The supply chain perspective and customer needs surfaced as central themes in the experts' comments too. With competition in the logistics industry estimated to intensify and customer demand for carbon-neutral services rising, the need for emission calculation and optimization becomes a business imperative in logistic service provision. Logistics providers need to evaluate which capabilities they can leverage now and in the future for emission calculation –driven service provision.

Experts mentioned the need for standardization, which is expected to improve accuracy for emission data, in addition to transparency to increase logistics service providers accountability. **Customers evaluate services' trustworthiness through transparency, hence the current resistance calls for improved dialogue between logistics providers and customers.** Here, third parties may be needed to facilitate collaboration.

> *"We can already see that our customers are not just interested in but actively choosing more sustainable logistics solutions. Emission awareness among our customers is at a high level, and sustainability is one of the criteria when choosing the most suitable transport."* **Niina Kemppinen**, Partner Network Manager

Information sharing between supply chain actors has been found to drive better performance in earlier research (Micheli et al., 2020). Additionally, understanding the green transition in general is essential e.g., due to the variety of different standards. Knowledge plays a crucial role, particularly in selecting an appropriate calculation standard for measuring a company's performance.

A company's efforts to achieve low or zero emissions can be hindered by factors such as the variety of measurement standards and customers' unwillingness to pay for these greener options. Other obstacles to renewal may include internal resistance or the company's size and available resources. However, drivers for renewal include legislation, customer demand, and the potential for a competitive advantage. Furthermore, the company itself can become a pioneer in its pursuit of carbon neutrality goals and initiatives.

Key insights:

1. Transparency in data and calculations are absolutely necessary to drive emission reductions in logistics. Greater transparency increases accountability for logistics services providers, helping clients assess which provider best matches their needs.

2. However, the use of primary data from all parts of the transportation chain is not an end in itself with the current means and methods of accessing and processing the data.

3. Emission calculation frameworks that offer well justified emission factors for different transportation modes and the possibility to use primary data when available (such as EcoTransIT) offer viable solutions to achieve comparable and reliable results.

4. There appears to be the opportunity to gain a first-mover advantage for those actors that are willing to invest proactively to cater for the most ambitious customers' needs. The role of emissions as customers' decision-making criterion is expected to increase rapidly in some customer segments. Services providers need to ensure now that they have the capabilities to respond to the surge in customer demands related to emission calculation and reduction in the short- and middle-term future.

Background information about the report

This CCR Insights report was carried out as part of Wiima Logistics Oy research- and development project at the Centre for Collaborative Research CCR, Turku School of Economics at the University of Turku, Finland. The project focused on green transition and emission calculations in supply chains.

For more information visit: https://www.utu.fi/en/university/turku-school-of-economics/ccr/research-projects/Emission-Calculations-in-Supply-Chains

This report was done in a research project funded by Wiima Logistics. The overall aim of the research project was to examine the emission calculation practices prevailing in the logistics sector and to identify current best practices as well as to look towards the anticipated futures of logistics emission reductions.

Taina Eriksson works as Research Director, Titiana Ertiö as Research Manager and Maria Jussila as Project Researcher at the Centre for Collaborative Research CCR. Ella Huovinen and Veera Antonen contributed to the project through their respective MA theses.

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References

Anderson, P., Tushman, M. L. (1990). Technological Discontinuities and Dominant Designs: A Cyclical Model of Technological Change. *Administrative Science Quarterly,* 35 (4), 604–633. https://doi.org/10.2307/2393511

Directorate General for Climate Action. The EU transport sector and its contribution to reaching climate neutrality. Retrieved from https://climate.ec.europa.eu/eu-action/transport/overview_en

McKinsey (2020). How the European Union could achieve net-zero emissions at net-zero cost. Retrieved from https://www.mckinsey.com/capabilities/sustainability/our-insights/how-the-european-union-could-achieve-net-zero-emissions-at-net-zero-cost

Micheli, G. J. L., Cagno, E., Mustillo, G., Trianni, A. (2020). Green supply chain management drivers, practices and performance: A comprehensive study on the moderators. *Journal of Cleaner Production,* Vol. 259, 121024. https://doi.org/10.1016/j.jclepro.2020.121024

UN Fact Sheet (2021). Climate Change. Sustainable Transport Conference. Retrieved from https://www.un.org/sites/un2.un.org/files/media_gstc/FACT_SHEET_Climate_Change.pdf


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