The Chartered Institute of Logistics and Transport Ireland

CILT Ireland Policy Research

Towards a Decarbonisation Roadmap for Road Transport Companies in Ireland: A Gap Analysis of Policy Agenda and Industry Perception

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CILT Policy Committee

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Executive Summary

The Government of Ireland has set out to pursue a climate-resilient economy and become carbon neutral by 2050. Increasing demands for emissions mitigation will put greater pressure on transport activities for the movement of people and freight. The transport sector in Ireland will have to take prompt action in response to the climate emergency.

The Irish Government has demonstrated increased effort in policy development towards the low-carbon transition for the transport sector in recent years. The Chartered Institute of Logistics and Transport (CILT) welcomes the policy measures proposed by the Irish government to support the transport industry in reducing their carbon emissions in the last two years, but these interventions have yet to have a significant effect on the reduction of emissions.

Research studies on decarbonisation policy have focused mainly on the public stakeholders' perspective, but there has been little work exploring the Irish industry stakeholders' experiences of the existing decarbonisation measures.

Hence, in this study, with a special focus from the transport industry perspective, this report captured the current awareness and perception among the Irish road transport operators (public transport and freight) of transport decarbonisation policies and measures in Ireland. Online survey questionnaires, in-depth interview and focus group interviews were conducted from March to September 2021 to obtain first-hand information and insights from transport operators and experts in Ireland.

The research findings suggested that there is a significant misalignment between the government's incentivised decarbonisation direction and the industry's preferences. The current government policies on transport decarbonisation are less reflected in terms of measures and support schemes for the majority of SMEs in the market.

CILT is of the view that alignment is needed with the overarching decarbonisation plan on the national level. Clear and consistent sector-specific objectives need to be introduced and clarified for the transport sector. More specifically, clearly defined quantifiable targets for both public transport and freight transport are needed for the industry to formulate their action plans. Based on the findings in this study, a list of recommendations is proposed for transport decarbonisation policy development, ranging from regulatory, pricing, technological strategies, to measures that could promote behavioural change.

We hope this study will help policymakers in Ireland to gain a fuller understanding of how logistics companies in Ireland perceive the current policy and the challenges facing the

logistics industry for low-carbon transition. Focusing on the industry's perspective can help policy research to develop robust policy interventions with effective measures to bridge the policy implementation gap, and potentially informing future policy objectives.

A better understanding of transport operators' attitudes and motives (especially SMEs) and the challenges they face in decarbonising can inform a more effective response by policy-makers, vehicle manufacturers, and the wider stakeholders in the society to intervene in the uptake of decarbonisation measures in the transport industry in Ireland.

Contents

1. Introduction and Research Background

The Government of Ireland has set out to pursue a climate-resilient economy and become carbon neutral by 2050. Increasing demands for emissions mitigation will put greater pressure on transport activities for the movement of people and freight. The transport sector in Ireland will have to adapt to this new climate reality.

Since 2020, the Chartered Institute of Logistics & Transport (CILT) in Ireland is conducting a series of policy research that analyse climate change implications for the Irish transport sector. In this study, we focus on the transport industry perspective and aim to identify the gaps between the current transport decarbonisation policy agenda and industry perception. The findings inform a list of recommendations to support the dissemination and implementation of current transport decarbonisation policies in Ireland, as well as some suggestions for future policymaking.

1.1 Transport decarbonisation policy development in Ireland

On 14 July 2021, the European Commission released the latest instalment of the European Green Deal: '*Fit for 55'* carbon emissions reduction plan. This package is meant to have all EU member countries align a wide range of EU policies with the EU's 55% (based on 1990 levels) net emissions reduction target for 2030.

Halving EU emissions in nine years has set out ambitious and challenging decarbonisation target for the transport sector across EU member states. The changes in this package related to the **road transport** sector are:

- An EU-wide phase-out for the sale of Internal Combustion Engines (ICE) cars, no later than 2035;
- Introducing an Emissions Trading Scheme for transport.

Some reaction from Ireland to this new target is "*Ireland is not on a downward curve yet*", "*transport is the big carbon polluter at EU level, where measures are most radical*" (O'Sullivan, 2021[1]).

In recent years, Ireland has shown its determination to embark on this 'Road to Zero'. However, there is a substantial hill to climb to achieve carbon neutrality as a society by 2050. In an earlier research study by CILT, entitled '*Transport Policy Review: Where does Ireland*

[1] How will the EU climate plan affect Ireland? https://www.irishtimes.com/news/politics/q-a-how-will-the-eu-climate-plan-affect-ireland-1.4620478, Irish Times

stand on Climate Change for Transport and Logistics sectors[2]*'*, the policies in Ireland towards decarbonising the transport sector were reviewed (see Table 1-1 below).

Table 1- 1 *Transport-related decarbonisation policies in the EU and Ireland*

EU Level	**Ireland National Level**
• The European Green Deal (2019) • 'Fit for 55' carbon emissions reduction plan (July, 2021)	• Climate Action Plan (2019) • Climate Action and Low Carbon Development (Amendment) Bill 2021 (2021) • National Development Plan 2021-2030 (2021)
EU Transport Sector Level	**Irish Transport Sector Level**
• The European Commission Sustainable and Smart Mobility Strategy (December, 2020)	• Sustainable Mobility Policies Review (2019) • Low Emissions Vehicle Toll Incentive (LEVTI) (2020) • Alternatively-Fuelled Heavy-Duty Vehicle (AFHDV) purchase grant scheme (March, 2021) • Ten-year Strategy for the Haulage Sector (on-going public consultation, 2021)

Great efforts towards decarbonisation from the Irish government, transport industry and research institutes have been witnessed in recent years. A general trend towards 'electrification' has been observed in the national and industry decarbonisation roadmap reports (see **Appendix A**), where transport, power generation, and heating are the three major targeted sectors.

However, these national and industry decarbonisation roadmap reports are mainly from a top-down perspective, that is most of these identified roadmaps are from policymaker and public stakeholder's perspectives. For transport decarbonisation, there has been little work exploring the Irish industry stakeholders' experiences of the decarbonisation policies and measures.

[2]CILT (2021)Transport Policy Review: Where does Ireland stand on Climate Change for Transport and Logistics sectors, https://www.cilt.ie/Policy/Policy-Documents

1.2 Research aim and objectives

Given the abovementioned research gap, this study focuses on the transport industry perspective and aims to pinpoint the gaps between the current transport decarbonisation policy agenda and industry perception.

To achieve this aim, three objectives are set out in this study:

- **Research Objective 1:** To investigate how Irish road transport practitioners perceive decarbonisation measures and policies.
- **Research Objective 2:** To identify the barriers and enablers for transport companies to decarbonise.
- **Research Objective 3:** To pinpoint the policy implementation gap between the government's agenda and the industry's performance.

The remainder of this report is structured as follows. The 'Literature review' section briefly outlines the key academic research studies used as theoretical support for this study. The "Methodology" section presents a mixed-method approach, a combination of online questionnaires and interviews was used to obtain primary data from transport operators and key stakeholders in Ireland. The "Data analysis and research findings" section firstly presents a descriptive analysis of the survey results; followed by the decarbonisation barriers identified to address research objectives 1 and 2, respectively. A list of policy recommendations is proposed in Section 5. Lastly, this report concludes with future research directions and reflections on research limitations.

2. Literature Review

In this section, the key academic research studies are reviewed and used as the theoretical framework to conduct this study. The transport decarbonisation barriers and enablers identified from an international perspective are summarised in sections 2.1 and 2.2, respectively. As clean vehicle technology is one of the key enablers in transport decarbonisation strategy, thus, section 2.3 provides a detailed review on the uptake of clean vehicle technology in Europe.

2.1 Transport Decarbonisation Barriers

A recent study by Tölke and McKinnon (2021) entitled "*Decarbonizing the operations of small and medium-sized road carriers in Europe*" conducted a comprehensive survey of 811 road freight carriers across 32 European countries on their awareness and commitment towards decarbonisation. The study shows about two-thirds of road freight carriers consider freight decarbonisation to be a priority for their sector, however, 70% of them are lacking of knowledge about the adoption of carbon-reducing measures, and 43% felt having difficulties to calculate and report their emissions in road freight operations.

Cost pressure is still among the biggest barriers that hinder environmental improvement. As the majority of the small and micro operators (with a fleet size of less than 10 vehicles) work on slim profit margins, they do not see business benefits from being green (Tölke and McKinnon, 2021). Nevertheless, obtaining the buy-in from these majority SME transport operators is another key barrier to be tackled in pursuing low-carbon transport (Tölke and McKinnon, 2021).

Table 2- 1 *Decarbonisation barriers identified among European transport operators*

Barrier Category	Barriers
Political	Politicians and policymakers are pinning their hopes on zero-emissions truck technology to deliver this decarbonisation.
Economic	Cost pressures among the majority of small operators.
Social	Involvement and buy-in from SME carriers.
Technological	Supply of new vehicle technology.
Legal	The majority of the transport mobility strategy is focused on passenger transport and most of the references to freight relate to modal shift.
Environmental	Transport relies on road mode.

Source: Tölke and McKinnon, 2021

2.2 Transport Decarbonisation Enablers

The report '*Decarbonising Transport in Europe*' published by the International Transport Forum (ITF,2021b) summarises the findings of the project "Decarbonising Transport in Europe". This project modelled transport activity in Europe and provided detailed quantitative evidence on the actual impact of CO_2 mitigation measures, which allows European decision-makers to identify and assess realistic pathways towards decarbonising transport to 2050 and to help the European Union to achieve its CO_2 reduction ambitions for the transport sector.

ITF proposed **six types of interventions** to decarbonise the transport sector, including both passenger transport and freight transport in urban and non-urban areas. These interventions are proposed under six categories, namely economic instruments, regulatory instruments, infrastructure & land use, operations management, innovation, and exogenous factors (ITF,2021b).

The decarbonisation interventions related to the public and freight transport (HDV and HGV sectors) are summarised in Table 2-2.

With a more focussed perspective from the logistics industry, the research study by McKinnon and Petersen (2021) entitled '*Measuring Industry's Temperature: An Environmental Progress Report on European Logistics*' surveyed over 90 senior executives in Europe. The study indicated that about 25% - 30% of businesses are still at an early stage in the decarbonisation process. The study put forward a few overarching strategies for the companies to cut their carbon emission in their supply chain and logistics operations, strategies include (McKinnon and Petersen, 2021, p.22):

- Adopt best practices in sustainable logistics;
- Liaise with public policy-makers;
- Acquire skills in sustainable logistics;
- Devise a logistics decarbonisation roadmap;
- Incentivise logistics and IT service providers.

In comparison to the abovementioned ITF's study, which provides a list of decarbonisation enablers from a policymaker's perspective, this study by McKinnon and Petersen (2021) offers a set of decarbonisation enablers for the transport industry practitioners to adopt in their operations.

Table 2-2 *Decarbonisation actions and trends for each type of intervention*

Type of intervention	Specific decarbonisation actions
Economic instruments	• Distance charges; • Port fees; • Road pricing; • Parking pricing and restrictions; • Carbon pricing.
Regulatory instruments	• Incentives for low/zero-emission vehicles, related infrastructure and mandates; • Incentives for low/zero-emission fuels and related infrastructure and mandates; • Speed limitation for road transport; • Fuel economy standards; • Urban vehicle restrictions; • Incentives for uptake of Heavy Capacity Vehicles (HCV).
Enhancement of infrastructure and land use	• Improved land-use planning and transit-oriented development; • Public transport priority measures – express lanes, service improvement; • Infrastructure/network improvement for public transport;
Operations management	• Incentives for asset sharing and physical internet; • Integrated public transport ticketing.
Stimulation of innovation	• Support for autonomous vehicles in freight transport; • Increased implementation of ITS, i.e. eco-driving
Exogenous factors	• Autonomous vehicles for passenger transport; • Decarbonisation of energy sources; • Increase uptake of e-commerce; • Increased uptake of teleworking.

Source: ITF, 2021b, p.4.

2.3 Adoption of alternatively fuelled vehicles fleets

Decarbonisation policies increasingly aim to take action to improve air quality, reduce GHG emissions, increase energy security (through enhanced energy efficiency and diversification), and stimulate innovation and economic growth (Mohammed *et al*., 2020). Among the interventions mentioned previously (see Table 2-2), the adoption of new clean-vehicle technologies has been identified as an important means of tackling many of these issues in Europe and globally (Mohammed *et al*., 2020).

The ambitious decarbonisation targets set by the governments in Europe all point to a clear policy steering direction towards the adopting of clean vehicles (also sometimes referred as alternatively fuelled vehicles). The uptake of clean vehicle technology is acknowledged among governments in Europe as one of the key solutions to reduce carbon emissions and phasing out the reliance on fossil fuels (Mohammed *et al*., 2020; ITF, 2021).

What are the alternatively fuelled vehicles?

Alternatively fuelled vehicles (AFVs) are defined as "vehicles that run on fuel other than traditional petroleum-based fuels (petrol or diesel), or any technology powering an engine which does not solely involve petroleum" (Mohammed *et al*., 2020, p.1). AFVs include electric vehicles (including battery electric vehicles and plug-in hybrid EVs), hydrogen fuel cell vehicles, biofuels, ethanol, and biodiesel vehicles (Mohammed *et al*., 2020).

In comparison to the conventional internal combustion engine (ICE) vehicles, AFVs have several benefits for the environment and public health, such as a significant reduction in GHG emissions and hazardous emissions that cause air pollution, and less noise pollution during operations (Mohammed *et al*., 2020; ITF, 2021a).

The institutional and governmental action is the key to increase the diffusion of clean vehicles in the market (Mohammed *et al*., 2020). Despite governments' efforts, the growth of AFVs among the bus and truck fleets has been relatively slow.

Globally, the share of AFVs in 2017 accounts for 4.4% of the total number of vehicles in circulation (Mohammed *et al*., 2020). While in Europe, diesel buses still account for 94.5% of the EU fleet, with only 0.6% being battery electric; For freight transport, almost 90% of the EU van fleet runs on diesel, just 0.3% of vans are battery electric; 97.8% of all trucks in the EU run on diesel, only 0.04% of trucks are zero-emissions (ACEA, 2021) (see Figure 2-1).

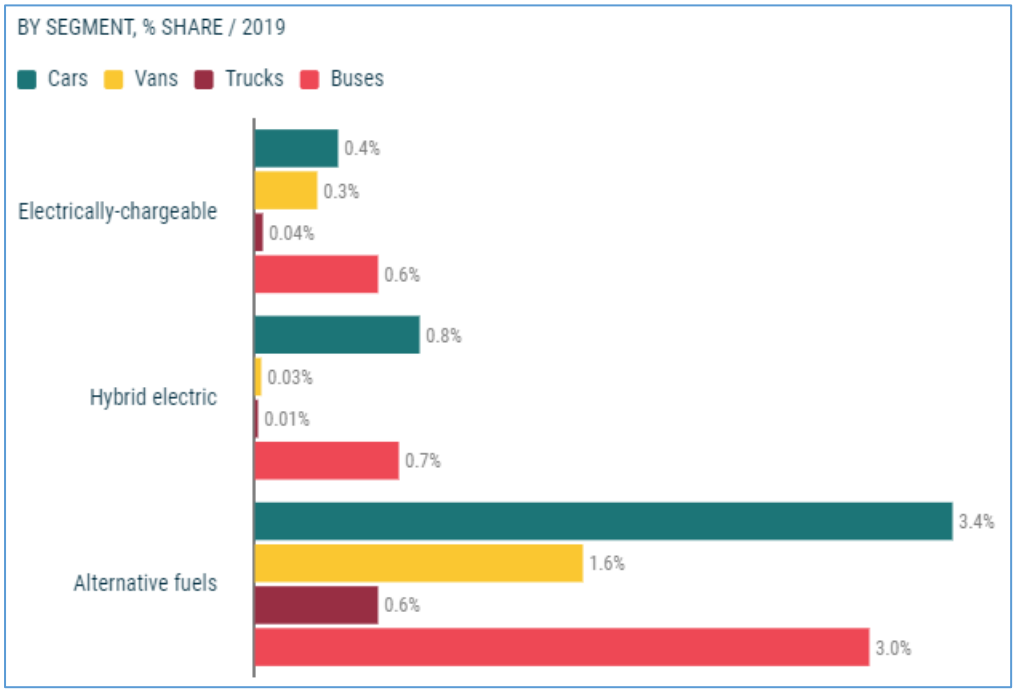

Figure 2- 1 *Share of alternatively fuelled vehicles (AFVs) in the EU market*

Source: ACEA, 2021

The global climate change agenda and EU's policy objective of reducing greenhouse gas emissions from transport have shifted the global appetite for EV. The increased policy support for EVs under the COVID-19 pandemic economic recovery packages helped to boost sales, especially in the second half of 2020 in Europe (ITF, 2021a).

According to the European Environment Agency (EEA, 2021[3]), electric cars, including battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs), are gradually penetrating the EU market with a steady increase in the number of new electric car registrations annually. However, overall, electric vehicles still account for a market share of only 3.5 % of newly registered passenger vehicles as of 2019.

In 2020, there are approximately 4 813 electric vehicles (including BEVs and PHEVs) in Ireland, which accounts for 4.1% of total registered vehicles (EEA, 2021). The current uptake has fell short from the 10% target (equating to approximately 250 000 electric vehicles) that the Irish Government set out for 2020 in the 'Electric Vehicles Roadmap'[4] published by SEAI in 2011.

Nevertheless, the market growth of electric vehicles is mainly concentrated in premium passenger cars and more recently in light-commercial vehicle fleets for urban deliveries (ITF, 2021a). For the heavy-duty vehicles market – buses and trucks, the market availability is still the biggest issue.

Table 2- 3 *Battery electric bus and truck sale in 2020 in Europe*

Bus	Truck
Europe is the second-largest market for electric buses, with more than 2,000 registrations in 2020.	• 450 units sold in Europe (2020); • Hyundai Motor delivered its first 10 units of the Xcient fuel-cell heavy-duty truck in Switzerland (2020). • Sales of electric light commercial vehicles (LCVs) – 33,000 units in Europe (2020).

Source: ITF, 2021a.

Major manufacturers in Europe are scaling up programmes and investments for zero-emission trucks. The 2020 pledge from European manufacturers Daimler, Scania, Man, Volvo, DAF,

[3] EEA (2021) New registrations of electric vehicles in Europe, https://www.eea.europa.eu/data-and-maps/indicators/proportion-of-vehicle-fleet-meeting-5/assessment
[4] SEAI (2016) Electric Vehicles Roadmap, https://www.seai.ie/publications/Electric-Vehicle-Roadmap.pdf

Iveco and Ford to phase out sales of conventional diesel trucks by 2040 demonstrates their commitment to decarbonising freight transport (ITF, 2021a).

To this regard, a recent report by the Transport & Environment[5] points out that the governments need to raise targets to increase the production of zero-emissions trucks throughout the decade to ensure the industry decarbonises on time - "*Truckmakers are going green quicker than policymakers…this is not the case of the free-market doing its job, but rather policymakers failing to do theirs. Truckmakers are clearly able to decarbonise quicker. It's time to make them"* (Transport & Environment, 2021).

[5] Europe's leading NGO campaigning for cleaner transport.

3. Methodology

This study focuses on the transport industry perspective and aims to pinpoint the gaps between the current transport decarbonisation policy agenda and industry perception.

To achieve this aim, three objectives are set out in this study:

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- **Research Objective 2:** To identify the barriers and enablers for transport companies to decarbonise;
- **Research Objective 3:** To pinpoint the policy implementation gap between the government's agenda and the industry's performance.

To achieve these objectives, firstly an online questionnaire was launched to canvass the attitude and concerns of public transport operators and road freight operators in Ireland. This was followed by in-depth interviews and a focus group with selected transport companies and government organisations to investigate the identified issues and generate practical recommendations for the transport industry. The detailed methodological steps applied in this study are documented in the following sections.

3.1 Transport operator survey

First, an online survey questionnaire was developed to understand how road transport practitioners perceive decarbonisation in Ireland. The first part of the survey recorded the respondents' demographic characteristics, while the second part asked about their perceptions, knowledge and concerns about the decarbonisation measures in Ireland. Open questions were asked about the respondents' key concerns and challenges in decarbonisation they experienced. The questions about the practitioners' awareness, attitude, and concerns were adopted from the 'Road Carrier Survey' by Tölke and McKinnon (2021), who studied road freight carriers in Europe. These questions helped to capture Irish road transport practitioners' perceptions regarding current decarbonisation efforts and to identify any gaps between the government's policy agenda and the industry's practice (see **Appendix B** for the questionnaire used in this study).

Sampling targeted road transport operators in Ireland, including road freight transport operators and public service vehicle (PSV) operators. Given 1,721 private operators are operating in the private bus and coach industry in Ireland (CTTC, 2020) and 3,791 road haulage operators-hire and reward (Department of Transport, 2021) in Ireland, a combination of convenience sampling and purposive sampling strategy was used in this study to capture

as many responses as possible (see **Table 3-1**). The online questionnaire was disseminated by posting the online survey link on CILT Ireland's social media pages and weekly e-newsletter. The population was approximately over 3,000 based on the number of followers to these pages. Individual email invitations were also sent to transport associations and transport companies identified through the publicly available information on the Internet.

Table 3- 1 *Survey dissemination*

Dissemination Channel	Number of Invitations Sent	Date
Social media posts (Twitter, LinkedIn)	Multiple	March – May, 2021
CILT weekly newsletter	Multiple	April - May 2021
Survey sent to transport associations	5 (CTTC, IRHA, FTAI, IEA, IIFA)	May 2021
Survey invitation sent by Email to transport companies (https://www.goldenpages.ie)	250 (Coach: 114; Haulage: 136)	June 2021

A total of **28 responses** were received between March and June 2021, representing an 11% response rate. The demographic characteristics of the sample are presented in **Table 3-2**

Table 3- 2 *Demographic characteristics of the surveyed companies*

	Number	Percentage	
Company Business Type			
Passenger Transport	8	29%	Public bus passenger services Coach & Bus Tours School transport
Freight Transport	20	71%	General freight transport and distribution
Company Ownership			
Irish	27	96%	
Others	1	4%	Local operation of a multinational company
Company Geographic Presence			
Leinster	17	61%	Dublin, Carlow, Kildare, Kilkenny, Longford, Louth, Meath, Offaly.
Munster	8	29%	Cork, Limerick, Waterford.
Connaught	2	7%	Galway, Roscommon.
Ulster	1	4%	Monaghan
Number of Full-Time Employees			
Less than 10	15	54%	
10 - 50	6	21%	
51 - 250	7	25%	
Company's Fleet Size			
No vehicles	1	4%	

1 - 5	7	25%	
6 - 10	7	25%	
11 - 20	5	18%	
21 - 50	2	7%	
51 - 100	4	14%	
101 - 250	2	7%	
Main Use of the Vehicle			
Own account	7	25%	
Hire or reward	21	75%	

3.2 Interviews

After conducting the survey questionnaire, some issues and questions emerged. In order to further investigate the identified issues and delve into the reasons behind the decarbonisation attitude of the transport industry operators, we carried out interviews with key stakeholders in the Irish transport sector. Before the interview, preliminary findings from the questionnaire were shared with targeted participants, along with a list of proposed interview questions. One individual interview and one focus group discussion with five participants were conducted from August to September 2021 (see Table 3-3).

Table 3- 3 Interviews participants in this study

Interview	Interviewee's Org. Type	Expertise
Individual interview (via Telephone)	Freight Industry Association	Freight transport
Focus group interview (via online conference)	Local authority	Public & Freight Transport
	Industry Association	Public & Freight Transport
	Commercial Transport Company	Public transport
	Energy management consulting company	Energy, Transport
	NGO	Supply chain, Freight transport

To analyse the qualitative data obtained from the open questions in the online survey and interviews, an iterative qualitative data coding process was applied to compare and contrast the findings with theoretical frameworks. Power and proof quotes were selected to present the results and demonstrate the evidence. **Table 3-4** below illustrates the coding process with some example codes and quotes.

Table 3- 4 *Qualitative data coding process example*

Proof quotes	Open codes	Refined Axial code	Selective code *(Theoretical category)*
"No incentives from the State. The emission class of our fleet have no	State incentives; Euro emission standards	Government incentives;	Government policy (Financial and regulatory)

bearing on Tolls, Road Tax, Fuel Rebate or Dublin City Permit. A Euro 1 HGV is the same as a Euro 6 from a State costs perspective."		Vehicle regulation standards	
"grants for new fleet"	Incentive for new fleet	Government incentives	Government policy (Financial)
"high cost and poor incentivisation ....."	*lack of incentives*	Government incentives	Government policy (Financial)

4. Data Analysis and Research Findings

4.1 Demographic characteristics of the surveyed transport operators in Ireland

Among the 28 research participants in this study, 8 of them were passenger transport operators, such as public bus service operators and coach companies in Ireland; the other 20 participants were operators from the road freight haulage sector. The majority of the surveyed companies are Irish companies, with only one haulage company is a British-owned company with local operations in Ireland.

In terms of the company's geographic presence, about two-third (17 companies) of the surveyed companies are primarily based or registered in the Leinster region, locating in the counties in east and southeast of Ireland, such as Dublin, Carlow, Kildare, Kilkenny, Longford, Louth, Meath, Offaly. The rest of the companies are located in Munster (Cork, Limerick, Waterford), Connaught (Galway, Roscommon), and Ulster (Monaghan), respectively.

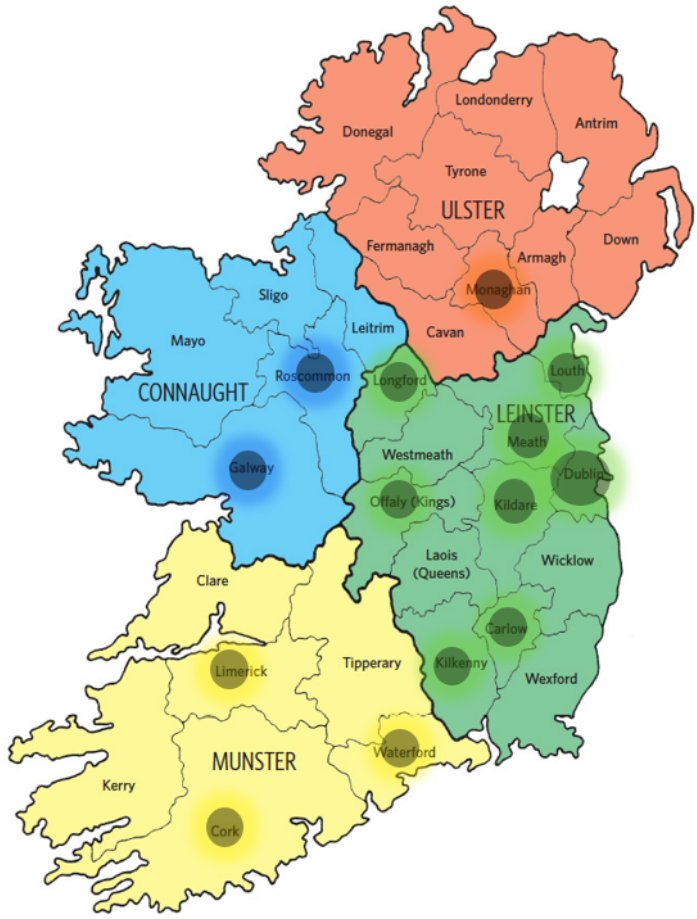


Figure 4- 1 *Geographic presence of the surveyed transport companies*

Key Finding 1

All the surveyed companies are SMEs, among which 50% are micro companies with less than 10 employees; Half of them have less than 10 vehicles.

In this study, as shown in **Error! Reference source not found.** below, all the surveyed companies were small and medium-sized enterprises (SMEs) based on the European Commission's definition of SMEs, which is a company with 249 or fewer employees. More than half (54%) of our surveyed companies are micro-companies, with less than 10 full-time equivalent employees; 6 companies (21%) are small companies, with 10 – 50 full-time equivalent employees; The rest 7 companies (25%) are medium companies with a headcount of between 51 and 250.

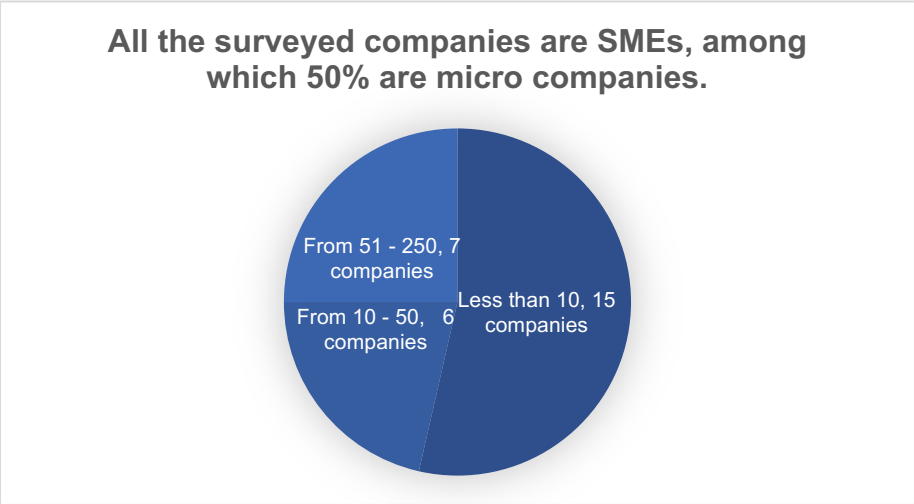
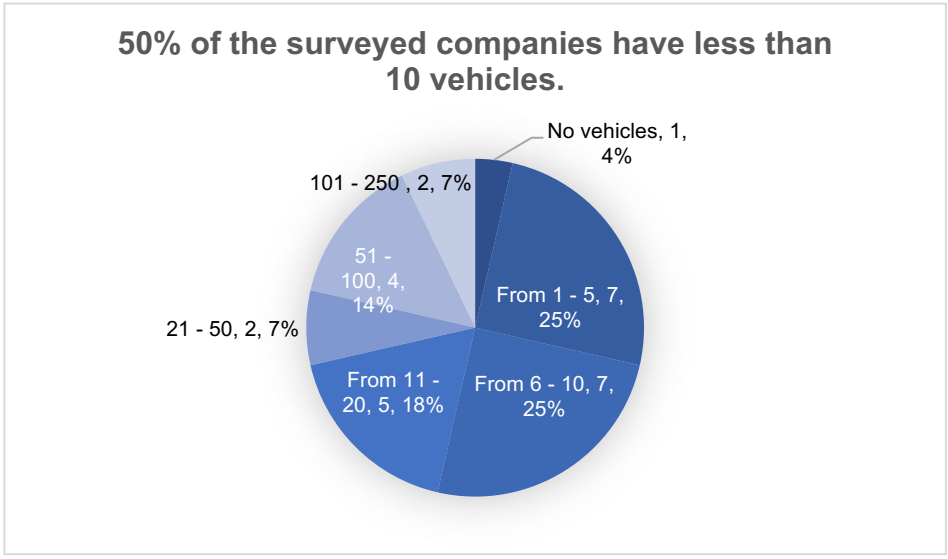


Figure 4- 2 *Company size in terms of headcount*

In terms of fleet size operated by the company (see **Figure 4-3**), about 50% (15 companies) of the surveyed companies have less than 10 vehicles in their companies; 25% of them have 11 – 50 vehicles, and the rest 21% of the companies operate a relatively large fleet, with more than 50 and up to 250 vehicles. In terms of the main use of the vehicle, 75% of the



companies were operating as ‘hire or reward’, and the rest 25% were ‘own account’ operation.

Figure 4- 3 *Fleet size of the surveyed companies*

4.2 Industry practitioners’ perceptions on decarbonisation

Key Finding 2

Only 20% of the companies plan to implement decarbonisation measures in the next two years.

In the second part of the survey, in order to investigate how road transport practitioners perceive decarbonisation in Ireland, we asked the participants to rate the level of importance of decarbonisation in their business. The result is shown in **Figure 4-4**.

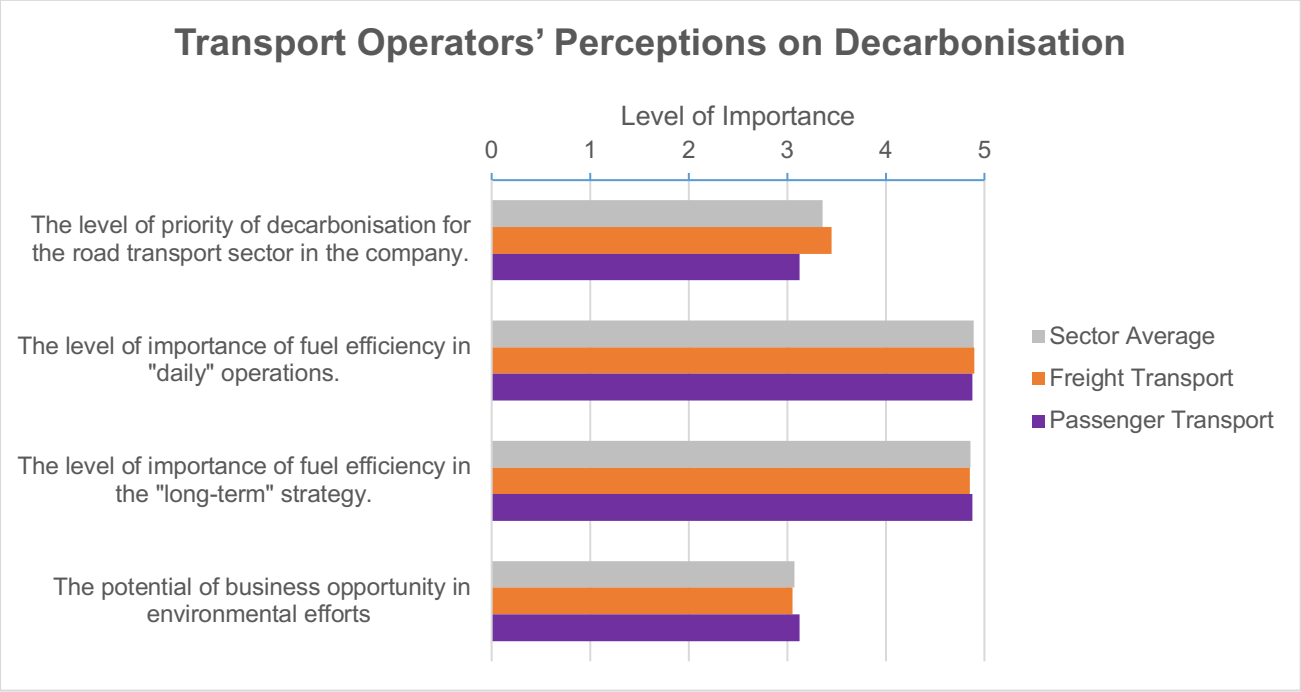


Figure 4- 4 *Level of importance of decarbonisation among transport operators*

On an operational level, both passenger transport operators and freight transport operators were unanimously prioritising fuel efficiency in their daily operations and long-term strategy.

In general, the transport operators considered there were business opportunities in carbon reduction efforts. However, only one-fifth of the surveyed companies plan to implement decarbonisation measures in the next two years, the majority of the operators presently do not have any concrete plan at an organisational level to reduce the carbon emission in the transport operations (see **Figure 4-5**).

Operators with future decarbonisation plans include measures such as upgrading their fleets to the cleaner Euro VI diesel trucks, changing to low rolling resistance tyres, optimising the load capacity, taking eco-driving training, uptake the alternative-fuelled vehicles, as well as

collaborating with their contractors who have already invested in carbon and environmental-friendly vehicles and services.

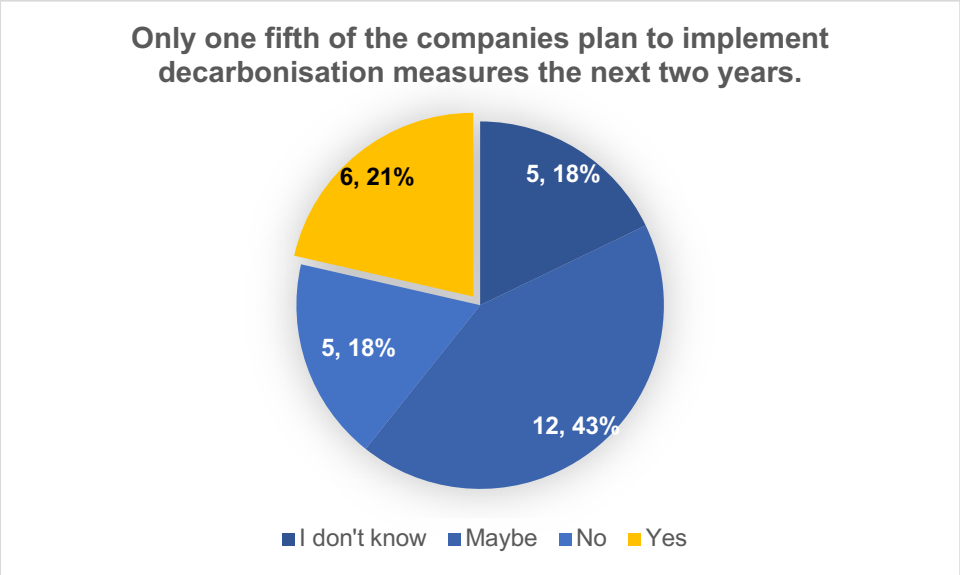


Figure 4- 5 Number of companies that plan to implement carbon reduction initiatives

Key Finding 3

43% of the companies were not able to calculate transport-related emissions in their operations.

In terms of the know-how to calculate transport emissions, the participants were asked to indicate their capability and knowledge to calculate carbon emissions.

The result shows that there were still 43% of the surveyed companies were not able to calculate transport-related emissions in their operations (see **Figure 4-6**). About half of the

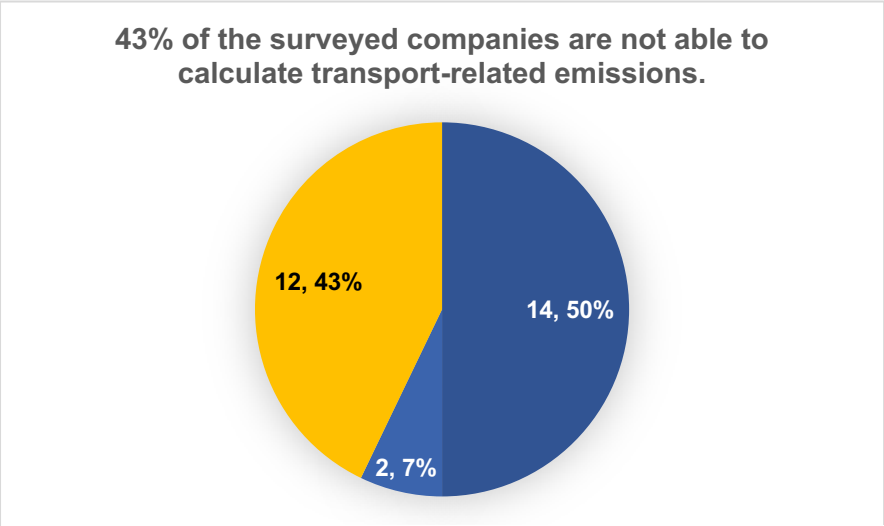


Figure 4- 6 Capability to calculate transport-related emissions

surveyed operators were able to calculate transport-related emissions at the company level, and 7% of them were able to calculate emissions at the customer level.

Key Finding 4

None of the companies are currently benefiting from carbon reduction related funding schemes.

Since 2019, the Irish government has launched a number of supportive funding scheme and incentives towards transport decarbonisation, such as the *Low Emissions Vehicle Toll Incentive (LEVTI)* in 2020 and the more recent *Alternatively-Fuelled Heavy-Duty Vehicle (AFHDV)* purchase grant scheme in March, 2021.

The participants were also asked about their experience with these government schemes. Although the majority surveyed transport companies (71%) were aware of the Irish government's financial schemes or funding towards carbon reduction for the transport sector, none of the surveyed companies were benefiting from these carbon reduction-related funding schemes.

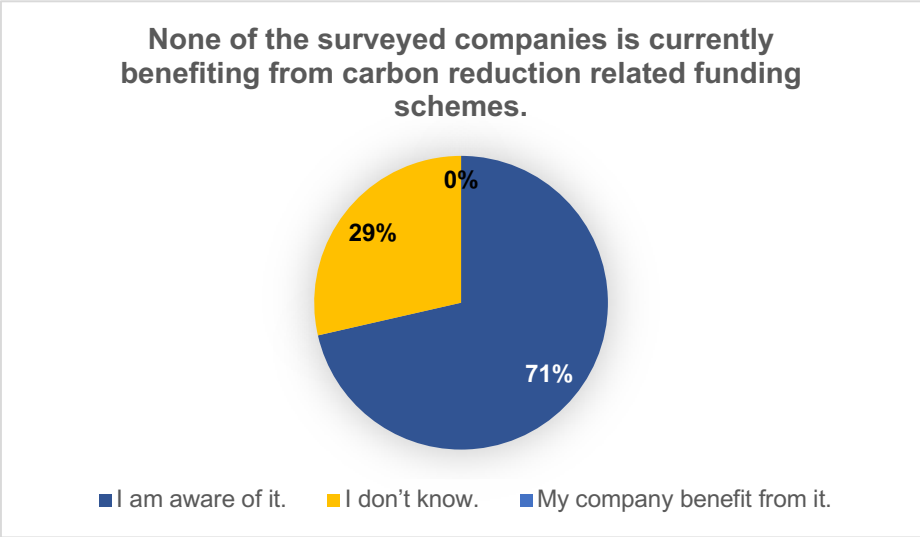


Figure 4- 7 *Awareness of government's support policies*

4.3 Industry practitioners' knowledge of decarbonisation

To understand the knowledge level of decarbonisation measures among the Irish transport industry practitioners, the participants were asked to indicate their understanding and experiences about the carbon reduction measures, such as operational measures, technical measures, and energy options. For all the 28 surveyed passenger and freight transport operators, the awareness level towards the decarbonisation measures was high, ranging from 75% to 100% regarding different measures.

Key Finding 5

The surveyed transport operators are highly aware of the relevant decarbonisation measures, they unanimously prioritise fuel efficiency in their daily operations and long-term strategy. However, specific vehicle technical measures are less adopted by the operators.

Passenger transport operators (as shown in **Figure 4-8**) surveyed have demonstrated a high level of awareness of the decarbonisation operational measures. However, measures such as *route optimisation (with 38% implementation level)* and *load capacity optimisation (25%)* have a rather lower implementation level. This could be due to public bus operators have less flexibility and control over the route choice and passenger numbers on board.

In comparison, vehicle technical decarbonisation measures were less adopted by the passenger transport operators. Measures such as *light weighting* (with 13% implementation level), *shorter vehicle-renewal cycles* (25%), *low rolling resistance tyres* (13%), and *vehicle aerodynamics* (13%) were only implemented by two operators of the surveyed companies.

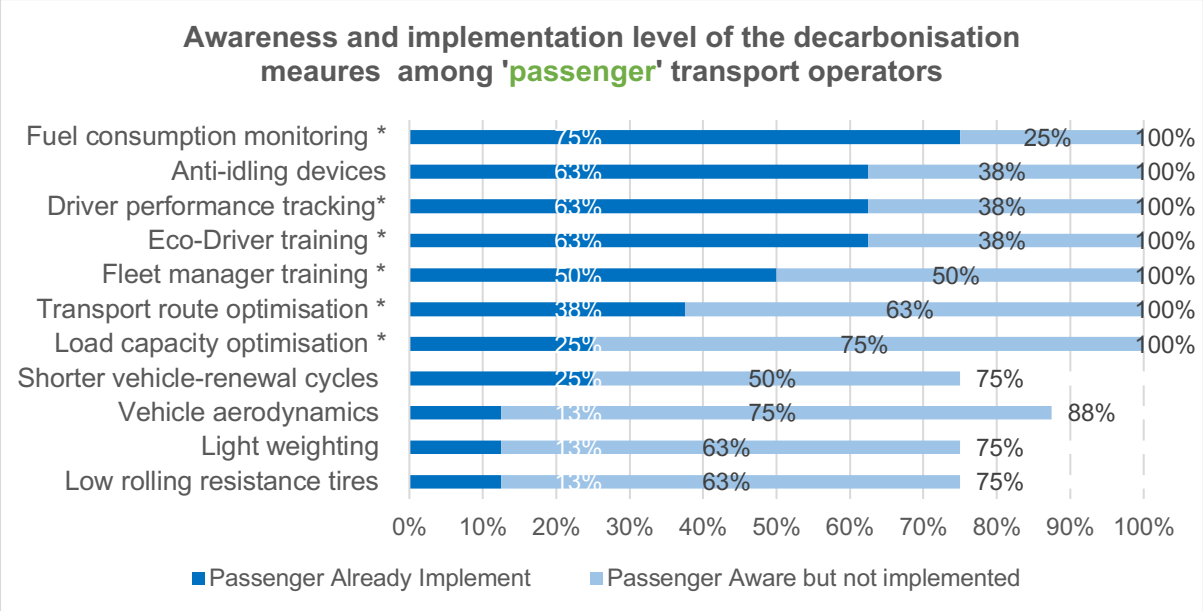


Figure 4- 8 *Awareness and implementation level of decarbonisation measures among 'passenger' transport operators*

Freight transport operators (as shown in **Figure 4-9**) have demonstrated an 80 to 100% awareness level for all the decarbonisation measures. Operational measures such as *fuel consumption monitoring (with 75% implementation level)*, *driver performance tracking (65%)*, *transport route optimisation (55%)* and *load capacity optimisation* (50%) were already implemented by more than half of the freight operators. For vehicle measures, similar to the surveyed passenger operators, freight operators generally were aware of these measures. However, few of them were adopted in their operations.

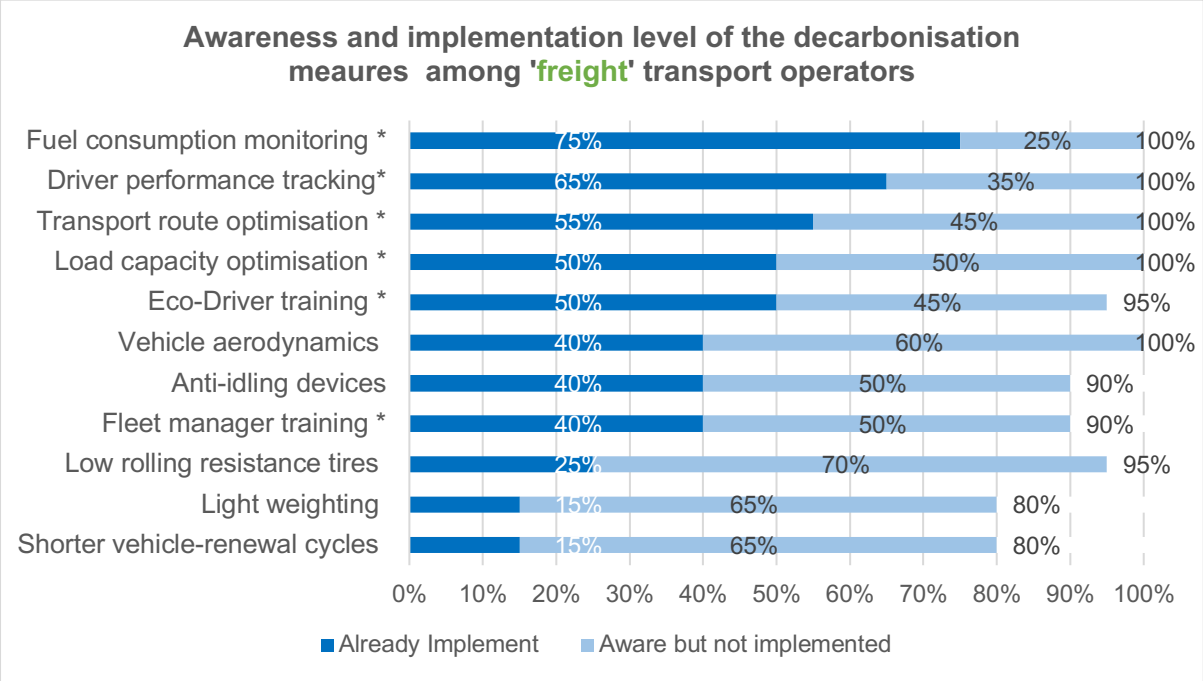


Figure 4- 9 *Awareness and implementation level of decarbonisation measures among 'freight' transport operators*

Note: Measures with "" are operational measures, the rest are vehicle technical measures.*

Key Finding 6

For the uptake of clean energy options, there is a misalignment between the government's incentivised direction (i.e. CNG, LNG, FCEV, Plug-in Hybrid and EV) and the industry's preference (i.e. hybrid, hydrogen and biofuel).

In this section, the perceptions regarding alternatively-fuelled vehicles' options among the operators are identified (see **Figure 4-10**).

On an overall level, *hybrid, hydrogen,* and *biofuel* were rated as more feasible options by the operators based on their experience. In particular, public transport operators were more optimistic about adopting electrically powered vehicles, due to the Low Emission Bus Trial carried out by the Department of Transport in 2019.

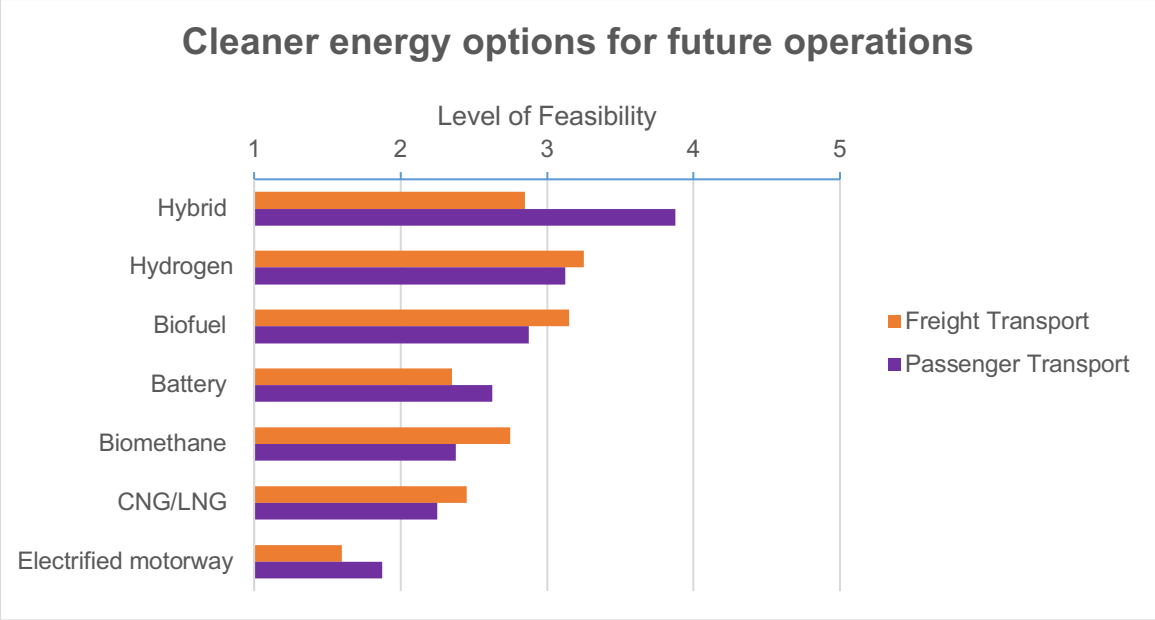


Figure 4- 10 *The feasibility of adopting cleaner energy options for future operations*

However, a misalignment between the government's incentivised direction and the industry's preference has been observed. As indicated in the latest '*Ten-Year Strategy for the Haulage Sector'*, the Irish government policy favoured cleaner energy options such as CNG, LNG, FCEV, Plug-in Hybrid and EV (Department of Transport, 2021). However, the low uptake rate of these alternatively-fuelled vehicles is mainly due to the market availability and supporting infrastructure. Thus, limited infrastructure acting as a barrier for further uptake by operators.

Currently in Ireland, for *public service vehicle* (PSV) bus operators, a range of clean vehicle trials have been carried out by operators under the *Low Emission Bus Trial* project. Plug-in hybrid electric buses have been observed as the option with great potential to scale up.

For *freight* operators, only CNG fuelled HGVs are available in Ireland. The other option such as LNG is much more expensive than its diesel equivalent vehicles, which is also subject to travel limitation on Eurotunnel and ferries. Electric HGVs are not available to the Irish market yet. However, there are a few models on trial in continental Europe (left-hand drive market). Table 4-1 has shown the current market availability of alternatively-fuelled HDVs in Ireland.

Table 4- 1 *Market availability of alternatively-fuelled HDVs in Ireland*

Energy Option	HDV/PSV buses	HGV Trucks
CNG	Two CNG and biomethane powered buses trials in Cork and Dublin in 2019[6]: o 1 x single-deck compressed natural gas (CNG)/bio-CNG bus; o 1 x double-deck compressed natural gas (CNG)/bio-CNG bus; CNG fuelling outlets in Ireland[7]: o Dublin Port, Cashel, Clonshaugh (Dublin), Ballysimon Road(Limerick) o There are also 3 private CNG refuelling stations in operation.	Currently less than 100 CNG trucks operating in Ireland. SCANIA and IVECO offer a CNG fuelled vehicle. (IRHA, 2021[8])
LNG	**Currently not available in Ireland.**	o LNG requires different tanks and fuel metering systems. Currently no fuelling outlet in Ireland. o The vehicle is about €45,000 more expensive than its diesel equivalent. This vehicle also cannot travel on the Eurotunnel and certain ferries (IRHA, 2021)
Hydrogen Fuel Cell	Currently two hydrogen buses in Dublin for testing as part of the Department of Transport's Low Emission Bus Trial[9]. o 1 x single-deck hydrogen fuel-cell bus; o 1 x hydrogen fuel cell electric double-deck bus in Dublin.	**Currently not available in Ireland.** These vehicles are significantly more expensive than their diesel equivalent, plus a considerable weight disadvantage (IRHA, 2021)
Plug-in Hybrid Electric	o 100 Alexander Dennis Enviro400ER plug-in hybrid buses, with a further order of 180 buses by the NTA in 2021. o These buses are operated by Dublin Bus in Dublin, and a further 26 operated by Bus Éireann in Galway[10].	**Currently not available in Ireland.** Two manufacturers, SCANIA and DAF, are currently trialling diesel-electric hybrids (IRHA, 2021).
EV	4 x single-deck battery-electric buses being tested as part of the Department of Transport's Low Emission Bus Trial.	**Currently not available in Ireland.** Suitability for long-range HGV is currently in doubt. None of the mainstream manufacturers have an electric HGV yet to market, albeit many have versions on trial. RENAULT is the first with a 26 tonne rigid available in limited numbers, cost about € 450,000 and an additional weight penalty of 2 tonnes (IRHA, 2021).

[6] https://assets.gov.ie/34685/0eadd0e2d4704fddb32c42e7d939c7ef.pdf
[7] https://www.gasnetworks.ie/business/natural-gas-in-transport/compressed-natural-gas/
[8] IRHA submission to the Department of Transport public consultation on the ten-year strategy for Ireland's road haulage sector.
[9] https://www.gov.ie/en/press-release/fb42f-ireland-takes-next-step-in-testing-hydrogen-buses-in-transport-fleet/
[10] https://www.sustainable-bus.com/news/280-plug-in-hybrid-buses-adl-to-nta-ireland/

4.4 Decarbonisation barriers

In order to identify the enablers and barriers behind the decarbonisation efforts, the participants were asked to rate the internal and external factors that could influence their company's decision making towards decarbonisation. Follow-up interviews and focus group discussion with key stakeholders have also brought insights to this section.

The internal factors and external factors are shown in **Figure 4-11** below are the commonly known factors identified in previous research studies in the European context. On an overall level, all these factors were also demonstrated a strong influence level on Irish transport operators.

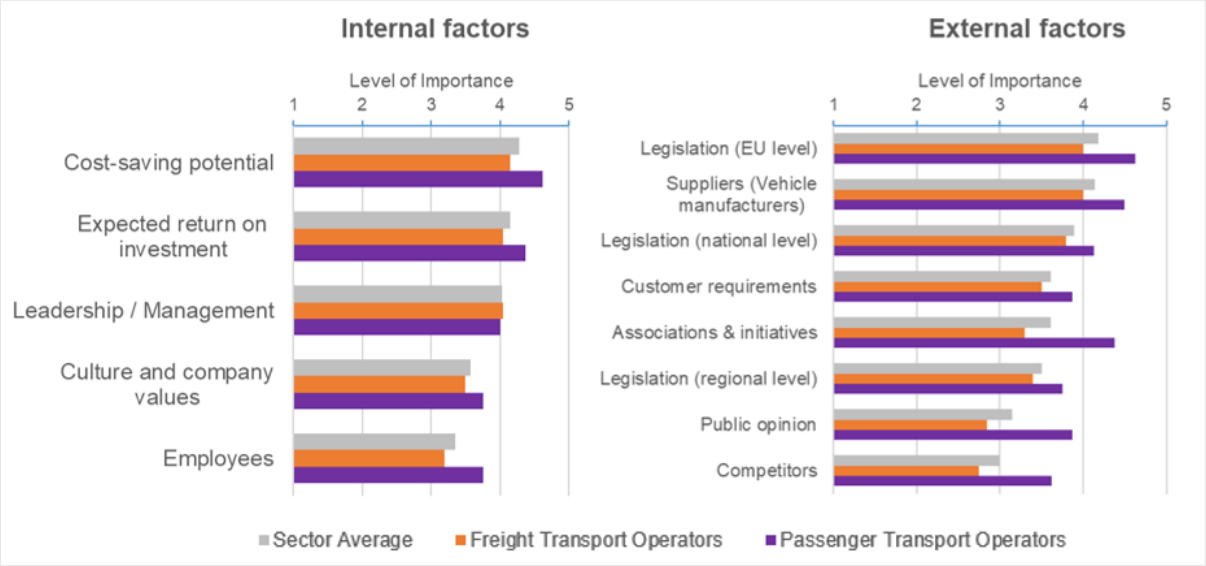


Figure 4- 11 *Factors influencing transport company's decarbonisation decisions*

We then analysed the responses from the open questions on the current risks and challenges that Irish transport operators experienced in their decarbonisation endeavour. The barriers can be generally categorised into 8 main barriers and relative sub-themes. Some specific examples are also listed in **Table 4-2** below.

Some commonly shared challenges among both freight and passenger operators are discovered as follows:

- The **high cost** of cleaner energy-powered vehicles (HGVs and buses) is still the main barrier to the Irish transport operators. The currently existing new technologies such as electric HGVs or hydrogen HDVs are still very expensive to almost SMEs operators.

(For example, a Volvo EV truck costs about £300,000; the new hydrogen bus adopted by Bus Eireann costs €800,000 each[11]).

- The **availability of the infrastructure** for these new energy options is still not ready yet in Ireland. Road haulage and public coach service generally have much longer travel mileage in Ireland. The facilities for fuelling and charging are crucial to the operators to switch to these alternatively-fuelled vehicles.
- The **awareness level** towards the decarbonisation measures among Irish transport operators is very high, however, presently none of the 28 surveyed companies benefits from the current government financial supportive schemes towards decarbonisation. Also, apart from financial policies, regulatory policies are also needed on both a national level and local authority level. A more systematic approach on regulation in both urban and non-urban areas need to be developed for a different type of fuelled vehicles, such as the cleaner Euro VI diesel, electric, CNG, bio-CNG, etc.

***Table 4- 2** Decarbonisation Barriers identified among Irish transport operators*

Main Barriers	Themes	Specific Examples
Cost	High capital cost	• Cost of the fleet, infrastructure, technology; • Viable price for investment; • Customer willingness to pay; • Customer commitment
	Cost-saving potential	• Vehicle life span
	Expected return on investment	• Vehicle life span; • Vehicle residual value
Infrastructure	Infrastructure availability	• Fuelling depot for CNG; • Charging facilities for electric vehicles (especially for buses at touristic sites and hotels); • Availability of facilities in Ireland to support long-distance transport operations
	Infrastructure cost	• High investment for purchasing alternatively-fuelled fleet
Government Policy	Government Leadership	• Awareness and knowledge at the leadership level for decarbonisation in the sector
	Financial support	• Lack of grant for the new and cleaner fleet; • Lack of incentives for uptake cleaner fleet, such as Tolls, Road Tax, Fuel Rebate or Dublin City Permit.
	Regulatory support	• Local authority to lift city permit for the cleaner fleet; • Formulate relevant regulations based on fleet emission standards, such as the Euro emission standard.

[11] https://buseireann.ie/bus_eireann_news.php?id=4986&month=Jul

Stakeholder collaboration	Customer	• Willingness and commitment to bear the cost of decarbonisation
	Societal sustainability	• Engage with wider society
Technology	Cost of technology	• Lack of technology at a viable price
Geographical issue	Dispersed demand	• Infrastructure availability at long distance
Training	Availability	• Lack of training for new technology, such as driving, fuelling new vehicles
	Enforcement	• Training (such as eco-driving) needed to be embedded in the test (e.g. RSA's CVRT test)
Short-term solution	Availability	• Lack of feasible and practical solutions to be adopted

Source: Questionnaire, interviews and focus group discussion.

5. Recommendation for Policy on Transport Decarbonisation in Ireland

A clear roadmap for the Irish transport industry to transit into the low-carbon trajectory is needed. This study suggests that the transport industry requires a suite of policies with a combination of complementary measures that work together. Actions from both policymakers and industry practitioners are essential to achieve the desired outcomes.

This study's empirical investigations have captured a perspective on the current decarbonisation practice from the transport industry, as well as a more in-depth understanding of their attitude towards the current decarbonisation policies in Ireland.

Utilising the framework from Tsoi *et al*. (2021)[12], we propose some recommendations for policy development on transport decarbonisation in Ireland from the following four areas: regulatory, pricing, technological strategy, and behavioural change.

5.1 Regulatory policies

Policy framing requires a clear and consistent alignment of vision, objectives, targets and action plans, as the market requires stability and certainty (Tsoi *et al*., 2021). From the flagship policy programme European Green Deal in 2017 to the latest environmental package 'Fit for 55' published in July 2021, the European Union has set out the vision to make Europe carbon-neutral by 2050. For the road transport sector, the emphasis is on the alternative and cleaner energy fuels for all vehicles, intending to phase out the sale of Internal Combustion Engines (ICE) vehicles no later than 2035.

The transport sector as one of the key economic sectors in Ireland is also the key sector to secure the carbon reduction goal. In line with the roadmap to a carbon-free Europe, sustainable mobility has been put forward by the Irish government as one of the key actions in recent years since 2019. Alternation fuels, railways, and urban mobility as key initiatives have been put on the agenda for road passenger transport and freight transport sectors.

However, there is a lack of clear and consistent alignment from the overarching decarbonisation vision in the national climate plan to the specific objectives set out for the transport industry. More specifically, clearly defined quantifiable targets for both public transport and freight transport are needed for the industry to formulate their action plans.

[12] In this study, the authors have studied transport decarbonisation policies and performances from 16 leading global economies in an extensive period from 1990 to 2018.

Two recommendations on regulatory policies are proposed based on the findings from this study.

First, clear carbon emission standards and regulations for different vehicle types need to be established. Clear standards need to be set and aligned with the EU standards and made explicit on what a clean vehicle minimum standard is (e.g. Euro VI for road haulage). This is a major missed opportunity that needs to be seized in Ireland. Tsoi *et al*. (2021) also pointed out regulating fuel quality and fuel economy standards can be a '*very first step*' for decoupling carbon emissions from economic growth. Its effectiveness can be enhanced if mandatory standards are applied to both vehicle consumers and manufacturers.

By setting clear vehicle emission standards, complementary measures (such as Diesel Rebate Scheme, or an incentive on city permit) could be introduced to reward operators for using clean fleets. Existing programmes in Ireland such as *Lean & Green* by GS1 Ireland (https://www.gs1ie.org/tools-services/programmes/lean-green/) and *ECOfleet* by AEMS (https://aems.ie/ecofleet3/) have demonstrated significant performance improvement in haulier fleet carbon reduction.

Second, in addition to the current regulatory framework, contingency plans should also be considered to build into the decarbonisation roadmap. The road freight transport sector is being constantly affected by the on-going disruptions, such as Brexit, the COVID-19 pandemic, the surge of fuel price, and driver shortage. During the engagement with the transport operators in this study, a sense of '*overwhelmed*' has been felt. The operators are preoccupied with on-going workload, and hardly have the capacity or resources to make a strategic plan for decarbonisation in their operations. Contingency plans should be developed in the policy to help transport operators tackle disruptions and prepare for unforeseen risks.

5.2 Pricing policies

The study by Tsoi *et al*. (2021) suggested that policy-making needs to move beyond single policy measures, and a combination of sets of complementary measures is necessary. This is especially essential for pricing policies. For example, the introduction of strong carbon pricing needs to be supported by incentives for renewable energy and cleaner vehicles, these complementary measures can work together to achieve the desired outcomes (Tsoi *et al*., 2021).

The **Diesel Rebate Scheme (DRS)** has been identified from our research as one of the tools that is already in place, and with great potential to be used as a complementary measure in Ireland. The scheme so far has been used mainly for price discounts. The haulage operators

in the diesel rebate scheme get no incentive within the diesel rebate scheme for being greener. Potentially, the DRS could be modified as a cash reward scheme to incentivise operators for adopting greener options. The grants and other processes could be simplified and implemented through the Local Enterprise offices (LEOs). Once again, clear regulatory policies on the clean vehicle are needed.

A structural change of the policy implementation process could help to improve the use of these existing policy levers (such as the Diesel Rebate Scheme). A dedicate work group for transport decarbonisation could be formed from different functions and departments from the central government and local authorities, thus, to avoid a silo-structured governance structure. Research studies have emphasised that a well-defined governance structure is essential to the realisation of policy objectives in transport decarbonisation (Marsden and Rye, 2010; Walker *et al*., 2015; Tsoi *et al*., 2021).

5.3 Technological strategies

Technological transition in the decarbonisation process is difficult, not only the development of new clean vehicle technologies but also the buy-in and uptake from the customer and transport operators. As mentioned previously, decarbonisation policy roadmap requires a clear and consistent regulatory direction to maintain stability and certainty in the market, and it also requires enabling measures such as incentives or tax benefits (Tsoi *et al*., 2021).

Another key consideration when formulating the technological strategy in transport decarbonisation, is the timeline of the transition period. Tsoi *et al*.'s (2021) study found that each country would follow a different pathway to decarbonise, and making progress at different speeds. As per the latest European Green Deal 'Fit for 55' package, the year 2035 has been set as the deadline for phasing out ICE vehicles.

The two major barriers for the bus and haulage operators to take-up alternatively-fuelled vehicles in their operations are the significant upfront investment costs and infrastructure availability. For example, the latest hydrogen-fuel-cell-electric double-deck buses would cost approximately €800,000 with limited market availability[13]. Also, charging facilities are needed to support the long-distance transport operations in Ireland, especially for buses at touristic sites and hotels.

[13] In July 2021, Bus Éireann purchased three new hydrogen-fuel-cell-electric double-deck buses that will be used on commuter services in the Greater Dublin Area.
https://buseireann.ie/bus_eireann_news.php?id=4986&month=Jul

The global climate change agenda and EU's policy objective of reducing greenhouse gas emissions from transport have shifted the global appetite for EV. For passenger electric cars, a steady increase is witnessed in the number of new electric car registrations annually in Ireland, however, the uptake of EV among HDV operators is rather slow and difficult.

Much of clean vehicle technology for HGVs is still in its infancy, and not widely available to the market yet. For example, a 'Hydrogen Fuel Cell' HGV could be 4 to 5 times the price of their diesel equivalent, with a considerable weight disadvantage; 'Plug-in Hybrid Electric' manufactured by SCANIA and DAF are currently still in the trial; None of the mainstream manufacturers have an electric HGV yet to market, albeit many have versions on trial. RENAULT is the first with a 26 tonne rigid available in limited numbers, cost € 450,000, and an additional weight penalty of two tonnes. These clean vehicle technologies for the HGV market are either not commercially available to the 'right-hand drive' Irish and British market yet, or being commercially at a viable price for the operators to invest.

Considering Ireland's almost 40,000 heavy goods vehicles are diesel-fuelled and 45% of which are over ten years old (Department of Transport, 2021). It is crucial for the Irish government, the public, and the freight transport industry to work together and set out a feasible timeline to gradually phase-out conventional HDVs and HGVs. However, only when clean vehicles are commercially available and viable.

Prior to clean vehicle technologies becoming available to the mass market, 'stepping-stone' vehicle and fuel technologies should be encouraged during this transition period. Cleaner options such as the Euro VI diesel trucks and alternative biofuel for trucks could be an alternative in the near future. This view has also been shared by the policy expert from Logistics UK (formerly the Freight Transport Association) at a recent urban logistics expo panel discussion in London[14].

To this end, Hydrotreated Vegetable Oil (HVO) as an alternative fuel has been highlighted by energy experts in Ireland as a feasible solution that could have a significant impact on carbon reduction. HVO, as a synthetic diesel made with food waste and by-products from food production, emits 90% less CO_2 than conventional diesel[15]. The fuel is suitable for all diesel engines. However, the major drawback is price, as it costs 70% more than conventional diesel. Belgium recently established three new fuel outlets for HVO in 2021. However, for biofuels, it is important to note that the full life cycle well-to-wheel (WTW) emissions of the

[14] 'Freight in the City Expo' at London's Alexandra Palace, 28 September 2021.
[15] Brussels Times, 2021. Fossil-free diesel available in first pumps. https://www.brusselstimes.com/news/belgium-all-news/188467/fossil-free-diesel-available-in-first-pumps/

various biofuels can differ widely, with the best-performing pathways generally relying on waste oils or low-carbon biomass feedstocks (ITF, 2021a).

Apart from vehicle and fuel technologies, energy infrastructure such as grid access for electrification should also be considered. For example, grid access should be prioritised for trucks over data centres. Moreover, electricity generated from renewable sources such as wind farms and wave generation requires substantial investments in infrastructure, which should also be included in the long-term technological development strategy.

5.4 Behavioural change

The decarbonisation transition not only needs the buy-in from the transport operators and their customers but also the wider society and individual end consumers to engage in this process. Enabling mechanisms are necessary to allow individuals and businesses to make the change (Tsoi *et al*.'s, 2021).

In this study, a number of measures were identified that could be considered by policymakers and regulators to accelerate the behavioural change towards low-carbon transport.

First, the application process of green funding should be simplified and implemented through local authorities. As identified in this study, the awareness and adoption of the current existing low-carbon transport-related funding or incentives among the surveyed transport operators are very low.

The key to improving the awareness of these incentive schemes among the transport operators, especially the majority of small and micro companies, is to simplify the process and implemented it through the local authorities, such as Local Enterprise Offices (LEOs). There are arms of government that can deliver these policy messages to SMEs, but they're not being used to deal with any transport-related policy, such as Enterprise Ireland and LEOs.

Meanwhile, from the local authority's perspective, the local authorities tend to provide clean transport-related funding (such as E-cargo bikes for the last mile delivery services) to local SME businesses, rather than directly to the transport operators. The local authorities also share the challenges, such as the buy-in from small businesses.

Second, to support policy promotion and dissemination to the transport industry, decarbonisation best practice case studies in a storytelling manner should be developed. The case study should be developed for educational purposes, using practical language to convey the policy message into transport everyday operation practice. Such case

studies could be developed by an independent and professional body (such as CILT) with a supporting role, and a degree of rigor and fact check of the cases is essential.

A good example was the UK 'Freight Best Practice' developed by the UK Department for Transport in the early 2000s (and stopped around 2010), using simple and clear company case studies to showcase the company's success story in implementing changes, and also showcase the financial benefit associated with it. This could be a good way to promote policy messages to the micro and small players.

Third, a benchmarking tool should be developed to disseminate best practice examples with industry operators in Ireland. Such tool could be developed as a mini free app for education purpose that allows operators install in their phone. The app could act as an educational tool for operators to understand the industry/sector average performance level, and learn from the best practice in the EU and other regions.

Fourth, enforcement measures are needed to evaluate the operators' performance improvement. For example, the telematics system could be installed on the vehicles to gather driving performance data on a voluntary basis, as an incentive for tax reduction.

Last, a platform for stakeholder dialogues could be useful to engage a wide range of stakeholder representatives from both the public and private sectors. Such a dialogue platform enables a much greater involvement of both the public and businesses in discussions over issues of low carbon transport and how they might contribute to this fundamental change.

In this regard, the 'freight partnerships' model in the urban logistics field has shown to be an effective way to address transport problems. A freight partnership is a long-term partnership between freight stakeholders that on a formal or informal basis meet regularly to seek solutions to problems and discuss concerns. Most partnerships do not receive any funding, while in other cases some partnerships have received project funding (Browne *et al*., 2019).

6. Conclusion

Focussed on the transport industry perspective, this study captures the current awareness and perception among the Irish road transport operators (public transport and freight) towards the transport decarbonisation policies and measures in Ireland. The gap between the government's agenda and the industry's performance is identified through empirical investigation. Moreover, the decarbonisation barriers from the transport operators' perspective were identified. Enablers were also proposed for both the government and industry to take action upon.

The Irish Government has demonstrated increased effort in policy development towards the low-carbon transition for the transport sector in recent years. However, this study finds that a significant misalignment between the government's incentivised decarbonisation direction and the industry's preferences exists, which might hinder the uptake of cleaner vehicles among HDV and HGV operators. The current decarbonisation policies indicate a trend towards 'electrification' for the transport sector in general. However, given the limited technology maturity and market availability, the 'electrification' might not be a feasible option for the HDV and HGV operators. In addition, the high upfront investment of cleaner vehicles and the availability of the infrastructure (vehicles and fuelling/charging facilities) across the country are also major barriers. Furthermore, small and micro companies are the major force in the transport industry in Ireland (similar in the European context), and they are less interested in adopting 'green' practices in their operations or participate in the current decarbonisation schemes.

Hence, the current government policies on transport decarbonisation are less reflected in terms of measures and support schemes for the SMEs operators in the market. Also, there is a lack of clear and consistent alignment from the overarching decarbonisation vision in the national climate plan to the specific objectives set out for the transport industry. More specifically, clearly defined quantifiable targets for both public transport and freight transport are needed for the industry to formulate their action plans.

Through the in-depth interviews with key stakeholders and experts in the Irish transport industry, a list of recommendations for policy development from the following four areas: regulatory, pricing, technological strategy, and behavioural change.

In conclusion, this study highlights that:

1) Clear carbon emission standards and regulations for different vehicle types need to be established. Clear standards need to be set and aligned with the EU standards and

make it explicit what a clean vehicle minimum standard is. This is a major missed opportunity that needs to be retained in Ireland.

2) Contingency plans need to be introduced in the decarbonisation roadmap to tackle disruption events such as Brexit, COVID-19 pandemic, fuel price volatility and driver shortage.
3) A combination of sets of complementary measures is necessary. The introduction of strong carbon pricing needs to be supported by incentives for renewable energy and cleaner vehicles. These complementary measures can work together to achieve the desired outcomes.
4) Many existing levers (i.e. the Diesel Rebate Scheme) have not been used, which could potentially be modified as complementary measures.
5) The decarbonisation grants and other support schemes could be simplified in the application process and implemented through the local authorities, such as Local Enterprise Offices (LEOs).
6) In the process of phasing out traditional fossil fuel vehicles, 'stepping-stone' vehicle and fuel technologies should be promoted and utilised, such as the cleaner Euro VI diesel trucks and alternative biofuel for trucks.
7) In order to support decarbonisation policy promotion and dissemination to the wider transport industry practitioners, best practice handbook and case studies should be developed to convey policy messages in a practical manner.
8) Last, establish a platform for stakeholder dialogues would be useful to engage a wide range of stakeholder representatives, especially for the majority of small and micro operators.

However, this study also has some limitations. Given that 1 721 private operators are operating in the private bus and coach industry (CTTC, 2020) and 3 791 road haulage operators (Department of Transport, 2021) in Ireland, our survey sample (28 operators) only captured a fraction and a snapshot of the industry profile. However, through the engagement with industry practitioners to obtain primary data, and the future dissemination of this study, we hope to continue raising the awareness towards the low-carbon transition to CILT members, the wider public audience, stakeholders, and the government.

We hope this study will help policymakers in Ireland to gain a fuller understanding of how road public transport and road freight transport companies, especially small and micro operators in Ireland perceive the current policy and the challenges for low-carbon transition. Focusing on the industry's perspective can help policy research to develop responses and robust policy interventions with effective measures to bridge the policy implementation gap, and potentially informing future policy objectives.

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Appendix A - Overview of Relevant Transport Decarbonisation Reports in Ireland

No.	Year	Research Project Title	Organisation	Sectors	Stakeholder Perspective	Summary	Source Link
1	2019	Climate Action Plan 2019	Government of Ireland	Transport, Electricity, Enterprise, Build Environment, Agriculture, Waste	Government	Reduce carbon intensity of travel (EV, biofuel, prioritise public transport, low emission zones, decarbonise HGV) Target and measures proposed.	https://assets.gov.ie/10206/d042e174c1654c6ca14f39242fb07d22.pdf
2	2011	Electric Vehicle Roadmap	SEAI (Sustainable Energy Authority of Ireland)	Private passenger car only	Government	This roadmap provides scenarios for accelerated deployment of battery electric vehicles (BEVs) and plug in hybrid electric vehicles (PHEV) in the private vehicle fleet to 2050.	https://www.seai.ie/publications/Electric-Vehicle-Roadmap.pdf
3	2019	A roadmap for the deployment of electrofuels for the decarbonisation of heat and transport in Ireland	SEAI (Sustainable Energy Authority of Ireland) & National University of Ireland, Galway	Transport; Fuels	Government	This project will provide a roadmap to policymakers in Ireland for gaseous electrofuels to reduce curtailment/constraint and drive deep decarbonisation in heating and transport through sector coupling. The roadmap will outline the financial costs and benefits of electrofuels for deep decarbonisation and sector coupling. It will enable policymakers to assess potential supports necessary to stimulate investment in the technology.	https://www.seai.ie/data-and-insights/seai-research/research-projects/details/a-roadmap-for-the-deployment-of-electrofuels-for-the-decarbonisation-of-heat-and-transport-in-ireland
4	2017	Ireland's low carbon future -Dimensions of a solution	ESB (Electricity Supply Board)	Energy; Transport	Industry; Government	Summary of decarbonisation roadmaps in EU for energy sector. Common themes that emerge from these roadmaps and can inform the transition in Ireland. (p.55)	https://www.esb.ie/docs/default-source/Publications/dimensions-of-a-solution---full-report-with-contents-links
5	2017	Transitioning to a low carbon energy system What is the best route forward for Ireland?	PwC	Energy; Transport; Heat	Government	Three-phase policy recommendations for private/public/commercial transport. (EV, VRT on fuels, CNG, biofuels)	https://www.pwc.ie/publications/2017/transitioning-to-a-low-carbon-energy-system.pdf

6	2020	Vision 2050 Decarbonisation by sector - Transport	Gas Network Ireland	Transport	Industry; Government	CNG for HGVs and buses.	https://www.gasnetworks.ie/vision-2050/decarbonisation-by-sector/transport/
7	2013	Low Carbon Energy Roadmap for Ireland	Deane et al., 2013 (UCC)	Transport, Power, Residential, Services, Industry	Government	Scenario analysis: In order to reduce 80% of CO2 emission, electric vehicles appear in the energy mix in 2030 and by 2050 all the private car fleet (approximately 3 million vehicles) are electrified. Freight transport which cannot be electrified is fuelled by biogas (725 ktoe) and the remainder is supplied by ethanol (781 ktoe) and diesel (208 ktoe)	https://www.esri.ie/system/files?file=media/file-uploads/2015-07/BKMNEXT292.pdf
8	2014	Opportunities to Decarbonise the Irish Transportation Sector	Mulholland et al., 2014 (UCC)	Transport	Government	Outline policy options for long-term decarbonisation in the Irish transport sector, with a focus on private cars, light commercial vehicles and heavy-duty vehicles (which together constitute 93% of final energy consumption in the transport sector). (HVO, EV, biofuels, uptake of energy-efficient vehicles)	https://www.epa.ie/pubs/reports/research/climate/Research_Report_321.pdf
9	2020	A Hydrogen Roadmap for Irish Transport 2020-2030	Hydrogen Ireland Association	Transport	Industry; Government	Deployment of hydrogen mobility in Ireland. Hydrogen Fuel cell vehicles to include 30 Buses, 50 cars & 10 Trucks on Irish roads by 2023.	http://hydrogenireland.org/2020/06/11/a-hydrogen-roadmap-for-irish-transport-2020-2030-hydrogen-mobility-ireland/

Appendix B – Questionnaire Design and Dissemination

The design of this questionnaire is inspired by the research study by Tölke and McKinnon (2021) entitled "*Decarbonizing the operations of small and medium-sized road carriers in Europe*", who conducted a comprehensive survey of 811 road freight carriers across 32 European countries on their awareness and commitment towards decarbonisation.

The online questionnaire is conducted using MS Forms and can be accessed at:
https://forms.office.com/r/EyUhWmun7a

	Questionnaire Introduction and Instruction The Government of Ireland has set out to pursue a climate-resilient economy and become carbon neutral by 2050. Increasing demands for emissions mitigation will put greater pressure on transport activities for the movement of people and freight. The transport sector in Ireland will have to adapt to this new climate reality. In 2021, the Chartered Institute of Logistics & Transport (CILT) in Ireland is conducting a series of policy research studies that analyse climate change implications for the Irish transport sector. In this study, we focus on the transport industry side and aim to develop a roadmap with practical recommendations for road transport companies in Ireland to transit towards the low-carbon trajectory. The purpose of this questionnaire is to capture Irish road transport practitioners' awareness, attitude, and concerns about available carbon reduction measures in Ireland. The questionnaire should take about 5 - 10 minutes to complete. Your decision to take part in this questionnaire is entirely voluntary. The information that you disclosed in the questionnaire will be protected and any personal information will be treated in strict confidence. We appreciate your valuable input. In return for your time, you will receive a copy of the report of the research findings once it is completed. CILT (Ireland) Policy Committee policy@cilt.ie https://www.cilt.ie/Policy	
No.	**Questions**	**Multiple Choice**
Section A	*Company Profile*	
1	Which type of road transport operations does your organisation primarily involved in?	• Passenger Transport • Freight Transport
2	What is the main activity by business type? (*CSO - Road Freight Transport Survey)	*Passenger Transport* • Public bus services • Private Coach Bus (including Coach Tourism) • Taxi

		Road Freight Activity • All business activities • Transport • Mining and quarrying (including sand and gravel merchants) • Creameries and agricultural co-operative societies • Manufacture of food and feeding stuffs • Manufacture of drink and tobacco • Manufacture of glass, cement and clay products • Other manufacturing • Building and construction • Distribution • Agriculture and livestock dealing • Local authorities • Other • Manufacturing industry
3	What is your company ownership?	● Irish ● Local operation of a multinational company ● Other, ____
4	Where does your company primarily base at? Please specify the county.	(Short answer question)
5	What is the number of full-time equivalent employees in your company?	● Less than 10 ● Between 10 to 50 ● Between 50 to 250 ● More than 250
6	If your company owns a fleet, what is your company's fleet size?	*Please indicate the number of operation vehicles (including public service vehicles, heavy/light goods vehicles)* ● No vehicles ● 1 - 5 ● 6 -10 ● 11-20 ● 21-50 ● 51-100 ● 101-250 ● 251 and above
7	What is the main use of the vehicle?	• Own account • Hire or reward

	(*CSO - Road Freight Transport Survey)	
Section B	*Industry practitioners' perspectives*	
8	Please indicate the level of priority of decarbonisation for the road transport sector in your company.	(Scale Question) Priority Low to High 1 ,2 , 3, 4, 5
9	Please indicate the level of importance of fuel efficiency in daily operations.	(Scale Question) Priority Low to High 1 ,2 , 3, 4, 5
10	Please indicate the level of importance of fuel efficiency in the long-term strategy.	(Scale Question) Priority Low to High 1 ,2 , 3, 4, 5
11	To what extent do you perceive business opportunity in environmental efforts?	● Not a business opportunity ● To a small extent ● To a moderate extent ● To a large extent ● To a very large extent
12	Does your company plan to implement any major carbon reduction initiatives in the next two years?	● Yes, please briefly indicate the nature of this initiative _____ ● No ● Maybe ● I don't know.
13	[continued] > If so, please briefly indicate the nature of this initiative.	(Short answer question)
Section C	*Industry practitioners' know-how*	
14	How do you rate your company's capability to calculate transport-related emissions?	● No capabilities at all ● At company level ● At customer level
15	To what extend are you familiar with the following carbon-reducing measures? Operational Measures ● Eco-Driver training ● Fleet manager training ● Transport route optimisation ● Fuel consumption monitoring ● Driver performance tracking ● Load capacity optimisation	● I don't know. ● I am aware of it. ● I /my company implement it.
16	To what extend are you familiar with the following carbon-reducing measures? Technical Measures ● Shorter vehicle-renewal cycles	● I don't know. ● I am aware of it. ● I /my company implement it.

	● Vehicle aerodynamics ● Low rolling resistance tires ● Light weighting ● Anti-idling devices	
17	Please rate the feasibility of the following energy options for the future operations of the carriers.	*(Where 1 = "least likely" 5 = "most likely")* Energy Options ● Biomethane ● Electrified highways ● CNG/LNG ● Battery ● Biofuel ● Hybrid ● Hydrogen
18	To what extend do you think of the following factors influencing your company's decarbonisation efforts?	*(Where 1 = "No influence" 5 = "Highly influence")* Internal Factors ● Cost-saving potential ● Culture and company values ● Expected return on investment ● Leadership / Management ● Employees External Factors ● Customer demand ● Suppliers (Vehicle manufacturers) ● Competitors ● Legislation (EU level) ● Legislation (national level) ● Legislation (regional level) ● Associations & initiatives ● Public opinion Other external stakeholders . Other factors, please specify ____
19	Are you familiar with the Irish government's financial schemes or funding towards carbon reduction for transport sector?	● I don't know. ● I am aware of it. ● I /my company benefit from it, briefly indicate the nature of this initiative _____
20	What are the main challenges or risks you experienced in the	(Short answer question)

	implementation of carbon reduction measures?	
21	Please let us know if any training related to decarbonisation is required for you or your company?	(Short answer question)
22	Please add any comments that you would like to make.	(Short answer question)
Section D	*Follow-up Interview*	
23	Would you like to participate in an interview to let us know more about what incentives and changes to legal and business conditions would be required to increase engagement with the decarbonisation process?	● Yes, I am happy to participate in an interview. ● No.
24	Please let us know your contact details if you would like to receive further communications from us (Optional)	Name: _____ Company Name: _____ Email: _____

Appendix C – Interview Questions

To further investigate the identified issues and generate practical recommendations for the transport industry, we conducted online interviews and focus group discussions from August to September 2021 to follow up with transport companies and key stakeholders in the Irish transport sector.

The following questions were used as a guide for the interview conversation, and not all questions were expected to be answered.

Questions about identified issues in the survey

1. In your opinion, what are the main reasons behind the company's decision towards low-carbon transition?
2. What measures does your company particularly take to reduce carbon emissions? Any difficulties to implement those measures?
3. Which of the cleaner energy options would you consider to uptake in your company in the future, and what are the main factors affecting the decision?
4. Does your company currently calculate transport emissions? If no, what are the reasons? What support would aid your company in calculating the transport-related carbon emissions?
5. Does your company currently benefit from the Irish government support schemes towards transport decarbonisation? If not, what are the reasons? Any difficulties in applying for these schemes? What support would aid your company in applying these schemes?

Questions about future actions towards decarbonisation

6. How can we motivate the micro and small transport operators in Ireland to transit towards a low-carbon trajectory?
7. In your opinion, what *strength* that Irish transport operators have that can help to drive the decarbonisation process?
8. What are the *opportunities* you see in the Irish transport sector that we can obtain in the short term and long term?
9. What actions do you think the *government* and the *transport companies* can take on their side to make this happen?

About the Authors

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Eoin is Associate Professor of Logistics and Supply Chain Management at Edinburgh Napier University. He previously led the National Institute for Transport and Logistics (NITL) at Technological University Dublin. He previously worked with a number of UK universities including the University of South Wales. Eoin has carried out research and published peer-reviewed journal articles on sustainable supply chains, collaboration, and urban logistics.

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Rachel is a Public Transport Analyst in the National Transport Authority. She previously worked in engineering consultancies in Ireland and the Netherlands. She gained her BSc. in Spatial Planning from DIT and MSc in Transport, Infrastructure and Logistics from Delft University of Technology, the Netherlands. She is also a committee member of the Irish branch of the Transport Planning Society.

Tim Hayes, **Education and Training Committee Chair**

Tim is a member of the Institute's Council, Policy Committee, and is Chair of its Education and Training Committee. Former CEO of Bus Eireann and CILT in Ireland. Over forty-five years has held a range of senior management positions in transport and tourism and has lectured at third level. He holds BE, M.Eng.Sc. and MBA degrees and is a Fellow of the Institute.

John Henry, Membership Committee Chair

John is a Chartered Engineer, and Director and Chief Executive of the Dublin Transportation Office (which integrated into the establishment of the National Transport Authority in 2009). John has had a wide-ranging career in the area of transportation in both the public and private sectors in Ireland and abroad.

Mick Curran, CEO of CILT Ireland

Mick has for the last three years been the CEO of the Chartered Institute of Logistics and Transport (CILT). Additionally, prior to joining CILT, Mick spent 24 years as a member of the Defence Forces serving in a variety of roles both at home and overseas.