The Chartered Institute of Logistics and Transport

Policy Research

Transport Policy Review

Where does Ireland stand on Climate Change for Transport and Logistics Sectors?

| January 2021
| CILT Policy Committee
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Executive Summary

In response to the increasing climate disruption and global effort towards low-carbon transition, the Irish Government has set out to pursue a climate-resilient economy and become carbon neutral by 2050. This was set out in the Climate Action Bill published in October 2020. The transport sector in Ireland as the second-largest contributor to non-ETS carbon emissions accounts for over 27% of emissions.

The transport sector needs to reduce carbon emissions by 80% by 2050 to meet the decarbonisation target. However, the evidence has shown that the emissions from the transport sector are projected to increase by between 10% and 12% by 2020. There is still a long way to go to achieve the 2030 and 2050 targets.

In 2020, the Chartered Institute of Logistics & Transport (CILT) in Ireland undertook research that analysed climate change implications for the transport industry. In so doing, raising the awareness and readiness of CILT members and wider stakeholders.

The first study in this CILT Ireland climate change series focused on policy review. The findings suggested that the Government in recent years has increased efforts towards the low-carbon transition in policy development for the transport sector, and the potential for improving sustainable mobility. In regard to passenger transport, measures have been put forward to promote active travel and public transport, particularly in urban areas. In contrast, freight transport is less reflected in terms of measures and support schemes for the low-carbon transition. The study identified and assessed a number of international sustainable transport measures that could potentially be adopted in Ireland. It gathered this data through a panel of 21 transport experts from both public and private sectors in Ireland.

By conducting this study, we hope to raise the awareness towards the low-carbon transition and disseminate research findings amongst CILT members and the wider public audience, stakeholders, and the government.

Key Messages

- Ireland will need policies and measures that are radical, innovative and forward-looking to reduce the carbon emission from the transport sector.
- The panel of experts generally supported measures focused on urban areas and measures that promote active travel for pedestrians and cyclists, which is aligned with the current sustainable mobility policy agenda in Ireland.
- The freight transport and logistics sector require more supportive policies and initiatives to increase the industry awareness and readiness to embrace the low-carbon transition, especially in light of Brexit's impact on trade patterns and supply chains.
- Rail freight is rated by freight transport panel experts as the measure with the greatest positive potential on sustainability. The Department of Transport, Tourism and Sport (DTTAS) in Ireland also put forward "rail freight promotion" as a potential measure to tackle climate change in the policy review (DTTAS, 2019). Paradoxically, rail freight in Ireland is facing great challenges to grow and has dropped to one of the lowest levels in terms of modal share among other EU states. The cost-efficiency and viability of the modal shift in the Irish context is still debatable. Factors such as infrastructure investment, freight quantity, density, and distance travelled need to be considered. With regard to passenger travel, in 2020, the Irish government has set out to upgrading and electrification of the main commuter rail lines into Dublin. However, the awareness and readiness of rail freight operations need to be further studied.
- Clean and renewable fuel (e.g. electricity, biofuels, and compressed natural gas) have been considered with great potential for decarbonisation and achieve more sustainable transport in Ireland. This will lead to an increased demand for clean and renewable energy and its infrastructure. However presently, especially for freight transport, these new vehicles and infrastructure are not able to offer at a commercially viable price for operators. Moreover, the full fuel life cycle "well-to-wheel" emission factors need to be considered. Clean energy such as offshore wind energy could be a long-term approach for Ireland to tackling the high energy cost.
- For passenger transport, pricing-related policy measures such as the higher price of fuel, more strict and expensive driver training and licensing, and increased road revenues and expenditures are not recommended by the panel experts, as these measures could lead to greater social disparities.
- Prioritising policies is rarely a straightforward process, especially when time and resources are finite. Soft measures with low costs and low investments would have a strong positive impact on savings of energy consumption and carbon footprint.
- Collaborations between government, industry, professional body (such as CILT) and research institutes are needed to support policy decisions.
- Raising the knowledge and awareness of decarbonisation and sustainability planning in the transport sector and wider society is the key to bring Ireland onto a lower carbon trajectory in the long term.

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1. Introduction

In response to the increasing climate disruption and global effort to achieve sustainable development, the Irish Government published the Climate Action and Low Carbon Development (Amendment) Bill[1] in October 2020. Ireland is now legally bound to achieve a climate-resilient and carbon-neutral economy by 2050. The aim is to reduce Ireland's non-ETS emissions[2] by 30% by 2030, relative to 2005 levels, and achieving net-zero carbon emissions by 2050. For the transport sector, the target is to reduce carbon emissions by 80% by 2050, relative to 1990 levels. The increasing demands for emissions mitigation will put greater pressure on transport activities for the movement of people and freight. Decisions on the mode of transport, vehicle, technology, infrastructure, route planning, frequency of delivery, fuel choice and fuel economy will all be affected. The transport sector will have to adapt to this new climate reality.

In 2020, CILT is commissioning research that analyses climate change implications for Ireland. Four policy research topics around the theme of climate change and sustainable transport are proposed as follows:

- Transport policy review
- Study of industry awareness and readiness towards the low-carbon transition
- Spatial and transport planning study
- Climate change implications and new obligations for Ireland

This first study focuses on the review of transport policies in Ireland in regard to climate change issues. By capturing the current policies and measures in Ireland towards climate change and sustainability in the transport and logistics sector, and identifying the leading and innovative practices in Europe, this study is set out to gain a better understanding of where Ireland currently stands on climate change for transport and logistics sectors, and to propose recommendations to the Irish government and the industry.

1 *The Climate Action and Low Carbon Development (Amendment) Bill* https://www.gov.ie/en/publication/984d2-climate-action-and-low-carbon-development-amendment-bill-2020/

2 *Direct emissions associated with heating in buildings, transport, waste and agriculture.*

1.1 The Purpose of this Research

In response to the United Nations' Sustainable Development Goals on "Climate Action" and the Irish National 2050 emissions reduction target, this research aims to review the current sustainable transport policies in Ireland, and identify international sustainable transport measures that could be adopted in the Irish context. From a practitioner perspective, the main objectives of this research are:

- To review the available evidence on policies addressing climate change in the transport and logistics sector in Ireland from publicly available documents;
- To identify and assess international sustainable transport measures that could be potentially adopted in Ireland;
- To publish a CILT Policy Research Report to inform and support CILT members and those involved with public and corporate decision-making;
- So that other organisations can draw on the findings, and disseminate to the wider industry.

1.2 Overall Research Approach

Firstly, a comprehensive review of relevant academic literature and government policy reports was conducted on sustainable transport policies in Ireland and relevant policies in Europe (see Section 2). Policies on both passenger and freight transport are reviewed. Further, a two-round Delphi study was conducted to canvass the opinions of transport experts in Ireland and assess the potential impact of international sustainable measures if adopted in the Irish transport sector (see Section 3). The Delphi method is widely used in building consensus for public policy. Based on the analysis of the two-round questionnaire, a list of potential policy measures that have been ranked as potentially having a strong impact are proposed (see Section 4).

2. Sustainable Transport Policy in Ireland and Europe

2.1 Global Agenda towards Sustainable Transport

The World Meteorological Organization (WMO) (2019) reports that the greenhouse gases in the atmosphere hit a new record in 2018, exceeding the average yearly increase of the last decade. The continuing long-term trend will lead to increasingly severe impacts of climate change, including rising temperatures, more extreme weather, water stress, sea-level rise, and disruption to marine and land ecosystems. Currently, there is no sign of a slowdown, let alone a decline, in greenhouse gases' concentration in the atmosphere. The United Nations Environment Programme (UNEP) points out that climate change can still be limited to 1.5°C degrees, on the condition that a 7.6% cut in emissions must be achieved every year from 2020. If we do not intervene, the temperature can be expected to rise 3.2°C above pre-industrial levels, with devastating effects (UNEP, 2019).

There are a number of policy initiatives published in 2019 and more recent in 2020 to continue to tackle climate change in Europe and on a global level.

The United Nations Climate Change Conference (COP25)

In December 2019, the 2019 United Nations Climate Change Conference (COP25) took place in Madrid, Spain. A majority of European Union lawmakers were hoping to symbolically declare a "climate emergency" during a debate to increase pressure on the incoming EU executive to take a stronger leading role in the fight against climate change (World Economic Forum, 2019).

The European Green Deal

In December 2019, the European Commission presented the European Green Deal, in response to the commitments of governments and companies to meet the targets set by the Paris agreement. The main ambition is to make Europe the first climate-neutral continent in the world by 2050. In the roadmap to a carbon-free Europe, sustainable and smart mobility has been put forward as one of the key actions. Alternation fuels, railways, and inland waterways as key initiatives have been put on the agenda (see Table 1).

Table 1 The European Green Deal actions on transport

Actions	Indicative Timetable
Strategy for sustainable and smart mobility	2020
Funding call to support the deployment of public recharging and refuelling points as part of alternative fuel infrastructure	From 2020
Assessment of legislative options to boost the production and supply of sustainable alternative fuels for the different transport modes	From 2020
Revised proposal for a Directive on Combined Transport Review	2021
Review of the Alternative Fuels Infrastructure Directive and the Trans European Network – Transport Regulation	2021
Initiatives to increase and better manage the capacity of railways and inland waterways	From 2021
Proposal for more stringent air pollutant emissions standards for combustion-engine vehicles	2021

Source: McLoughlin and Deane (2020), p.14

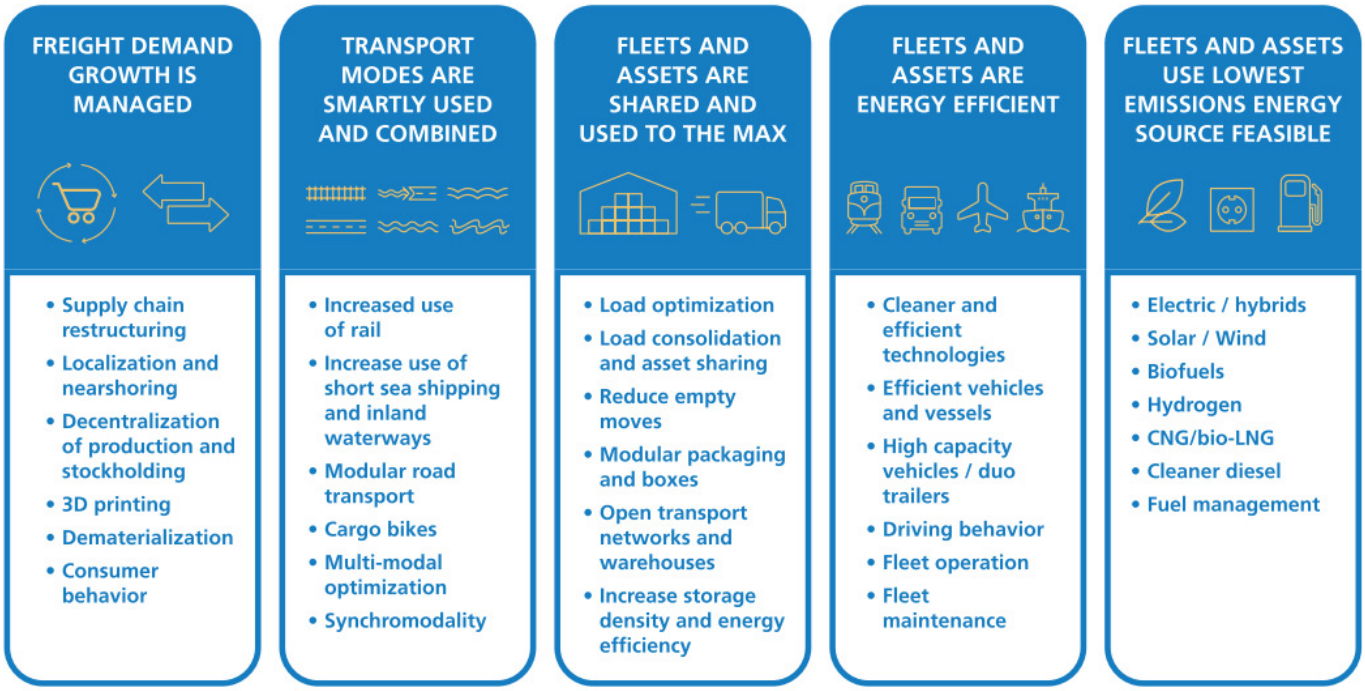
The Roadmap towards Zero Emissions Logistics 2050

Logistics activities account for 10-11% of global carbon emissions, around 90% of which come from freight transport. According to the International Transport Forum/OECD, global carbon emissions from the movement of freight could more than double by 2050 unless radical new policies and practices are adopted. And yet, the freight transport and logistics sector have so far avoided coming under this climate scrutiny (McKinnon, 2020).

For freight transport and logistics, the *Roadmap towards Zero Emissions Logistics 2050* issued by the Alliance for Logistics Innovation through Collaboration in Europe (ALICE) proposed five solutions to decarbonise the freight transport sector, namely:

1. Freight transport demand growth is managed
2. Transport modes are smartly used and combined
3. Fleets and assets are shared and used to the max
4. Fleets and assets are energy efficient
5. Fleets and assets use the lowest energy source feasible

Figure 1 Solutions for freight transport and logistics decarbonisation



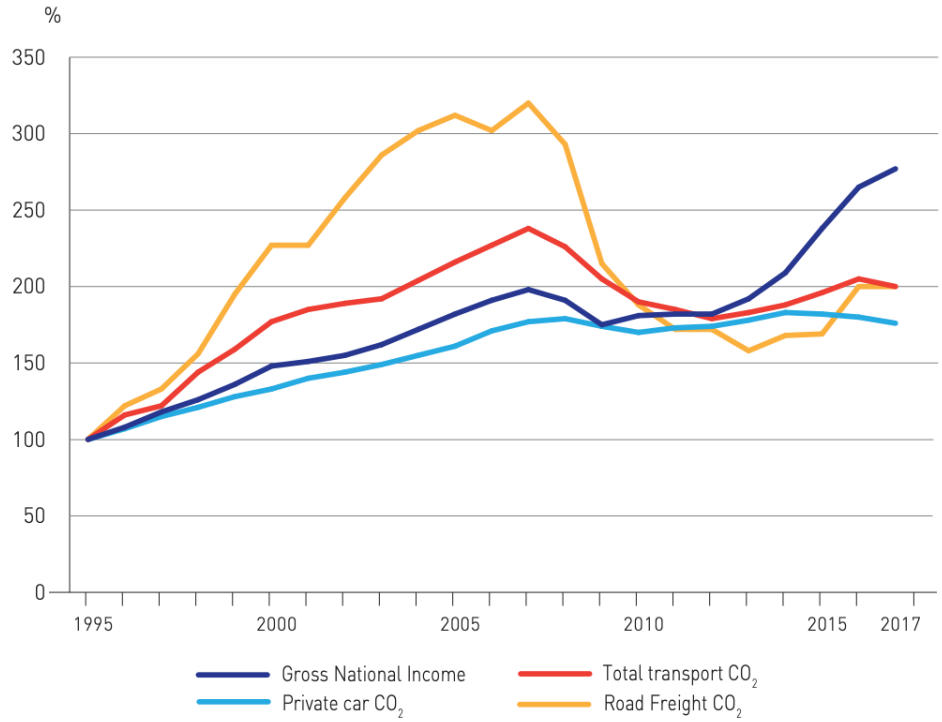
Source: ALICE, (2019)

2.2 Decarbonisation Target for Ireland

The European Union (EU) along with China, USA, and India are the four largest emitters that contribute to over 55% of the total emissions over the last decade (UNEP, 2019). In 2017, Ireland ranked ninth-worst out of 28 EU Member States in terms of total greenhouse gas emissions; and Ireland had the third-highest emissions of greenhouse gases per capita in the EU at 13.3 tonnes of carbon dioxide equivalent per capita, which was 51% higher than the EU28 average of 8.8 tonnes (CSO, 2019).

The transport sector in Ireland is the second-largest contributor (next to agriculture) of carbon emission. It accounts for 19.8% of the national total emissions, and 27.1% of the non-ETS emissions that make up the 2020 and 2030 targets (Climate Change Advisory Council, 2017). The national principal target is to reduce the carbon emissions from the three key sectors – agriculture, transport, and build environment by 80% by 2050 (relative to 1990 levels). However, emissions from transport are projected to increase by between 10% and 12% by 2020, relative to 2015 levels, reflecting economic growth (Climate Change Advisory Council, 2017). Figure 2 illustrates the growth trend between economic growth and transport emissions in Ireland. Ireland experienced significant growth in emissions during the Celtic Tiger years from mid-1990s to late 2000s, particularly in transport.

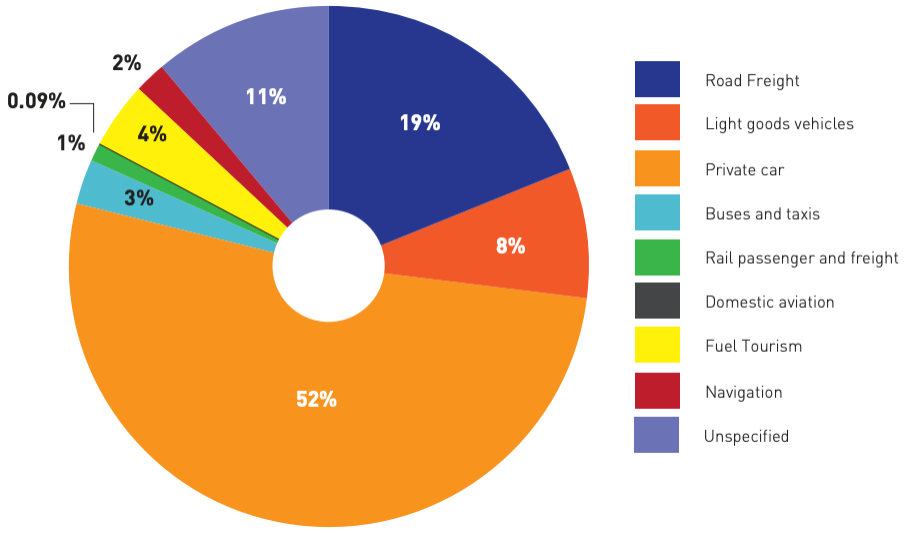
Figure 2 Comparison of economic growth and transport emissions



Source: Climate Change Advisory Council, (2019)

Figure 3 illustrates a breakdown of the modal shares of carbon emissions in Ireland. Private cars account for 52% of national transport CO2 emissions in 2017, still are the dominant mode of transport in Ireland. Road freight, including heavy goods vehicles (lorries and trucks) and light goods vehicles (vans), accounts for 19% of the transport emissions (Climate Change Advisory Council, 2019).

Figure 3 Modal shares of carbon emissions in Ireland



Source: Climate Change Advisory Council, (2019)

2.3 Sustainable Transport Policy in Ireland

This section maps out current policies towards the low-carbon transition and climate change-related issues in Ireland. In November 2019, the Department of Transport, Tourism and Sport (DTTAS) commissioned a Review of Ireland's Sustainable Mobility Policies – the first in 10 years. The sustainable mobility policies focus on active travel and public transport to ensure services that are more environmentally sustainable and are meeting the needs of a modern economy. Climate change is one of the key focus of the sustainable mobility review launched by DTTAS. The 73 pages detailed background paper by DTTAS on climate change challenge has provided a high-level overview of the climate change mitigation strategies and actions taken in the Irish transport sector.

This section presents the carbon reduction measures summarised by DTTAS as a basis to further discuss some of the key measures. The existing and potential carbon emission reduction measures (see Table 2) using the 'Avoid-Shift-Improve' (ASI) framework are summarised. The ASI framework is an international best practice to assess transport mitigation and low-carbon transition policies comprehensively and systemically.

Table 2 Existing and Potential Emissions Reduction Measures for the Transport Sector

		Policy Instruments	Existing Measures	Potential Measures
AVOID	Passenger	› Spatial planning › Fuel subsidies/taxes › Traffic management › Road pricing	› NPF › Carbon tax › College Gate and no car entry zones during peak times › Tolls	› Fuel subsidy/tax reform › Road pricing › Car sharing initiatives › Teleworking
	Freight	› User charges › Traffic management Logistics planning	› Tolls › HDV cordon	› User charges Logistics planning support
SHIFT	Passenger	› Public transport investment Cycling/ walking infrastructure › Optimise PT system Low Emission Zones	› BusConnects Smarter Travel Taxsaver › Bike to Work › Park & Ride sites	› Parking policies › New Park & Ride sites › Low Emission Zones
	Freight	› Rail freight	–	› Rail freight promotion
IMPROVE	Passenger	› Fuel economy standards › Alternative fuel infrastructure & supports › Ban on Internal Combustion Engine (ICE) cars Scrappage scheme › Company car tax	› VRT/motor tax › EU regulations on CO_2 › Biofuels Scheme › EV incentives	› Further EV incentives VRT/motor tax reform Scrappage scheme Ban/restrictions on ICE cars › CO_2 company car tax
	Freight	› Fuel economy standards › Fuel subsidies › Eco-driving	› EU regulations on CO_2 › Minimum excise relief for natural gas Biofuels scheme › Eco-driving › Research projects	› VRT/motor tax reform › Eco-driving supports Clean Vehicle Fund

Source: DTTAS (2019), p.57

There are also various government departments and public organisations addressing climate change-related issues on the national level, regional level, and sector-wise. A summary of the identified policy documents, authority reports, and on-going projects are listed below (see **Table 3**).

Table 3 Summary of identified policies and initiative sources in Ireland

Organisation	Policy Area	Publications
Policy documents		
Government of Ireland	National plan	The National Planning Framework 'Project Ireland 2040' - *Sustainable Mobility* as one of the key priorities (2017)
Department of Communications, Climate Action and Environment (DCCAE)	Climate change	› Climate Action Plan (2019) › National Mitigation Plan (2017) › The National Policy Position on Climate Action and Low Carbon Development (2014)
Department of Transport, Tourism and Sport (DTTAS)	Transport; Climate change; Spatial planning	› Sustainable Mobility Policy Review (2019) › Planning Land Use and Transport Outlook (PLUTO) 2040 (2018) › Developing Resilience to Climate Change in the Irish Transport Sector (2017) › Smarter Travel Plan 2009-2020 - the Framework Policy for Sustainable Transport (2009) › The National Cycle Policy Framework (2009)
Other authority reports		
National Transport Authority	Urban mobility	Canal Cordon Report (2016,2017,2018)
Climate Change Advisory Council	Climate change	Annual Review (2017, 2018, 2019)
The National Economic and Social Council (NESC)	Climate Change, Transport, Urban mobility	Transport research reports › Urban Structure, Spatial Planning and Climate Emissions (2019) › Transport-Orientated Development: Assessing the Opportunity for Ireland (2019) › Advancing the Low-Carbon Transition in Irish Transport (2019) › Modelling the Zero-Carbon Transition: International Approaches and Lessons for Ireland (2019) › Climate-Change Policy: Getting the Process Right (2019)
On-going projects		
Dublin City Council	Urban planning; Urban mobility	'Smart Dublin' project (due to complete in April 2020)
Transport Infrastructure Ireland (TII) & ARUP	Freight and logistics	'Decarbonisation in HGV' research project (on-going)

Source: CILT Ireland, 2020

2.4 Sustainable Transport Policy Development in Europe

According to the European Environment Agency (EEA) (2018), the EU transport sector in general is not reducing GHG emissions enough to limit its environmental and climate impacts in Europe. Alongside GHG emissions, the increasing air pollution (i.e. particulate matter (PM) and nitrogen dioxide), and noise pollution are also an impediment to environmental sustainability.

More recently in September 2020, the International Transport Forum (ITF) launched the *Transport Climate Action Directory* - more than 60 different carbon mitigation measures, as well as the evidence-based needed to assess their effectiveness (ITF, 2020).

There is great potential for Ireland to adopt international practices to alleviate the current environmental performance of the transport sector in Ireland.

Sustainable Transport Measures Identified for Passenger Transport

A summary of transport and land-use policies implemented in other European cities (such as Berlin, Hamburg, Munich, Vienna, and Zurich) that could potentially be adopted in Ireland is presented in Table 4.

Table 4 Sustainable Transport Measures Identified for Passenger Transport

Field of Action	Measures Identified in other European Regions
Policies that restrict car use ("Avoid")	
Price of gasoline	Increased taxes on retail price of gasoline.
Traffic calming and speed limits	Most residential streets are traffic-calmed at 30km/h or less, with speeds reduced to 20km/h on shared streets, and to 7 km/h on some residential streets.
Road supply	Motorways rarely penetrate into city centres; most neighbourhood streets discourage through-traffic by 30km/h speed limits and infrastructure modifications, such as narrowings, curves, speed bumps, raised intersections, and artificial dead ends.
Driver licensing	Strict and expensive driver training and licensing; probational licenses for young drivers.
Road revenues and expenditures	Revenue from roadway user taxes and fees are higher than roadway expenditures by all levels of government, providing an important source of general revenues.
Policies that promote public transport ("Shift")	
Quantity of service	The large increase in the total amount of public transport service; increased operating hours and frequency of service.
Quality of service	All systems have modernised their vehicles and stations; full coordination of schedules, fares, and routes across modes and operators; quicker and easier.
Home-to-work index	A readily accessible online calculator for commute time/cost to give citizens an opportunity to compare locations and its environs.
Policies that make walking and cycling more attractive "Improve"	
Car-free zones	Most cities have pedestrianised large areas of their downtown that are off-limits for automobiles with parking garages at the periphery.
Traffic calming	As noted above, residential streets discourage through-traffic and greatly reduce car speeds.
Pedestrian facilities	Pedestrian priority in car-free zones, traffic-calmed streets, and shared streets.

Bikeway networks	Comprehensive, region-wide integrated networks of paths and lanes for cyclists, including special provisions at intersections (traffic signals, advanced stop lines); extensive bike parking on sidewalks, on-street bike-corrals, and at public transport stations.
Traffic education	Traffic and cycling training is offered in most schools; priority of non-motorised modes emphasised in driver's training and testing.
Land-use planning and policies that facilitate compact, mixed land-uses	
Coordination with public transport	Strict land-use controls limit low-density sprawl and encourage compact development around public transport stop.
Planning process	Coordination of land-use plans among levels of government and across jurisdictions; integration of land-use, transport, and environmental planning at all levels of government.

Source: Buehler & Pucher, 2016

Sustainable Transport Measures Identified for Freight Transport

Freight transport measures for low-carbon transition in Ireland is currently under scrutiny. Freight vehicles in Ireland accounted for 13% of the national fleet with agricultural vehicles and motorcycles collectively representing a further 4.3% in 2018. The freight transport sector accounted for 27% of emissions (18.5% from heavy duty vehicles (HDVs) and 8.4% from light duty vehicles (LDVs)) in 2017 (DTTAS, 2019). The freight transport and logistics sector require more supportive policies and initiatives to increase the industry awareness and readiness to embrace the low-carbon transition, especially in light of the Brexit potential impact on trade patterns and supply chains.

To identify the international best practice on sustainable freight transport policy, measures from the *FREIGHTVISION: Sustainable European Freight Transport 2050* are used as the main reference in this study. "Freightvision" was a European Commission funded project carried out between 2008 and 2010. Involving more than 100 experts from governments, industries, and research institutes, the project identified a total of 35 policy actions and appropriate freight transport measures for road transport, rail transport, inland waterways and maritime, supply chain, energy supplier, and vehicle supplier. These measures are set out to design a long-term and sustainable freight transport strategy with a vision to 2050 in Europe (Helmreich and Keller, 2011). The potential impact of each policy action was assessed based on four sustainability criteria using a rating scheme (Helmreich and Keller, 2011).

The four sustainability criteria are:

- Potential to reduce GHG emissions;
- Potential to reduce fossil fuel share;
- Potential to reduce congestion;
- Potential to reduce road fatalities.

In recent years, sustainable freight transport practice in city and urban areas has received increasing public attention in European countries. The research carried out by Letnik *et al.* (2018) mapped and benchmarked sustainable urban freight transport-related policies and their maturity level among 129 European cities. Among these cities, Brussels and Paris were identified with measures to support low-carbon urban logistics. Dublin and Cork in Ireland were identified with policy related to "mobility plan with logistics measures", which indicates that the policy measures were still prioritised on passenger transport, logistics measures were not proposed or adopted. Although Letnik *et al.*'s (2018) study did not identify any urban logistics-related policy measures in Ireland, it is noted that there are a number of trials and pilot projects currently undertaken by the local authority Dublin City Council under the 'Smart

Dublin'[3] initiative. For instance, UPS has piloted a few measures in the city centre, such as urban eco-hubs, cargo bikes and alternative fuel vehicles as part of the "Smart Dublin" initiative (UPS, 2020). An Post also announced that all mail and parcel delivery in Dublin city centre is now emission-free as the delivery is carried by 47 zero-emission vehicles, avoiding 450 tonnes of CO_2 emissions (Gleeson, 2020).

The sustainable freight transport policy measures identified in the European context (Helmreich and Keller, 2011; Letnik *et al.*, 2018) is presented as follows (see **Table 5**).

Table 5 Sustainable Transport Measures Identified for Freight Transport

Urban freight transport	Road transport measures	Supply chain measures
› Off-street loading bays › Cargo bikes › Clean fuels and vehicles › Spatial planning for logistics › Freight routes, delivery, and servicing plans, › Mobile depots, › Off-peak deliveries, › By boat logistics › Urban distribution centres	› Investment in Intelligent Transportation Systems (ITS) › Investment in road infrastructure › Internalisation of external costs[4] › Modifying the rules for HGV weights and dimensions › Progressive distance pricing[5] › Different pricing with regards to type of freight › Harmonised speed limits › Congestion charge › Enforcement of regulations	› Training for eco-driving › Automated platooning[6] › Standardised loading units › E-freight[7] › Network optimisation – cargo owner › Network optimisation – logistics service provider › CO2 labels[8] › Intermodal transport › Transport consolidation and cooperation › Transport route planning and control
Vehicle supplier measures	**Rail transport measures**	**Inland waterways and maritime transport measures**
› Including CO2 standards into HGV regulations (EURO6) › BAT vehicle certification for heavy goods vehicles[9] › Clean vehicle technologies	› Investment in rail infrastructure › Freight prioritisation › Funding for ERTMS/ETCS[10] › Electrification of rail corridors › Longer trains and Heavier trains	› Investment in inland waterway transport infrastructure › Develop new technologies in inland waterways › Investment in maritime port infrastructure
Energy suppliers measures		
› Taxation of fossil fuels › Hydrogen infrastructure › Improved batteries(energy storage)		

Source: Adopted from Helmreich and Keller (2011), pp. 166-258; Letnik et al.(2018)

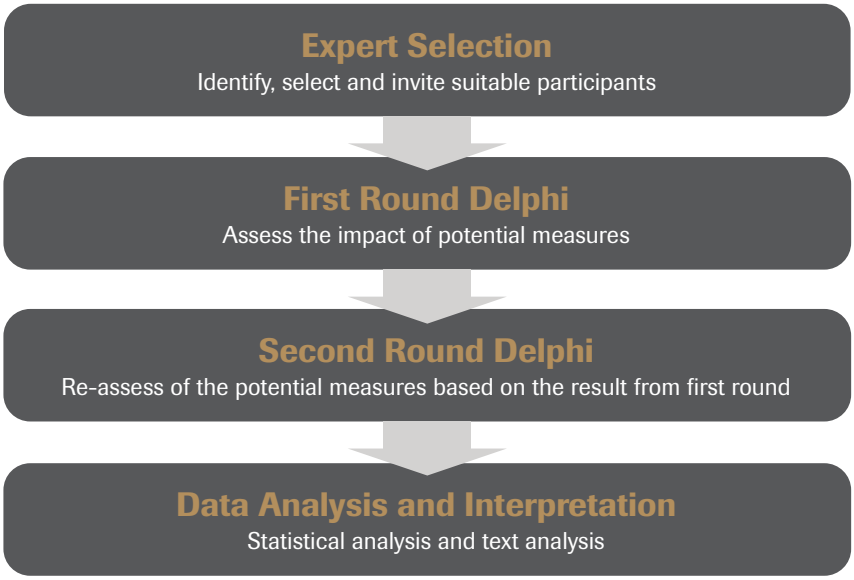
3 *Smart Dublin: https://smartdublin.ie/*
4 *All external costs, i.e. the infrastructure, environmental damages and those accident costs, which are not covered by the users' insurance are to be borne by them.*
5 *Progressive charging of freight depending on the total distance travelled.*
6 *Automated platooning refers to the situation in which trucks are coupled electronically and exchange information, but still need drivers that can intervene if needed.*
7 *A paper-free, electronic flow of information associating the physical flow of goods with a paperless trail built by ICT.*
8 *A tag on a product to inform the customer about a product's carbon footprint.*
9 *A certification system for Best Available Technologies (BAT) in greenhouse gas emission reduction and fuel efficiency in heavy duty vehicles.*
10 *ERTMS - European rail tra c management system; ETCS - European train control system.*

3. Research Methodology

3.1 The Delphi Method

The Delphi method is widely used in building consensus for public policy. A two-round Delphi questionnaire was conducted in this study. The questionnaire was used to canvass the opinions of transport experts in Ireland, as well as assess the impact of potential sustainable measures if adopted in the Irish transport sector. The Delphi method applied in this study followed the sequential order of Okoli and Pawlowski (2004) and Reefke and Sundaram (2018).

Figure 4 Sequential order of the Delphi steps



3.2 Expert Selection

A structured approach was followed for the identification and selection of experts as suggested by the literature guidelines (Okoli and Pawlowski, 2004; Reefke and Sundaram, 2018). The inclusion of experts from both passenger transport and freight transport industries was desirable in order to capture a wide array of opinions. Experts were matched to inclusion criteria and support the pooling of judgements (Reefke and Sundaram, 2018). The experts were nominated by the CILT Policy Research committee members and the selected experts had to fulfil the following criteria:

- Have a track record in professional and/or academic practice;
- Experienced in passenger transport and/or freight transport in Ireland;
- Demonstrated professional interest in sustainability and climate change.

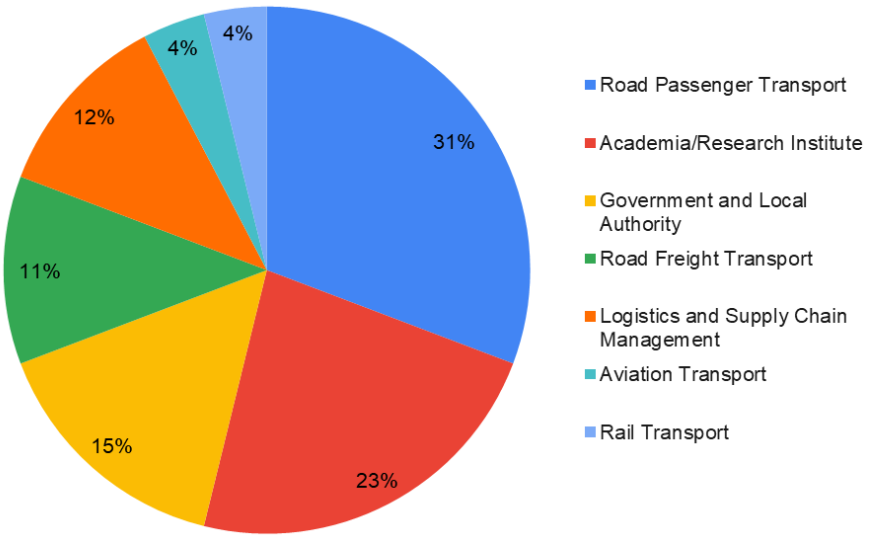
The Delphi expert panel size was followed recommendations that range from less than 15 to a maximum of 50 experts (Reefke and Sundaram, 2018). A total of **42 transport experts** in both public and private sectors in Ireland were approached to ensure broad representation of both passenger and freight transport community in Ireland. The number of survey responses in each round of the Delphi questionnaire is shown in **Table 6**. Experts from the initial sample were invited to participate in the first-round survey. In order to ensure a well-informed assessment process supported by a consistent panel, only respondents who participated in the first round were considered for inclusion in the second round survey. The total number of responses met the recommendations for Delphi panel sizes.

Table 6 Number of responses

Panel Expert	Initial sample	Round 1	Round 2
Government	12	4	1
Industry	23	12	6
Academia	7	5	3
Total	42	21	10
Response Rate		50%	47.6%

The **21 experts** who participated in the Delphi survey were classified according to their expertise areas, which ranged from academia, government and local authority, road passenger transport, road freight transport, logistics and supply chain management, aviation transport and rail transport (see **Figure 5**).

Figure 5 Key stakeholder groups represented in the expert panel



3.3 Data Collection Process

This study involved completing two rounds of a questionnaire survey. The purpose of the first-round Delphi questionnaire was to assess the potential impact of the sustainable transport measures that could be adopted in Ireland. The design of the questionnaire were adapted from Freightvision (Helmreich and Keller, 2011). A pilot test was conducted among the CILT policy research committee members to further refine the questions. The questionnaire was designed into two separate questionnaires – passenger transport and freight transport.

Round One Delphi Questionnaire

The questionnaire was conducted online using the SurveyMonkey survey tool (see **Appendix A**). A 7-point Likert scale was used to allow the participant to assess the potential impact of the sustainable measures, from "-3" strong negative impact to "3" strong positive impact.

The data collection period was from 24 April 2020 to 30 June 2020. An invitation to the online questionnaire was sent out to all 42 transport experts through email and a reminder email was followed after a week if the expert did not respond. A total of 21 experts completed the questionnaire.

Round Two Delphi Questionnaire

The purpose of the second-round questionnaire was to re-assess the impact of potential measures and their potential to be adopted in Ireland. The result of the first-round questionnaire was analysed and circulated back to the 21 experts anonymously along with a concise report of the preliminary findings. The second-round questionnaire was customised and sent to each expert separately with the group average results for each question and their previous response. The experts were invited to compare and reflect on their personal and group ratings for the second questionnaire and, if desired, modify their responses. By circulating the results and initial findings, we hope to reach a higher level of consensus among the expert panel.

The data collection period for the second round questionnaire was from 12 August to 31 August 2020. A total of 10 experts revised their ratings and provided some extra comments on the proposed measures. In terms of the validation of the questionnaire response, the rate of drop-outs from the first round to the second round was relatively higher (about 50%).

Based on the analysis of the two-round questionnaire from the expert panel, a list of sustainable transport policy measures assessed as potentially having high impact if adopted in Ireland are identified. Measures for passenger transport and freight transport will be discussed in the following sections.

4. Empirical Data Analysis and Findings

4.1 Passenger Transport

A total of 15 sustainable measures for passenger transport are assessed (see **Appendix B**).

The mean ratings were used to convey the potential impact ratings amongst the **15 panel experts** who participated in the passenger transport survey. A higher mean rating score implies a stronger potential positive impact on sustainability (see Figure 6). Whereas the corresponding standard deviations (SD) showed the spread of responses (see Figure 7). A higher SD score implies a wider divergence of opinion amongst panel members.

Top three sustainable measures with higher potential impact and generally favoured among all stakeholder groups:

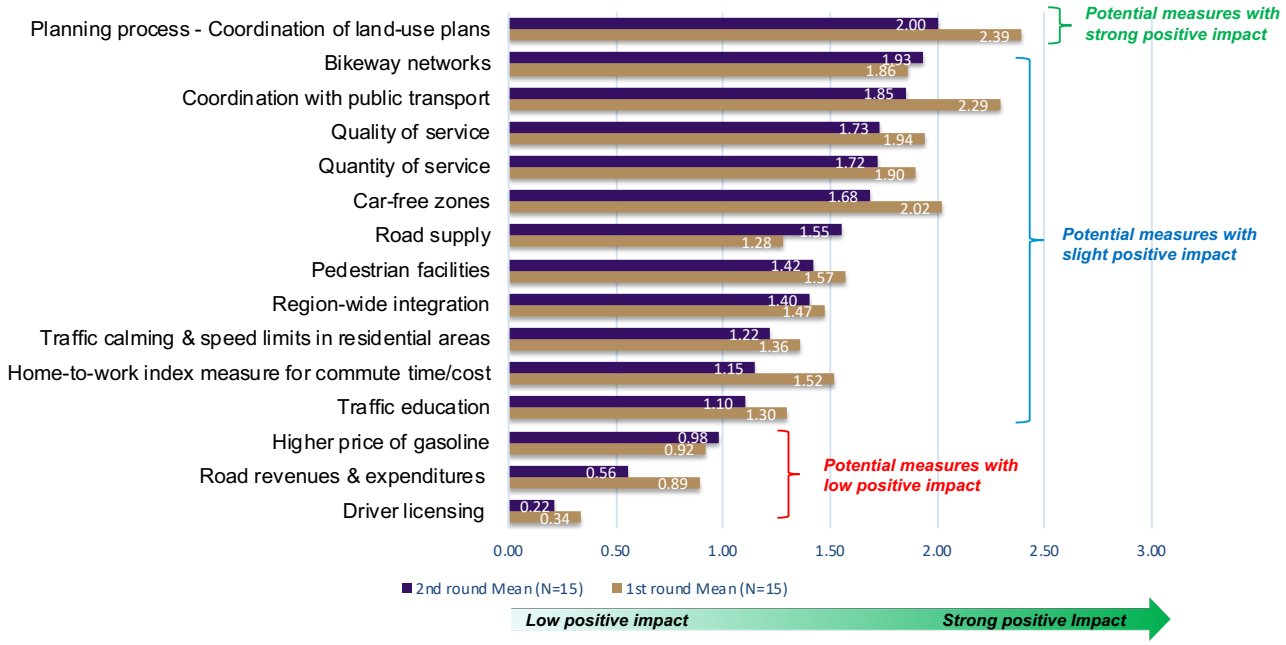
- **Planning process – coordination of land-use plans** remains as the most important measure to achieve sustainable transport among all panel members.
- **Bikeway networks** to promote active travel are favoured among all panel members;
- **Coordination with public transport** also received a higher degree of consensus among all panel members.

The least favoured measures also identified as follows.

- Strict and expensive driver training and licensing;
- Road revenues and expenditures;
- Higher price of fuel.

To further investigate consensus amongst different stakeholders towards potential measures, the panel experts' rating results were analysed in two groups: public stakeholders (panel experts from government and academia) and industry stakeholders (panel experts from industry and private sector) (see Figure 8). A higher SD score implies a wider divergence of opinion amongst the stakeholder group. Most of the proposed measures received a relatively balanced consensus between stakeholders in the public and private sectors. The consensus amongst the public stakeholders diverges slightly in contrast to experts from industry.

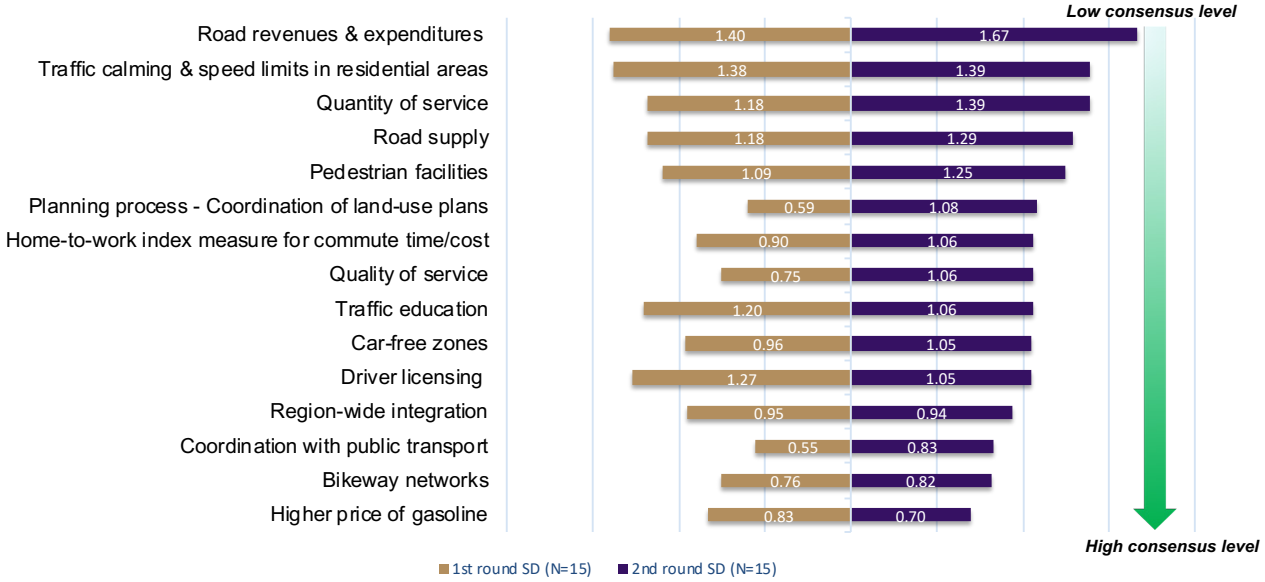
Figure 6 Ranking of passenger transport measures by their potential impact (Round 1 and Round 2 results)



Note: Scoring system: where '3' = strong positive impact; '-3'= strong negative impact.

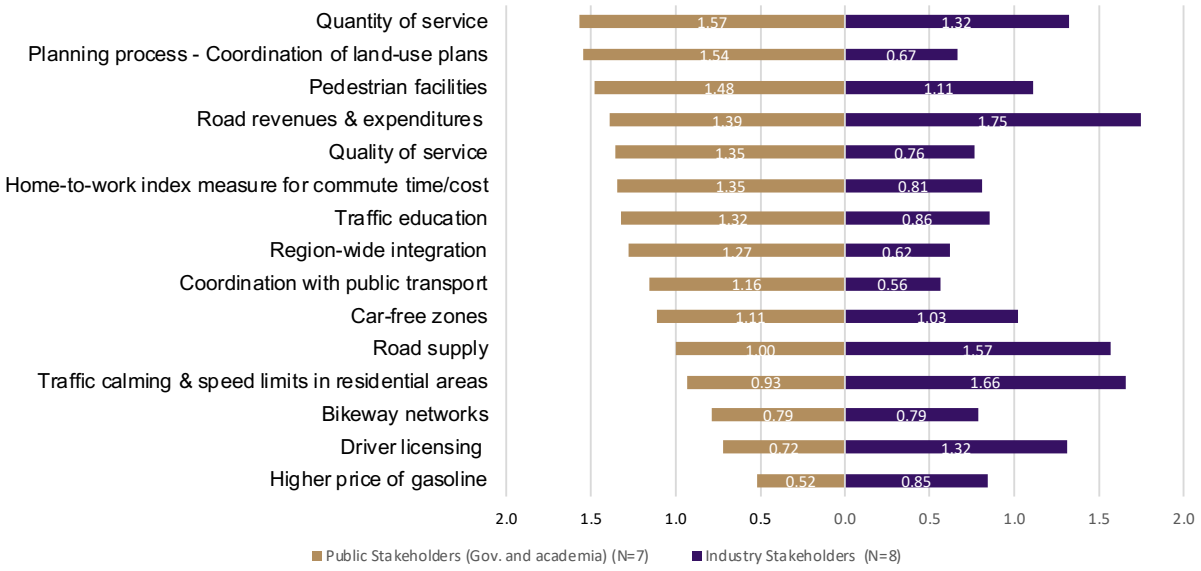
A higher mean rating score implies a stronger potential positive impact on sustainability.

Figure 7 Consensus amongst passenger panel experts towards potential measures (Round 1 and Round 2 results)



Note: A higher SD score implies a wider divergence of opinion amongst panel members.

Figure 8 Consensus amongst public and industry stakeholder groups towards potential passenger transport measures



Note: A higher SD score implies a wider divergence of opinion amongst the stakeholder group.

In summary, key findings for the passenger transport measures are as follows:

1. Land-use and transport planning are the most important to achieve sustainable transport. The panel experts advised that Ireland needs better road engineering and management, instead of building more roads. Increased road supply tends to result in more traffic, greater emissions, and greater congestion. Traffic demand management is also a key policy and there are insufficient skill-levels and investment in Ireland.
2. Public stakeholders generally support measures focused on urban areas and measures that promote active travel for pedestrians and cyclists, which is aligned with the current sustainable mobility policy agenda in Ireland. Infrastructure planning and investment need to shift more attention on pedestrians and cyclists to promote active travel, with consideration of the full journey including walkable access routes.
3. For public transport, increasing both quantity and quality of public transport, as well as improving multi-modal levels of integration effectively and efficiently is the key to promote the shift to public transport. Public transport regional-wide integration requires ease of interconnections and fair fares to increase ridership of all ages, abilities, and incomes. However, transport integration of networks and operations only works effectively on the ground if the network is managed by a dedicated transport management company or if the operating company is part of the transport authority. Moreover, public transport operators should be the pioneer to adopt cleaner Euro 6 engines or alternative fuel vehicles.
4. Pricing-related policy measures such as the higher price of fuel, more strict and expensive driver training and licensing, and increased road revenues and expenditures are not recommended by the panel experts, as these measures could lead to greater social disparities.
5. Collaboration among government departments, national, and regional level authorities is needed.
6. Sustainable transport needs creative thinking, honesty, and genuine engagement from both the public and private sectors.

4.2 Freight Transport

A total of 38 sustainable measures for freight transport are assessed by **10 panel experts** specialised in freight transport in Ireland. (see Appendix C).

The mean ratings were used to convey the potential impact ratings amongst the 10 panel experts who participated in the freight transport survey. A higher mean rating score implies a stronger potential positive impact on sustainability (see Figure 9). Whereas the corresponding standard deviations (SD) showed the spread of responses (see Figure 10). A higher SD score implies a wider divergence of opinion amongst panel members.

Top three sustainable measures which the panel assessed as having the highest potential impact and generally favoured amongst panel experts from both the public and private sectors.

Electrification of rail corridors

Rail freight is generally accepted as being more environmentally friendly than road freight. It is considered to be best practice internationally. The Transport Department in Ireland also put forward "rail freight promotion" as a potential measure to tackle climate change in the policy review (DTTAS, 2019). However, the cost-efficiency of the modal shift in the Irish context is still debatable. Factors such as infrastructure investment, freight quantity, and density, distance travelled (i.e. more than 300km to be viable for rail) need to be considered.

Paradoxically, rail freight in Ireland is facing great challenges to grow and has dropped to one of the lowest levels in terms of modal share among other EU states. The limited number of high volume bulk movements, Ireland's compact size, and the low density of activity all have limited economic viability of alternatives to road freight. Iarnród Éireann (Irish Rail) as the only rail freight operator in Ireland, the freight quantities are comparatively small and have declined starkly over recent decades. Although Irish Rail published the 2030 Rail Network Strategy Review[11] back in 2011, rail freight was not elaborated on in that report, and there is no update strategies on rail freight in recent years.

The role of rail freight in Ireland needs to be further examined in order to more comprehensively assess its potential role and feed into policy decisions. Possible areas to further consider and investigate are: the general awareness among key stakeholders, the development of the Western Rail Corridor, rail freight hubs by the major ports, incentives to increase the number of rail freight operators are worth further investigation to provide cost analysis and feasibility assessment. An in-depth feasibility study of the implementation of these measures in Ireland is required for further analysis and discussion.

Cargo bikes

Measures in the "Urban freight transport" category generally received relatively higher ratings. Cargo bike for urban delivery was favoured by panel experts. However, it is also noted that this measure will require a proper bikeway network design in urban areas to ensure road safety in cities.

11 *2030 Rail Network Strategy Review* https://www.irishrail.ie/IrishRail/media/Imported/IrishRail_28FebFinal_Part11.pdf

Transport consolidation and cooperation

Collaboration between supply chain actors is needed. Many measures will require collaboration between key stakeholders along the supply chains, such as end customers, logistics service providers, customs, shippers, vehicle manufacturers. More policy efforts, green technology, sustainability education should target these actors to facilitate and improve efficiency along the supply chain.

The **least favoured measures** identified:

Taxation of fossil fuels

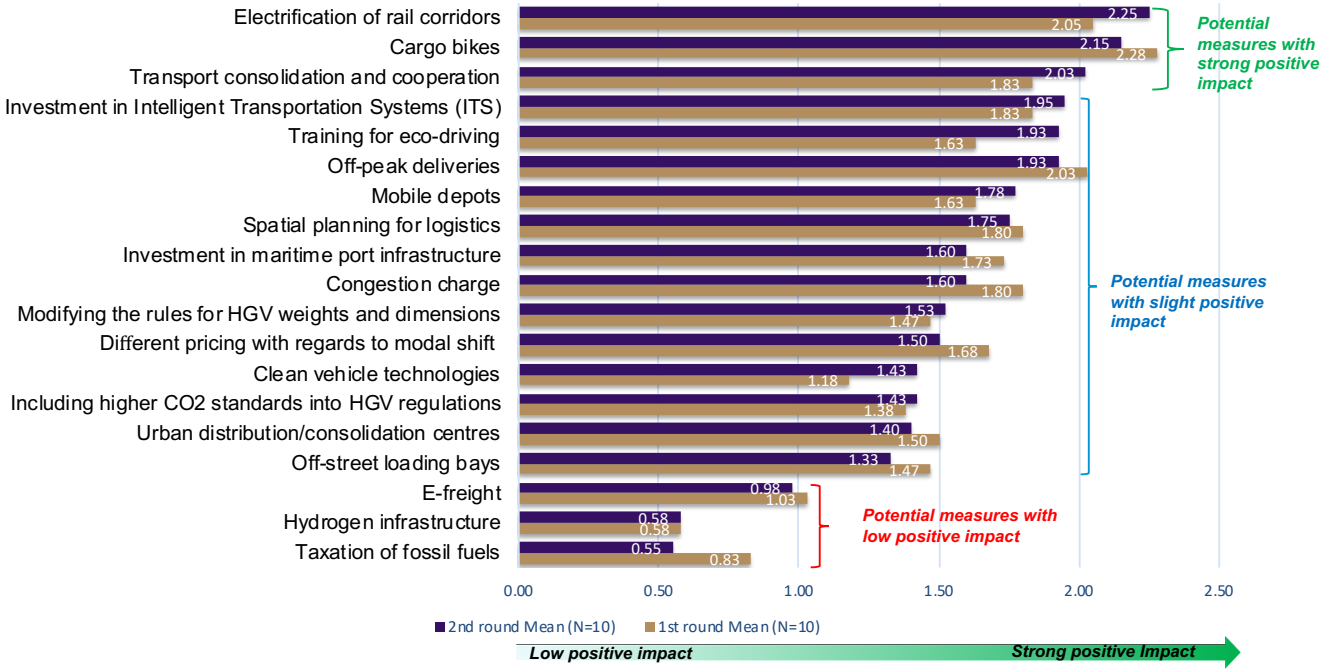
Presently there is no commercially viable alternative to diesel, the taxation on fossil fuel with no alternative will only put Ireland at a cost disadvantage commercially. Alternatively, measures to support the uptake of EURO VI/6 are needed.

Hydrogen infrastructure

A significant divergence of opinions amongst both stakeholders in the public sectors and industry was identified towards this measure. Given that presently there is no vehicle available for operators at a commercially viable price, hydrogen infrastructure will require significant investment and it takes time to be a viable alternative to fossil fuels.

To further investigate consensus amongst different stakeholders towards potential measures, the panel experts' rating results were analysed in two groups: public stakeholders (panel experts from government and academia) and industry stakeholders (panel experts from industry and private sector) (see Figure 11). A higher SD score implies a wider divergence of opinion amongst the stakeholder group. Most of the proposed measures received a relatively balanced consensus between stakeholders in the public and private sectors. However, the consensus amongst the panel experts from the public sector diverges on measures such as spatial planning for logistics, mobile depots; while industry experts' opinions towards hydrogen infrastructure measure diverge significantly.

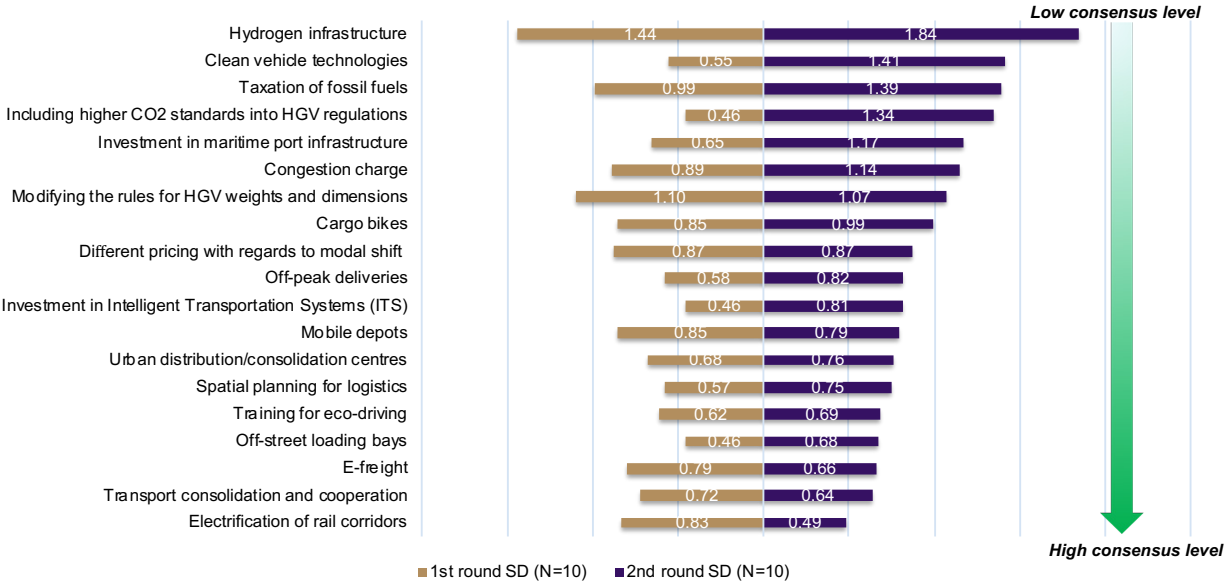
Figure 9 Ranking of freight transport measures by their potential impact (Round 1 and Round 2 results)



Note: Scoring system: where '3' = strong positive impact; '-3'= strong negative impact.

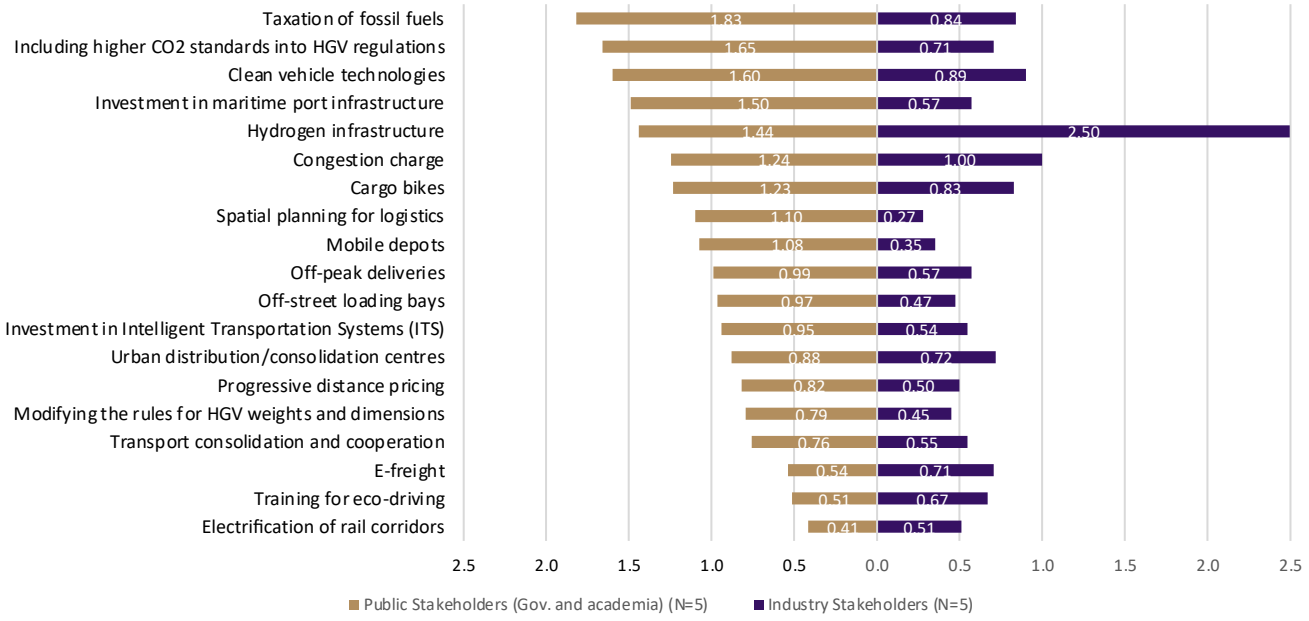
A higher mean rating score implies a stronger potential positive impact on sustainability.

Figure 10 Consensus amongst panel experts towards potential measures in freight transport (Round 1 and Round 2 results)



Note: A higher SD score implies a wider divergence of opinion amongst panel members.

Figure 11 Consensus amongst stakeholder groups towards potential freight transport measures



Note: A higher SD score implies a wider divergence of opinion amongst the stakeholder group.

In summary, key findings for the freight transport measures are as follows:

1. All 38 proposed sustainable measures are considered to have a positive impact on transport in Ireland, measures in "urban freight transport" and "rail freight" received relatively higher ratings than other measures.
2. Rail freight is generally accepted as being more environmentally friendly than road freight. Paradoxically, rail freight in Ireland is facing great challenges to grow and the freight quantities have declined starkly over recent decades. The limited number of high volume bulk movements, Ireland's compact size, and the low density of activity all have limited economic viability of alternatives to road freight. This area needs more attention especially in light of the post-Brexit impact on trade patterns and supply chains.
3. Road transport is the dominant mode of moving freight in Ireland. "Road transport measures" and "Energy & Vehicle supply measures" have a special focus on heavy goods vehicles (HGVs). The haulage industry needs more policy and supportive initiatives compared to other EU countries.
4. Alternative fuels (such as biofuels, HVO, CNG) and clean vehicle technologies (such as Euro 6/7 emissions standards for freight fleet, EV, hydrogen) need to further mature in order to offer at a commercially viable price for operators. In particular, the full fuel life cycle "well-to-wheel (WTW)" emission factors also need to be considered, leaving "well-to-tank" emissions out of the equation can be extremely misleading.
5. Last but not least, supply chain measures highlighted the role of other key stakeholders along the supply chain, such as end customers, logistics service providers, customs, shippers, vehicle manufacturers. Policy efforts towards green technology adoption and sustainability education should include wider audiences, thus encouraging positive behavioural change and foster collaboration among actors along the supply chain.

5. Conclusions and Recommendations

This study provides a timely overview of the current policies on sustainable transport in Ireland. International policy measures from other European countries are also identified and assessed. Although the Irish Government demonstrates increased effort towards the policy development of low-carbon transition for the transport sector, this study finds that the current policies tend to priorities passenger transport. Hence, freight transport is less reflected in terms of measures and supportive schemes towards a low-carbon transition. Through the Delphi study, the potential impact of adopting the identified international measures into the Irish context is assessed, and a list of recommended policy measures on sustainable transport is proposed.

In conclusion, this study highlights that:

- Ireland will need policies and measures that are radical, innovative, and forward-looking to reduce carbon emission from the transport sector.
- The freight transport industry requires more supportive policies and initiatives to increase the industry awareness and readiness for low-carbon transition, especially in light of Brexit's potential impact on trade-pattern and supply chains.
- Collaboration between government, industry, research institutes, and other stakeholders from both public and private sectors is needed to support policy decisions.
- Raising the awareness of climate change in the transport sector and wider society is the key to bring Ireland onto a lower carbon trajectory in the long-term.
-

Prioritising policies is rarely a straightforward process, especially when time and resources are finite. Currently, the mitigation measures in the transport sector have been categorised using the Avoid-Shift-Improve framework. It is possible to further aligning the measures into short-term (within 5 years), mid-term (5 to 10 years), and long-term (more than 10 years) timeframe. The study by Letnik *et al.*(2018) suggests that soft measures with low costs and low investments would have a strong positive impact on savings of energy consumption and carbon footprint. To put this in perspective, a single measure can bring on average about 20% to 30% savings of energy consumption and carbon footprint, while with an optimal combination of measures, the savings can be up to 60% to 70% (Letnik *et al.*,2018).

The Way Forward

More questions were generated during this study which we will attempt to address in future research at CILT:

- What actions should be taken first in the transport sector?
- How the industry, public authorities, and academia can contribute to this low-carbon transition in the transport sector?
- How should we manage the behavioural and organisational change to a low-carbon trajectory? Any best practice from other countries or cities that we can learn from?
- What can we do to foster stronger collaboration between stakeholders in Ireland?
-

Transport policies and procedures should be effective and efficient, based on objective analysis and practical experience, as well as focused on the future. Through dissemination of this study, we hope to raise the awareness and readiness towards the low-carbon transition to CILT members and the wider public audience, stakeholders, and the government.

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Appendix A:
Delphi Questionnaire

The first-round questionnaire was conducted online and available at https://www.surveymonkey.com/r/CILT_IRELAND.

The second-round questionnaire was distributed through the email invitation. In order to ensure a well-informed assessment process supported by a consistent panel, only respondents who participated in the first-round survey were invited for inclusion in the second-round survey. Each questionnaire was customised to display the panel average scores and on the respondent's first-round rating. The respondent was invited to re-assess the potential impact of the sustainable transport measures based on the panel average score.

Appendix B:

Passenger transport measures ratings

Table 1 Passenger transport measures ratings

Potential measures – Passenger Transport	Round 1 rating	Round 1 SD	Round 2 rating	Round 2 SD
Policies that restrict car use ("Avoid")				
Higher price of gasoline	0.92	0.83	0.98	0.70
Road supply	1.28	1.18	1.55	1.29
Driver licensing	0.34	1.27	0.22	1.05
Road revenues & expenditures	0.89	1.40	0.56	1.67
Policies that promote public transport ("Shift")				
Quantity of service	1.9	1.18	1.72	1.39
Quality of service	1.94	0.75	1.73	1.06
Region-wide integration	1.47	0.95	1.40	0.94
Home-to-work index measure for commute time/cost	1.52	0.90	1.15	1.06
Policies that make walking and cycling more attractive ("Improve")				
Traffic calming & speed limits in residential areas	1.36	1.38	1.22	1.39
Car-free zones	2.02	0.96	1.68	1.05
Pedestrian facilities	1.57	1.09	1.42	1.25
Bikeway networks	1.86	0.76	1.93	0.82
Traffic education	1.3	1.20	1.10	1.06
Coordination with public transport	2.29	0.55	1.85	0.83
Planning process - Coordination of land-use plans	2.39	0.59	2.00	1.08

Note: A higher mean rating score implies a stronger potential positive impact on sustainability; A higher SD score implies a wider divergence of opinion amongst panel members.

Appendix C:

Freight transport measures ratings

Table 2 Freight transport measures ratings

Potential measures – Freight Transport	Round 1 rating	Round 1 SD	Round 2 rating	Round 2 SD
Road transport measures				
Investment in Intelligent Transportation Systems (ITS)	1.83	0.46	1.95	0.81
Modifying the rules for HGV weights and dimensions	1.47	1.10	1.53	1.07
Progressive distance pricing	1.34	0.60	0.98	0.67
Different pricing with regards to modal shift	1.68	0.87	1.50	0.87
Harmonised speed limits	1	0.61	1.00	0.85
Congestion charge	1.8	0.89	1.60	1.14
Enforcement of regulations	1.28	1.13	1.23	1.04
Supply chain measures				
Training for eco-driving	1.63	0.62	1.93	0.69
Automated platooning	1.25	1.35	0.80	1.29
Standardised loading units	0.9	0.65	1.05	0.55
E-freight	1.03	0.79	0.98	0.66
Network optimisation – cargo owner	1.08	0.80	1.38	0.74
Network optimisation – logistics service provider	1.63	0.85	1.60	0.70
CO2 labels	0.65	0.39	0.83	0.24
Intermodal transport	1.59	1.10	1.53	1.00
Transport consolidation and cooperation	1.83	0.72	2.03	0.64
Transport route planning and control	1.63	0.58	1.73	0.45
Energy supply measures				
Taxation of fossil fuels	0.83	0.99	0.55	1.39
Hydrogen infrastructure	0.58	1.44	0.58	1.84
Improved batteries	1.15	0.24	1.20	1.21

Continued over...

Vehicle supply measures				
Including higher CO2 standards into HGV regulations	1.38	0.46	1.43	1.34
BAT vehicle certification for heavy goods vehicles	0.95	0.51	0.85	1.16
Clean vehicle technologies	1.18	0.55	1.43	1.41
Urban freight transport measures				
Off-street loading bays	1.47	0.46	1.33	0.68
Cargo bikes	2.28	0.85	2.15	0.99
Mobile depots	1.63	0.85	1.78	0.79
Urban distribution/consolidation centres	1.5	0.68	1.40	0.76
Off-peak deliveries	2.03	0.58	1.93	0.82
Spatial planning for logistics	1.8	0.57	1.75	0.75
Freight routes, delivery, and servicing plans	1.38	0.90	1.48	1.04
By boat logistics	1.3	1.14	1.38	1.31
Rail and Maritime transport measures				
Investment in rail infrastructure	1.8	1.01	1.75	0.98
Rail Freight prioritisation	1.75	1.09	1.80	1.03
Electrification of rail corridors	2.05	0.83	2.25	0.49
Longer or/and heavier trains	1.63	0.82	1.68	0.83
Investment in inland waterway transport infrastructure	1.05	1.16	1.20	1.27
Investment in maritime port infrastructure	1.73	0.65	1.60	1.17
Develop new technologies in inland waterways	1.2	1.16	1.30	1.18

Note: A higher mean rating score implies a stronger potential positive impact on sustainability; A higher SD score implies a wider divergence of opinion amongst panel members.

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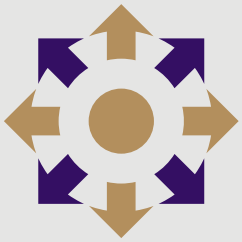

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