

Skillnet
**CLIMATE
READY**
ACADEMY



Breaking Boundaries:

Building Capacity to Manage
Sustainable Supply Chains

January 2025

Research collaborators:



20FIFTY
PARTNERS



Researchers:

Yvonne Delaney
yvonne.delaney@ul.ie

Michael Hennessy

Gerald O’Nolan
gerald.onolan@ul.ie

John McCarthy

Ingrid Hunt

Siobhan Kennedy

Miriam O’Riordan

Table of contents

Overview	5
Foreword	6
Executive Summary	7
Main Aims of Research	7
Barriers to Decarbonisation	7
Drivers and Enablers of Decarbonisation	7
Summary of Findings	8
Summary of Recommendations	10
1.0 Introduction	11
2.0 Sustainable Supply Chain Literature Review	12
2.1 Introduction	12
2.2 Barriers to Supply-Chain Decarbonisation	13
2.3 Drivers of Supply Chain Decarbonisation	13
2.4 Tackling Supply Chain Emissions	14
3.0 Methodology	15
3.1 Research Design	15
3.1.1 Individual Interviews and Case Studies	15
3.1.2 Focus Groups	15
3.1.3 Survey	16
3.2 Integration of Findings	16
4.0 Main Findings	17
4.1 Finding 1 - There is a need for widespread Awareness Raising and Capacity Building to strengthen Scope 3 emissions management across private sector	14
4.1.1 Overview of Findings	14
4.1.2 Key Awareness and Capacity Building Barriers	19
4.1.3 Key Awareness and Capacity Building Enablers	19

4.3	Finding 2 – New Strategies required to overcome Supply Chain Complexity	19
4.2.1	Overview of Findings	19
4.2.2	Key Sustainable Supply Chain Strategy Barriers	20
4.2.3	Key Sustainable Supply Chain Strategy Enablers	21
4.3	Finding 3 – Tackling the Cost and Infrastructure Challenges	22
4.3.1	Overview of Findings	22
4.3.2	Key Cost and Infrastructure Barriers	22
4.3.3	Key Cost and Infrastructure Enablers	24
4.4	Finding 4 – Role of Data in supporting Scope 3 Emissions management	25
4.4.1	Overview of Findings	25
4.4.2	Key Data Barriers	25
4.4.3	Key Data Enablers	26
<hr/>		
5.0	Summary and Analysis	27
5.1	Summary of Scope 3 Key Decarbonisation Barriers	27
5.2	Summary of Scope 3 Key Decarbonisation Enablers	28
6.0	Conclusion and Recommendations	30
6.1	Recommendations for Policy Makers	30
6.2	Recommendations for Organisations	30
	References	31

Overview



Literature Review

11



Semi-structured Interviews



65
Survey Responses

9



Industries

2



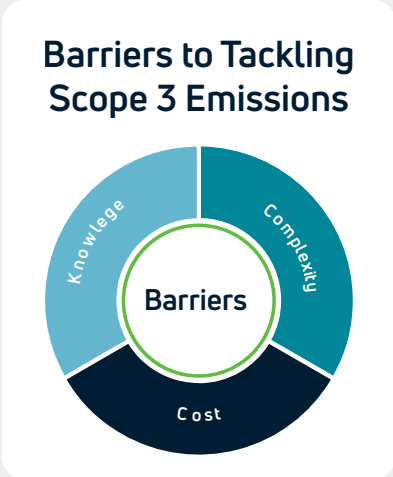
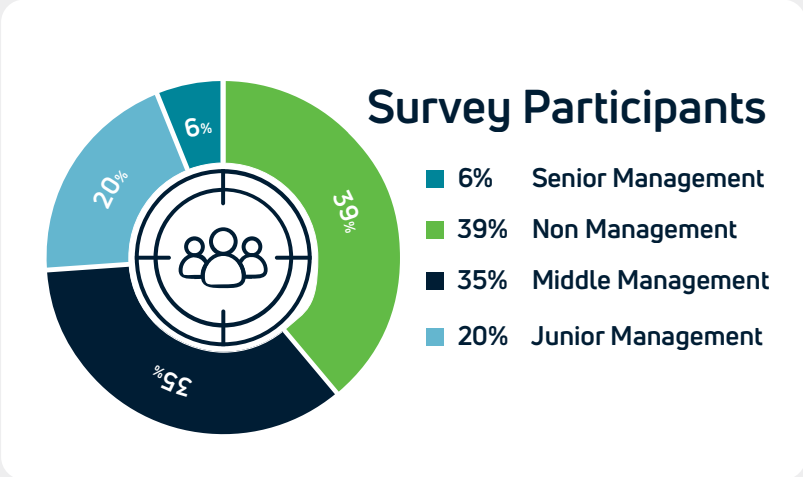
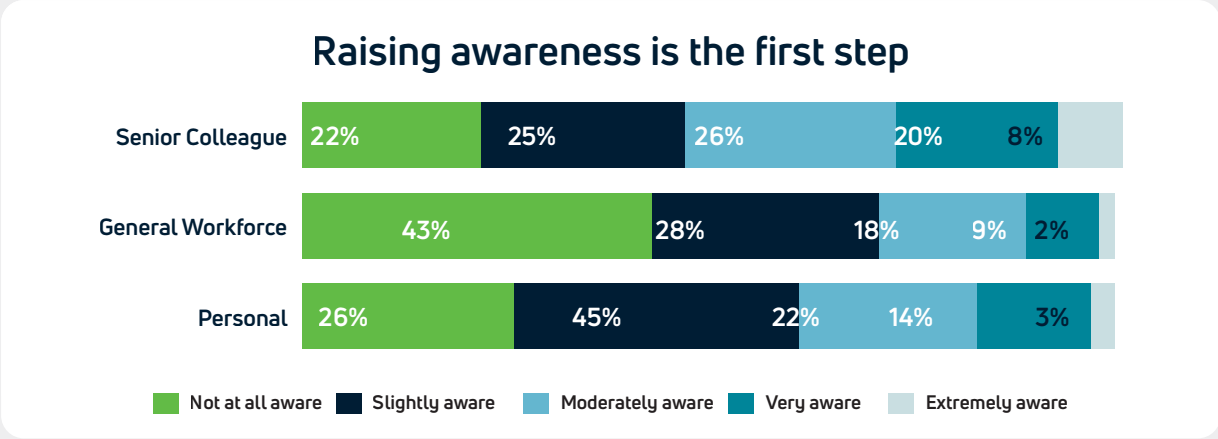
Focus Group

78%
Financial Support from Government

71%
Government and EU Regulation

66%
Greater Political Will

Solutions Enablers of Scope 3 Emissions Reduction





Foreword

Global supply chains play a pivotal role in the effort to address climate change, particularly in the reduction of greenhouse gas (GHG) emissions. While Scope 1 and Scope 2 emissions—direct emissions from owned or controlled sources and indirect emissions from the generation of purchased energy, respectively—are relatively well understood and managed by organisations, Scope 3 emissions, which result from activities not owned or controlled by the reporting organisation present a complex challenge for the private sector (Carbon Trust, 2024).

Scope 3 emissions account for up to 70% of a company's total GHG footprint according to the Science Based Targets Initiative (2023), encompassing a wide range of activities such as purchased goods and services, business travel, employee commuting, waste disposal, and the use of sold products. The complexity of tracking and reducing these emissions across a diverse and often global supply chain necessitates a comprehensive approach, combining robust data collection with innovative reduction strategies.

This report seeks to understand the boundaries organisations must respond to, to decarbonise their value chains. This report analyses and summarises the expert insights of key individuals in Irish and multinational organisations through semi-structured interviews, focus groups and questionnaires. The findings and recommendations in this report are intended to be a useful resource in highlighting the need for greater awareness of the issues and contribute to a sustainable future for all by focusing on decarbonisation of supply chains with a particular emphasis on Scope 3 emissions.

The Skillnet Climate Ready Academy extends our gratitude to the report authors, subject matter experts, organisations, and stakeholders who contributed to this report. Their insights and experiences have been invaluable in shaping our understanding of the challenges and opportunities associated with reducing Scope 3 emissions.

MARIA KELLY

DIRECTOR,
SKILLNET CLIMATE READY ACADEMY

Executive Summary

Organisations generate greenhouse gases (GHGs) in three ways, directly through operations, indirectly through the purchase of energy, and emissions embedded in the value chain from raw materials through to the end user of the product. Decarbonising the global value chain is one of the most significant opportunities to support system-scale net zero transformation globally (Science Based Targets Initiative, 2023).

This research highlights how managing Scope 3 emissions for an entire value chain presents significant challenges for organisations due to lack of knowledge, complexity of existing global value chains and the perceived costs associated with decarbonisation, suggesting leadership commitment, smarter supply chain strategies and Government support and regulation are required to effectively address this topic. However, the research identified that increased organisational knowledge and understanding are required before organisations begin to develop and execute Scope 3 emissions reductions strategies due to the complexity of the challenge that organisations face in decarbonising their value chains.

Main Aims of Research

- Identify the role of sustainable supply chains in progressing large organisations' environmental, social and governance (ESG) strategic goals across Ireland.
- Identify challenges, enablers and solutions towards environmentally sustainable supply chains.

Barriers to Decarbonisation

This research has identified major barriers and several minor barriers to decarbonisation of supply chains. Lack of knowledge, supply chain complexity, data issues and cost to decarbonise have been identified as the major barriers to decarbonisation by industry experts, interviewees and survey respondents. For example, the electrification of vehicles, developing enabling infrastructure or getting practical access to the grid is problematic

for industrial organisations with extensive supply chains while cost has been identified as stumbling blocks to sustainable supply chains.

Many participants stated that a further barrier to sustainable supply chains is a lack of knowledge not only amongst the industry workforce, but also on the part of policymakers, the civil service and regulators, resulting in a lack of a collaborative effort in identifying and delivering solutions to Scope 3 decarbonisation. This lack of knowledge about the extent of an organisation's Scope 3 emissions and what they need to do to tackle these emissions is a critical barrier to decarbonising the supply chain. Breaking down this knowledge barrier is an immediate requirement before organisations can begin to address the impact of their Scope 3 emissions.

Drivers and Enablers of Decarbonisation

Counteracting the barriers with systematic, scalable solutions at both macro and micro levels have been identified as critical to solving the key barriers to sustainable supply chains.

Educational supports for both industry and policymakers, enhanced government support and incentives to equip organisations with tools to progress and communication of key emerging regulatory landscape will be vital if the transformative impact of sustainable supply chains are to be realised.

Summary of Findings

A need for widespread awareness building across organisations:

- Providing upskilling opportunities to boost industry-wide and sector-specific knowledge of Scope 3 emissions is a crucial first step for organisations to grasp the complexity of Scope 3 emissions.
- All interviewees were experienced management, environmental or supply chain professionals with an awareness of the term 'Scope 3'. However, interviewees suggested that while they and their close colleagues knew about the issues involved, the more widespread workforce in their organisations would not be familiar with the term.

New strategies needed to overcome supply chain complexity

- Emerging regulation has the potential to drive supply chain transformation
- Enablers for organisations to achieving decarbonisation targets will include streamlined regulatory processes and government / EU incentives and penalties.
- Near sourcing, responsible sourcing and sustainable transport strategies identified as key target areas for organisations to reduce Scope 3 emissions.

Cost and Infrastructure barriers need to be tackled

- To overcome the complexity and costs involved in reducing scope 3 emissions, interviewees identified significant government investment in funding supports and infrastructure as essential.

Role of data in supporting Scope 3 Emissions Management

- Many big companies struggle with defining Scope 3 boundaries. A manufacturing firm may understand its product journey well up to a certain point, but that demarcation may extend beyond supermarket shelves where their understanding of the downstream impact of their product is more limited.
- Collecting Scope 3 data for a full value chain is challenging. Where data is unavailable, estimations are necessary using data like weight, quantity, and spend on materials, along with emissions. Additionally, the ability to track and trace the lifecycle of a product can be sector specific.

Table 1 - Summary of Key Barriers and Enablers by Thematic Finding

Thematic Finding	Barriers	Enablers
A need for widespread awareness building across organisations:	<ul style="list-style-type: none"> • Lack of knowledge 	<ul style="list-style-type: none"> • Competency Development • Industry Collaboration
New strategies needed to overcome supply chain complexity	<ul style="list-style-type: none"> • Complexity of Global Supply Chain 	<ul style="list-style-type: none"> • Optimising current supply chain strategies and activities • Near Sourcing Strategies • Responsible Supplier Procurement Policies • Sustainable Transport Strategies
Cost and Infrastructure barriers need to be tackled	<ul style="list-style-type: none"> • Limited understanding of return on investment • Lack of Understanding of True Economic Costs associated with Scope 3 Emissions 	<ul style="list-style-type: none"> • Emerging legislation will strengthen the business imperative for decarbonisation initiatives • Existing Tools can support Business Case Development
Role of data in supporting Scope 3 Emissions Management	<ul style="list-style-type: none"> • Traceability of Supply Chains 	<ul style="list-style-type: none"> • Voluntary and Compliance Reporting prompts better data collection and monitoring • Undertaking Product Lifecycle Assessments to collate data and measure impact

Summary of Recommendations

Recommendations for Policymakers and National Enterprise Agencies

1. Support competency development initiatives for industry: Skillnet Ireland and the Skillnet Climate Ready Academy have the capability and reach to implement awareness and capacity building campaigns and related competency development programmes in Sustainable Supply Chains to inform and educate organisations about Scope 3 emissions management.
2. Encourage the uptake of voluntary sustainability reporting standards for smaller organisations across Ireland through targeted sustainability competency development programmes for SMEs, particularly those who are part of a larger supply chain to enable better monitoring of emissions reporting across a value chain.

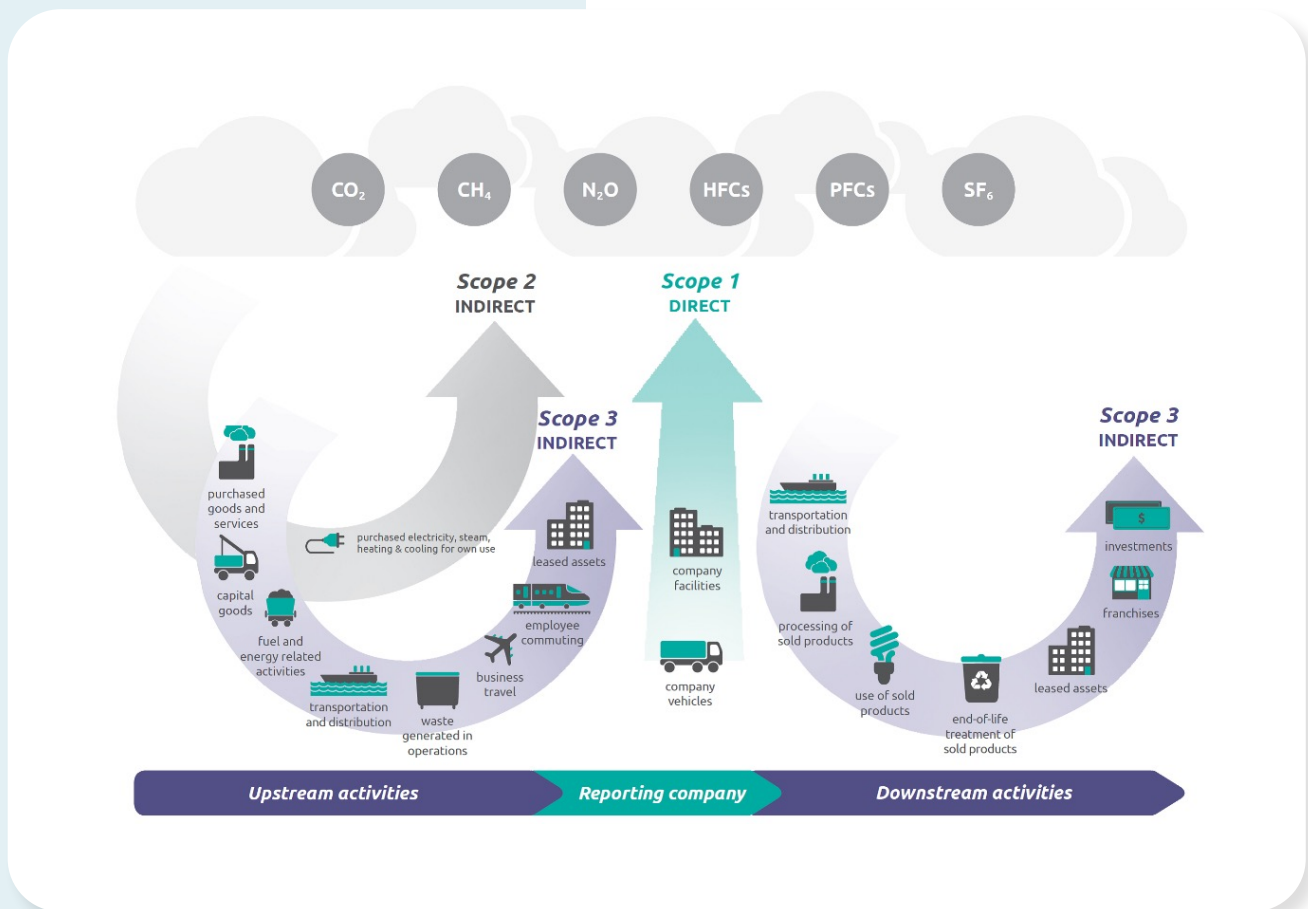
Recommendations for Organisations

1. Effective climate action needs to be driven from the very top and organisations should ensure senior leaders undertake Executive Leadership training in climate action and support the upskilling of its key supply chain decision makers in sustainability.
2. To help increase the knowledge and skills of their employees, senior leaders should encourage academic awards with a focus on supply chain sustainability to all involved in supply chains and then foster this initiative throughout the organisation.
3. Establish a dedicated sustainable supply chain team consisting of cross-functional members to bring together the key competencies and skillsets needed to support the development and delivery of transformative supply chain strategies e.g. near sourcing, responsible sourcing, sustainable transport strategies etc.
4. Initiate pilot projects in organisations focused on continuous monitoring, evaluation and improvement of sustainability performance in the supply chain e.g. organisational and / or product lifecycle assessment.
5. Work closely with suppliers and customers to promote sustainability and prompt new initiatives throughout the supply chain including the delivery of education.
6. To support stronger cross-departmental responses to enabling sustainable supply chains, encourage key personnel to rotate their roles within related supply chain, procurement and operational areas with a focus on developing a holistic, systematic response to decarbonisation challenges.

1.0 Introduction

Organisations generate greenhouse gases (GHGs) in three ways, directly through operations, indirectly through the purchase of energy, and emissions embedded in the value chain from raw materials through to the end user of the product. These are known as Scope 1, 2 and 3 emissions respectively. In some industries, such as the food sector, Scope 3 emissions have been shown to represent up to 88% of the total.

Figure 1: Overview of GHG Protocol scopes and emissions



Source: WRI/WBCSD Corporate Value Chain (Scope 3) Accounting and Reporting Standard (PDF), page 5

In compiling this report, the authors conducted semi-structured interviews with eleven key people connected to the industries which are recognised as large contributors to the accumulation of GHGs to examine the potential for, enablers and barriers to decarbonising supply chains across industry. These sectors included: chemicals, auto electrics, vision care, safety wear/PPE, medical technology, computers, food/baby formula, cement and building materials, investment management, laboratory sciences and pre-cooked food ingredients.

2.0 Sustainable Supply Chain Literature Review

2.1 INTRODUCTION

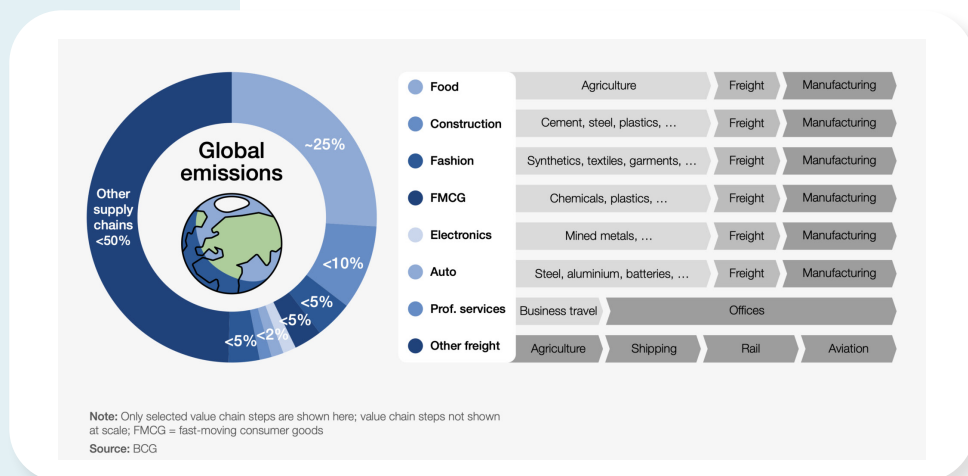
The impact of climate change to our planet is rapidly accelerating. With much of this acceleration driven by human activity, a growing number of leading firms are beginning to face the realisation that existing business and operating models cannot co-exist with international efforts to combat climate change.

As organisations begin to manage Scope 1 and 2 emissions reduction, leading global businesses are now targeting their focus towards Net Zero goals by evaluating the impact of their extensive, global supply chains, both upstream and downstream, on the environment. Scope 3 emissions, not produced directly by the company but by others in its supply chain, are significant. Scope 1 covers direct emissions, Scope 2 covers indirect emissions from purchased energy, and Scope 3 includes all other indirect emissions (Carbon Trust, 2024). Some firms’ supplier emissions can be up to ten times greater than their direct emissions (Boston Consulting Group, 2021) while studies show that Scope 3 upstream emissions of all American companies was 74% of a firm’s total carbon footprint (Asif et al., 2022).

Scope 3 emissions reporting is often incomplete and inconsistent, with 53% to 77% of emissions under-reported (Hansen et al., 2022). For those organisations that ignore supplier emissions as part of their carbon footprinting activities while touting direct emission reductions, this could be seen as green washing (Homroy and Rauf, 2023).

Historically organisations have focused on management and reporting of Scope 1 and 2 emissions. For organisations with access to the data, it was a relatively straight forward task to measure internally created emissions and account for energy purchases such as electricity. However, Scope 3 emissions are a far more challenging undertaking for organisations. According to Patchell (2018), the ambition of Scope 3 is to use the power and leverage of MNCs to drive emissions measurement and management throughout the value chain. If management and measuring could be achieved in the top 500 MNCs, this would offer the potential to radically reduce the world’s GHG emissions (Patchell, 2018). Furthermore, eight supply chains cause over 50% of global greenhouse gas emissions: Food, Construction, Fashion, Fast-Moving Consumer Goods (FMCG), Electronics, Auto, Professional Services, and Freight (Boston Consulting Group, 2021).

Figure 2: Eight supply chains are responsible for more than 50% of global emissions



Source: Boston Consulting Group, 2021.

2.2. BARRIERS TO SUPPLY-CHAIN DECARBONISATION

Global supply chains must decarbonise to achieve net-zero emissions. Decarbonising the eight major supply chains will require a combination of various methods, solutions and technologies but there are many reasons why companies are yet to focus on reducing emissions from their value chain.

In certain cases, perceived problems are obscured from view due to a lack of transparency about emissions (Boston Consulting Group, 2021). What cannot be seen, cannot be managed and the structures for achieving greater transparency, at the supplier level, are still undeveloped. In some industries, emissions are spread over numerous organisations in many different countries. This makes undertaking the challenge of decarbonisation difficult and the perception is that the process will be expensive (Boston Consulting Group, 2021). There may be the view that customers would be unwilling to pay the added costs of decarbonisation.

Lack of top management commitment, perceived costs, lack of training, and inadequate supplier commitment are some of the most important barriers that occur in the implementation of Sustainable Supply Chain Management (SSCM). Negri et al., (2020) have identified lack of managerial autonomy, inadequate R&D investment, and lack of ICT integration as major barriers.

Many final products are made up of hundreds or thousands of parts. Many of these parts come from a variety of suppliers who may have many more suppliers. These suppliers can change over time and for procurement departments, 'low carbon' may not always be a priority in undertaking purchasing decisions. Furthermore, raw material scarcity may also have an impact. For example, the chemicals needed for the batteries to power electric vehicles (e.g. lithium, nickel and cobalt) are critical elements that require sustainable management (Lehtimäki et al., 2024).

Barriers can be internal or external. The internal barriers involve organisation-related issues as noted above. External barriers involve forces present in the external environment, which can inhibit a company's ability to engage in SSCM practices. Sajjad, et al., (2015) examining motivations and barriers in New Zealand concluded that it could be a lack of supplier capability, inadequate consumer demand for sustainable products or services and lack of government support (Sajjad et al., 2015).

2.3. DRIVERS OF SUPPLY CHAIN DECARBONISATION

Drivers to achieve Scope 3 emissions reductions targets can also be internal (e.g. ethical values, brand reputation) or external (e.g. regulatory requirements). Whichever driver is relevant, consistent data sharing and interoperability are crucial for accurate Scope 3 emissions measurement (Stenzel and Waichman, 2023). Interoperability can be defined as 'a measure of the degree to which diverse systems, organisations, and/or individuals are able to work together to achieve a common goal' (Ide and Pustejovsky, 2010, p2). A study by the European Commission identifies missing interoperability as potentially a key driver to enhanced data sharing across firms in general (Stenzel and Waichman, 2023). Sharing primary data is required to accurately measure Scope 3 emissions but a lot of commercial data may be considered as 'sensitive' (Stenzel and Waichman,

2023).

Public-facing businesses may have a reputation and brand image to protect and therefore the motivation to enhance shareholder wealth and make environmentally favourable decisions will be aligned. The difficulty is in calculating these emissions. Economic input-output analysis methods can be used to estimate emissions in supply chains. They provide indicators of the origin of emissions by country and industry sector or product group (Schmidt et al., 2022). The GHG Protocol gives detailed descriptions of how to calculate emissions in each category (World Resources Institute, 2013).

2.4. TACKLING SUPPLY CHAIN EMISSIONS

The Boston Consulting Group suggests nine steps for CEOs to tackle supply chain emissions (Boston Consulting Group, 2021). Decarbonising supply chains offers significant potential for global climate action, with forward-thinking corporations already leading the effort.

Supply chain decarbonisation presents the world with huge, as yet unrealised, potential to impact global climate action. With the ‘buy-in’ of influential MNCs, who’s supply chain is spread across the world it is possible to influence the way business is done, even in the most remote and unregulated parts of the world and achieve net zero emissions by 2050. This will not be easy and will take time, but the most forward-thinking corporations are already undertaking this effort.

Figure 3: Nine step framework to tackle supply chain emissions



Adapted from Boston Consulting Group, (2021)

3.0 Methodology

The main output of the research is this research report. This section of the report provides an overview of the research design, participant recruitment and selection, data collection procedures and data analysis techniques.

3.1 RESEARCH DESIGN

The research team used mixed methods combining qualitative insights from semi-structured interviews, focus groups and quantitative survey data, the design of which was informed by a robust and systematic literature review. Interviews and focus groups were conducted with senior executives while the quantitative survey was completed by a group of supply chain practitioners.

3.1.1 Individual Interviews

Eleven semi-structured interviews with key individuals representing large organisations in the target sectors were conducted. Verified transcripts of interviews and focus groups were organised in a matrix to identify emerging themes or recurring patterns using the Braun and Clarke thematic analysis framework (2022). Several rounds of coding were required to ensure accuracy. This analysis formed the qualitative part of the study and provided material for the research team to design the survey which encompassed sixty-five participants. The survey forms the quantitative aspect of the study.

3.1.2 Focus Groups

One 60-minute focus group was conducted, with moderation by a senior researcher and the principal investigator followed by semi-structured interviews with members of the focus group. The themes discussed with the focus groups were:

- Awareness of the issue of decarbonisation of the supply chains among business professionals
- Barriers to achieving decarbonisation of the supply chain
- Drivers to achieving decarbonisation of the supply chain



Figure 4: Profile of participants from large organisations

3.1.3 Survey

The survey instrument consisted of 9 questions drawn from the interview and focus group data. Of the 65 participants, 40 held management positions (senior management = 4; middle management = 23; junior management = 13) and 25 held non-management positions.

Figure 5: Profile of focus survey participants

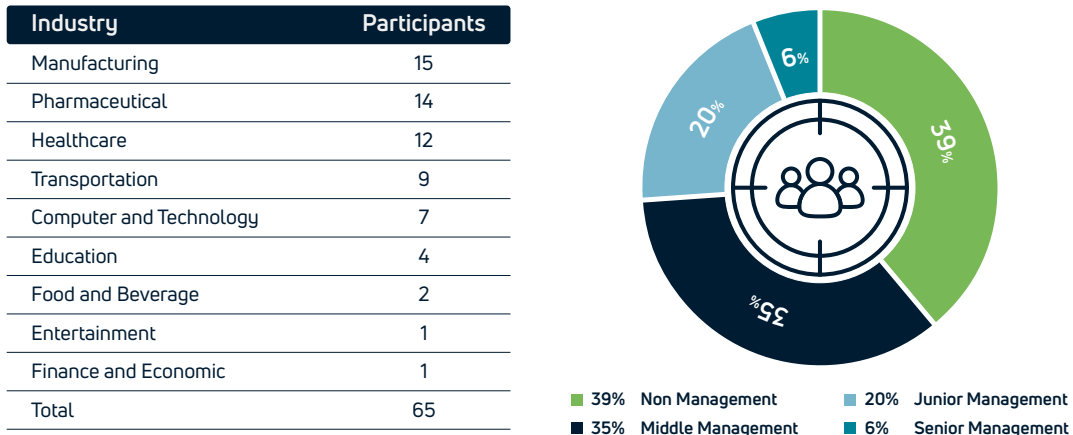


Table SEQ Table * ARABIC 2 - Survey participation by industry

The survey was distributed to the participants, identified by the principal investigator, via an online platform and participation varied across industries.

3.2. INTEGRATION OF FINDINGS

The different investigative strands were integrated to comprehensively interpret the findings, identifying key themes across both the qualitative and quantitative strands of research. The following section provides an outline of the main findings of this research.

4.0 Main Findings

This section of the report presents the main findings to emerge from the research. These comprise of the literature review combined with the insights and experience of the interview subjects, the experts who took part in focus groups and the outputs of the survey.

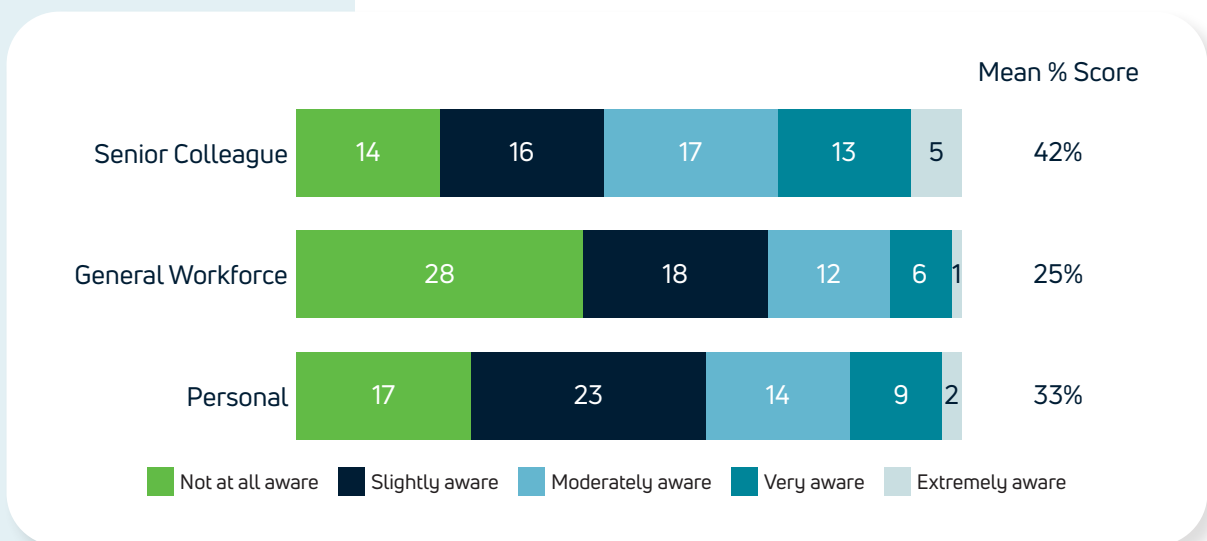
4.1. FINDING 1 – THERE IS A NEED FOR WIDESPREAD AWARENESS RAISING AND CAPACITY BUILDING TO STRENGTHEN SCOPE 3 EMISSIONS MANAGEMENT ACROSS PRIVATE SECTOR

The level of awareness of Scope 3 emissions is not widespread throughout organisations. Whilst all interviewees were aware of the term ‘Scope 3’, there was at least one admission that they had not heard of the term previously. Most noted that while they and other supply chain personnel knew about the issues involved, the more widespread workforce in their organisations would not be familiar with the term. Despite a lack of familiarity with the term, it was generally accepted that the wider workforce is aware of the need to adopt a sustainable supply chain and for large organisations to set an example for their suppliers to follow. Survey data corroborated the interview and focus group findings. Figure 7 illustrates the combined responses for the personal, general workforce and senior colleague awareness categories.

4.1.1. Overview of Findings

Most responses in the categories for personal and general workforce awareness indicated that the level of awareness was either slight (70%) or none at all (55%), which indicates that a lot of work is required to disseminate knowledge across organisations. The data also revealed that managerial level responses with a high degree of awareness were dominated by participants in the manufacturing, pharmaceutical, healthcare and computer and technology industries, whereas for the personal and workforce awareness categories, the transportation industry dominated the higher scores.

Figure 6: Survey responses regarding awareness of Scope 3 emissions (calculated as number of responses and mean % scores)



Note: Data represents survey respondents from all participating industries (n=65)



Survey data in Figure 6 illustrates significant variations in awareness levels, underscoring the need for tailored strategies to enhance an understanding of, and engagement with Scope 3 emissions across different segments of the organisation.

To quantify the level of awareness of Scope 3 emissions across the sample, mean percentage scores were calculated. These scores provide a standardised measure to facilitate comparison of awareness levels across different categories (personal, workgroup and senior management). A higher mean percentage score indicates a greater level of awareness within a category, while a lower score highlights areas where awareness is lacking and where targeted educational initiatives may be necessary. In addition to calculating the overall mean percentage score of each category, the distribution of responses within each category was also assessed.

Perceived awareness among senior colleagues was the highest in this sample, with a mean percentage score of 42%. A higher proportion of senior colleagues are “very aware” (20%) or “extremely aware” (7%) of Scope 3 emissions. Furthermore, the distribution within this category was more balanced, with almost half of the survey participants (54%) rating senior colleague awareness as moderate or higher. This indicates that senior colleagues are generally more informed or conscious about the topic compared to the general workforce which is a good starting point for targeted awareness-raising initiatives.

Survey data also illustrated that for senior colleague awareness, higher awareness was indicated by participants in the manufacturing, pharmaceutical, healthcare and computer and technology industries, whereas for the personal and

workforce awareness categories, the transportation industry dominated the higher scores.

Based on the survey data, the mean percentage score of 33% for personal awareness indicates that on average, individuals’ personal awareness levels are quite low. This signifies that when surveyed, most individuals rated their personal awareness closer to “not at all aware” and “slightly aware” (61% of participants), than as “very aware” or “extremely aware” (17%).

General workforce awareness was measured by asking survey participants to assess the perceived level of awareness amongst colleagues. Data indicated that a substantial portion of the workforce (71%) is either “not at all aware” or “slightly aware.” On the other end of the scale, general workgroup awareness rated as “very aware” or “extremely aware,” was just 11%, suggesting that awareness efforts are not reaching the workforce effectively.

Awareness of Scope 3 emissions depended on the individual’s personal experience and their organisation’s engagement with the topic. Some were very aware but this was not shared by all.

In the focus group, participants commented that they were in a learning phase and more key people within their organisations were beginning to understand the importance of the issue. Legislation, it was noted, will drive awareness.

However, for organisations who are increasing their awareness of the Scope 3 emissions reductions challenge, it has brought with it a realisation of the great complexity and difficulties involved in collecting data, devising and implementing solutions and completing accurate, verifiable reporting. The organisations who have studied the subject

4.1.2. Key Awareness and Capacity Building Barriers

Lack of Knowledge

Survey respondents rated 'Lack of knowledge' as a barrier on a scale of 0-3, where 0 indicates 'Not at all a barrier' and 3 indicates a 'Serious Barrier'. Not only did 49% of survey respondents indicate that Lack of Knowledge is a serious barrier to tackling scope 3 emissions, but it also received the highest mean score (66%), albeit marginal, in comparison to other suggested barriers such as cost and complexity (discussed in detail later in Findings 2 and 3).

These findings highlight lack of knowledge as a critical obstacle for businesses to overcome when building awareness and capacity within their organisations to tackle scope 3 emissions. Whilst the majority of the respondents (83%) agreed that Lack of Knowledge was at least a moderate barrier or greater, there were a minority who were not sure (15%) or felt it was not a barrier at all (4.61%).

4.1.3. Key Awareness and Capacity Building Enablers

Competency Development

Overall, it appears that those who have a sustainability role in an organisation are well briefed on the area of Scope 3 emissions but in many cases, this knowledge has been recently acquired and does not extend more broadly across organisations.

Interviewees cited the development of competencies on how and why a supply chain could decarbonise as a crucial enabler to combat the current lack of knowledge at all levels - from policymakers, to reporting and practitioners on the ground. Competency development interventions for both the public and private sector were highlighted as a crucial enabler towards national and organisation Scope 3 emissions reduction targets.

Industry Collaboration

Interviewees highlighted industry collaboration as an enabler of quickly enhancing knowledge and gaining access to best practice though many were not yet involved in any kind of industry collaboration. A number of interviewees stated that their corporate headquarters may engage in industry collaboration, looking at how to standardise methods of Scope 3 emissions calculation so that sectors will use the same calculation methods and within the same boundaries to create a recognised standard. There was no evidence from the research findings of industry collaboration on Scope 3 emissions at a local level however.

4.2. FINDING 2 – NEW STRATEGIES REQUIRED TO OVERCOME SUPPLY CHAIN COMPLEXITY

4.2.1. Overview of Findings

Many of the organisations interviewed highlight their limited knowledge about the scale of the Scope 3 emissions for their organisations as a barrier to the development of effective developing strategies and plans. Although, several interviewees classified their organisations as proactive in raising the topic at C-Suite level, other organisations are adopting a 'wait and see' approach.

Several larger organisations have been studying their Scope 3 emissions for years but find that one of their biggest challenges is to define the scope boundary. A manufacturing firm may have a very good awareness of their product from the elementary source right up to the supermarket shelves but that might not be where the demarcation ends. A similar situation arises with food products that need boiling water to rejuvenate and consume. In these cases, the demarcation goes beyond the supermarket shelf and into the consumer's home (see Section 4.4.3 for Data Enabler – Product LCA for more).

Transport and logistics form another part of the Supply Chain equation, and some organisations may have an easier job than others to capture the effects of this aspect. One organisation has been reporting on Scope 3 transport and distribution emissions since 2009, equating to 14 years of transport and emissions data, enabling them to focus in the last four years on conducting a deeper look into their upstream and downstream emissions.

Shipping modes is an area in which organisations are attempting to decarbonise their emissions from transportation including changes in shipping modes from air to ground and

ocean without impacting customer lead times. Interviewees noted here that success requires engagement and collaboration from different departments across an organisation including logistics / supply chain, finance, sales and customer support to enable this transformation.

Another strategic area identified by interviewees as having the potential to reduce emissions is packaging. Logistics managers see emissions as a simple equation of weight times distance times shipping mode. Some organisations have been successful in reducing the weight of packaging without affecting the security of their product. But there is a limit to how much you can strip down packaging before unintended consequences such as quality concerns emerge.

In some sectors, the potential for Scope 3 emissions reduction is limited at first view. For example, banking, insurance and professional services are usually not moving physical products. Therefore, their thinking in Scope 3 is confined to employee transport, working from home and executive travel. However, a number of these entities provide services that may have the potential to deliver Scope 3 impact such as green loans, green investments decisions etc. However, none of those interviewed noted the potential positive or negative role of their service products on Scope 3 emissions.

4.2.2. Key Sustainable Supply Chain Strategy Barriers

Complexity of Global Supply Chain

Based on the survey data, the mean percentage score of 64% indicates that on average, individuals perceive the complexity of addressing Scope 3 emissions as significant. In regard to the distribution of responses within the categories, 42% of survey participants considered complexity a moderate barrier, and 25% a serious barrier. Just 3% (n=2) of respondents indicated complexity as “not at all” a barrier in addressing Scope 3 emissions. There is notable uncertainty with regards to complexity with 23% of respondents indicating that they were unsure.

The complexity of the global supply chain was also a feature of the qualitative interviews and focus groups. Large organisations may consist of many sub-companies or sub-divisions and operate in, what one of the interviewees referred to as a ‘federal’ system. Acquisitions, over the years, will bring together a variety of different systems, cultures and nationalities with many thousands of suppliers under an overseeing group. These subdivisions will have diverse systems of procurement and finance. Financial information will be aggregated but there is less chance of that in procurement according to interviewees. Almost all interviewees agreed that their suppliers were geographically diverse. A lot of business-to-business suppliers are based in Asia while large organisations tend to make and sell goods globally resulting in both upstream and downstream emissions that are global in nature.

Interviewees also noted that the practice of divestment and acquisitions furthers the complexity of global supply chains beyond that of location. Large corporations are in the business of acquiring and divesting different components of their business to keep it fit and healthy for the market in which they operate. This changing boundary is another barrier to accurate and timely reporting of emissions. Divesting reduces emissions but acquisitions bring new emissions and their entire supply chain. Therefore, decisions as to whether to bring in raw materials from a more environmentally friendly source are not always straightforward.

Lack of control over the production of Scope 3 emissions has also been cited as a barrier. Most organisations are in full control of Scope 1 and 2 emissions, but Scope 3 requires the cooperation and input of others.

For a large multinational organisation, with thousands of employees, calculating the emissions associated with energy use whilst working from home or employee commuting may be complex.



4.2.3. Key Sustainable Supply Chain Strategy Enablers

Optimising current supply chain strategies and activities

Waste is an area that has a major impact on Scope 3 emissions and many organisations engage in a policy of waste minimisation for both economic and environmental purposes. All respondents had strategies in place to eliminate waste while a small number of sites have already eliminated landfill wastes from their sites. Some enterprises, by their nature, can recycle most of their waste while others need to be very innovative to achieve their goals in this area. An example of this is a practice known as Industrial Symbiosis where an industry can take the waste from other industries to use in their own manufacturing process.

Near sourcing strategies

For organisations with long term business models that rely on global procurement, changing their existing supply chain is not currently a feasible option. In the food processing sector in Ireland, a significant amount of ingredients are imported, processed and exported again as Ireland does not produce sufficient quantities of many ingredients and staple foods.

However, interviewees were confident that local or near sourcing strategies would make great sense where feasible and can support Scope 3 decarbonisation targets. Locally sourced packaging was highlighted during interviews as an example in which organisations

were identifying opportunities to reduce emissions. It was noted that sourcing decisions are currently made on the basis of economic viability and not on proximity of suppliers to operations, but policies geared towards near sourcing would be an effective enabler.

Responsible Supplier Procurement Policies

Interviewees noted that multinational organisations have rigorous onboarding processes when considering a new supplier. Although their principal consideration is specification and cost, the perception of interviewees was that because of the changing nature of business today, their organisations would need to consider more ethical decision-making processes including policies such as responsible supplier procurement.

The research findings suggest that organisations are aware of their duty regarding the societal impacts of their operations. This is particularly the case where they have operations in low-income countries. Apart from the moral imperative, evidence of unethical practices or other issues which harm the lives of people would have equally adverse public relations and commercial consequences for the organisation involved. Issues like child labour, prisoner labour and modern slavery need to be taken very seriously by multinational organisations. Most of these matters are bundled together with environmental issues under the area of environmental, social, and governance (ESG).

Sustainable Transport Strategies

Proactive organisations are tackling Scope 3 emissions by liaising with the suppliers in their value chain who belong to industries that account for a high share of global emissions. Both upstream and downstream transportation activities have been identified as key sources of Scope 3 emissions by interviewees. The greening of transportation along with value chain will be an essential tool to limiting and reducing Scope 3 emissions. Load efficiency, safety and ergonomics are environmentally friendly and make good business sense for organisations. Many organisations are moving towards digital generation of their shipping documents and have stopped using paper. Smarter logistics management also requires that no vehicle or vessel travels empty on either leg of its journey. Interviewees also identified the need for alternative transport solutions such as electric fleets as key to operating in a sustainable manner. As noted in Finding 3 below organisations will need to grapple with the business case for green transportation.

4.3. FINDING 3 – TACKLING THE COST AND INFRASTRUCTURE CHALLENGES

4.3.1. Overview of Findings

Based on the survey data, the mean percentage score of 65% indicates that on average, individuals perceive the cost of addressing Scope 3 emissions to be a considerable barrier. Regarding the distribution of responses, cost is primarily viewed as a 'moderate barrier' (40%), with a significant number viewing it as a serious barrier (23%). 5% of respondents indicated cost as "not at all" a barrier. Interestingly this category had the highest rating for the 'unsure' responses (26%) within this category (n = 17), indicating this barrier is associated with the highest level of uncertainty.

Interviewees stated that the cost of Scope 3 emissions reduction will be significant and convincing decision makers that this cost is worthwhile, is an uphill battle.

It was also noted by interviewees that the costs will ultimately be borne by the consumer while inadequate infrastructure and lack of policy were also cited in both the focus group and interviews as barriers to decarbonisation.

4.3.2. Key Cost and Infrastructure Barriers

Limited understanding of return on investment

Findings from the interviews suggest that sustainability officers are struggling to communicate in financial terms how businesses will profit from an investment in tackling scope 3 emissions over the long term. Key performance indicators (KPIs) used in large businesses are geared towards sustainable profitability and they sometimes restrict opportunity to communicate how sustainability for the planet is also sustainable for the business.

The changes needed to support Scope 3 emissions reduction have a cost and the return on investment or the internal rate of return can be difficult to sell and get buy-in from senior decision makers



within organisations. There is also a large knowledge gap between the financial decision-makers and the sustainability teams combined with a lack of published examples of decarbonising that makes the case for a return on investment. This is certainly the perception, and interviewees felt that currently there is little evidence to show otherwise. For some sectors, sourcing of very specific and rarified materials may have few alternative suppliers. If due to geopolitical conflict, a source becomes unavailable, getting an alternative supplier and ensuring that the data for Scope 3 emissions are forthcoming will take a considerable time. This additional time also adds extra cost.

Lack of Understanding of True Economic Costs associated with Scope 3 Emissions

Many organisations are struggling to register the accounting costs of Scope 1 and 2 and have yet to get to grips with Scope 3 costs, so an understanding of the true economic costs of decarbonisation are some way off.

True economic costs take into consideration costs that don't necessarily feature in accountancy rules. These include the cost of environmental degradation, negative health and social impacts, violation of people's rights, use of child labour, prisoner labour and corruption.

It emerged in interviews that while many organisations struggle to get to grips with the costs associated with GHG emissions, a select number of large multinational organisations have begun the process of analysing the true economic costs

of Scope 3 emissions. Organisations are motivated to do such analysis if they are consumer-facing firms whose products are sold to the general public. Public opinion and consumer choices, based on ethical considerations are forcing board rooms to take these issues more seriously even if there wasn't a moral imperative to do so.

Double materiality is a key part of the European Sustainability Reporting Standards (ESRS) and it will be mandatory for organisations to report in sustainability reporting. The introduction of double materiality means businesses must now consider two perspectives: what is material to them and what is material to the planet and society.

4.3.3. Key Cost and Infrastructure Enablers

Emerging legislation will strengthen the business imperative for decarbonisation initiatives

In January 2023, the European Union (EU) introduced the Corporate Sustainability Reporting Directive (CSRD) 1. It updates and reinforces the rules concerning the social and environmental information that organisations must report on and what is material to the planet and society. Not only will this legislation enhance the transparency of how businesses are tackling their Scope 3 emissions, but it will also broaden consumer knowledge and create the opportunity for financial investors to assess the sustainable impact of their investment portfolio.

The Corporate Sustainability Due Diligence Directive (CSDDD) was approved by the European Commission in March 2024. It sets obligations for organisations to address actual and potential adverse impacts on human rights and the environment, including those related to their own operations, their subsidiaries, and their suppliers.

Organisations will have to comply with the new rules in a phased approach from 2027. This will drive a better understanding of the skills needed to be deployed for sustainable supply chains and support the inclusion of compliance as a key driver for business case development for future sustainability projects.

Existing Tools can support Business Case Development

Interviewees emphasised the usefulness of applying existing business support toolkits to supporting business case development for sustainable projects including the use of lean and carbon footprinting, double materiality assessments and mapping tools to understand the current state of the emissions and identify improvement opportunities.

¹<https://www.smartfreightcentre.org/en/our-programs/global-logistics-emissions-council>



4.4. FINDING 4 – ROLE OF DATA IN SUPPORTING SCOPE 3 EMISSIONS MANAGEMENT

4.4.1. Overview of Findings

Understanding sources of Scope 3 emissions

Organisations may have a growing awareness of where their Scope 3 emissions are coming from but quantifying, verifying and reporting on the data will be difficult according to interviewees. Interviewees note that most of their Scope 3 emissions come from transportation, raw materials and purchases. Materials and purchases can be dealt with at the site level for multi-site organisations, but transport and logistics may be controlled from a corporate international level while for those engaged in food processing, agriculture accounts for a large amount of the Scope 3 emissions.

Scope 3 Data Collection

A number of interviewees admitted that they did not yet have precise data on Scope 3, particularly those directly concerned with manufacturing, whose main focus would be on Scope 1 and 2. Some organisations are very aware and have good records of many of the fifteen Scope 3 categories. Apart from purchased goods and distribution transport, some are reporting, with good precision, on the purchase of fuel and energy, employee commuting and waste but have greater difficulty calculating the Scope 3 contribution for capital goods, processing of sold goods and end-of-life treatment of sold goods. These last three, are not significant according to interviewees but organisations are struggling to define how they would calculate these figures.

Collecting Scope 3 data for an entire value chain is not easy. Companies need to develop estimates based on information such as weight, quantity and spending for procured materials, as well as emission factor databases based on country averages. There are now many consultancy firms offering to assist organisations in calculating Scope 3 emissions, but current calculation is mostly based on industry averages. Different organisations consider Scope 3 emissions to have different boundaries, i.e., from the beginning of the value chain to 'just after production', to 'point of sale' or right up to the 'end of life' of a product. The ability to track and trace the life of a product can also be sector specific.

Measuring and assessing Scope 3 emissions

Some organisations interviewed are not measuring and assessing Scope 3 emissions data currently. They are aware that regulations are coming and note that they will be compliant when they need to be. Others suggest that they are actively investigating ways that this might be addressed in the future but are still at the 'investigating' stage.

A number of interviewees cited their use of the Global Logistics Emissions Council (GLEC)¹, a methodology to calculate logistics GHG emissions using intensity factors. Some carriers have evolved sophisticated methods of calculating the known emissions caused by shipping products from one location to another. The calculation is the weight of the product times the distance travelled times the emission intensity. Some organisations are moving to calculate their intensity factors which will increase the accuracy of the recorded emissions.

The Carbon Trust and DEFRA (Department of Environment, Food and Rural Affairs), both British Government entities are used by organisations in Ireland that have extensive business interests in the UK: While currently using DEFRA factors, this organisation is examining ways to more precisely measure the embedded emissions in the products it buys and is less generic in its Scope 3 calculations. DEFRA produces a comprehensive set of tables to allow organisations to convert their known inputs into GHG



4.4.2. Key Data Barriers

Traceability of Supply Chains

Fundamental to achieving progress on Scope 3 emissions is knowing the full extent of the organisation's value chain. It may be a simpler matter to know who supplies you directly in a small or medium-sized company, but larger organisations may have thousands of suppliers and those suppliers also have suppliers. Interviewees stated that they could track and trace parts and products throughout the value chain. However, on closer inspection much of the traceability is confined to the direct, or Tier 1 supplier.

For example, some manufacturers bring rare raw materials directly from their origin and use them to make a product that is supplied to the end user. However, many more processes involve a much longer chain and downstream distribution does not always allow organisations to trace exactly where the product ends up. This comes back to the boundary of where an organisation's responsibility begins and ends.

When it comes to upstream suppliers, virtually all respondents claimed to be able to identify their Tier One suppliers. However, identifying the second tier and further along the chain is a work in progress for those who are actively putting strategies in place to deal with the issue. This is driven by current proposals at EU level for CSDDD. The proposal sets out the first EU-wide mandatory system of binding behavioural obligations for organisations in respect of human rights and the environment.

For organisations that source products and materials in Europe or North America, this does not appear to be a problem. Tracking and tracing of products has been done for a variety of reasons for generations. In other parts of the world, the activity gets more difficult. Interviewees state that most suppliers say they are willing to supply data but some do not keep that data themselves. Currently, most respondents say that they can get between 45 and 90% of emission data from suppliers but getting the remainder will be a challenge.

4.4.3. Key Data Enablers

Voluntary and Compliance Reporting prompts better data collection and monitoring

Operators of most Environmental Protection Agency (EPA) licensed activities, including industrial, waste, wastewater and dumping at sea, are required to submit an Annual Environmental Report (AER). This obliges most industrial organisations to monitor and measure the composition of their waste. All contributors were very well aware of this.

Voluntary standards such as the Alliance of Water Stewardship requires organisations to send questionnaires to suppliers who are aware of the importance of supplying this information. The value of voluntary standards was recognised in encouraging organisations to go beyond compliance in identifying and collating additional data throughout the supply chain. Other organisations state that less than half of their suppliers responded to a request for GHG disclosures. As a result, they are committing to the Science Based Targets Initiative (SBTi) to serve as a mechanism for data collection and reporting.

Undertaking Product Lifecycle Assessments to collate data and measure impact

The ability for organisations to analyse the full lifecycle of products is sector specific. A medical device may be delivered from a titanium processing plant to a factory where a prosthesis is manufactured and then is inserted to a known person's body via a hospital surgeon. This is a short chain and can be measured. On the other hand, the ingredients of a pizza may originate from many parts of the world and will be sold from business to business. However, most organisations are striving to evaluate this, but it may never be possible to measure it accurately given the complexities around data collection requirements where a large number of suppliers exist.

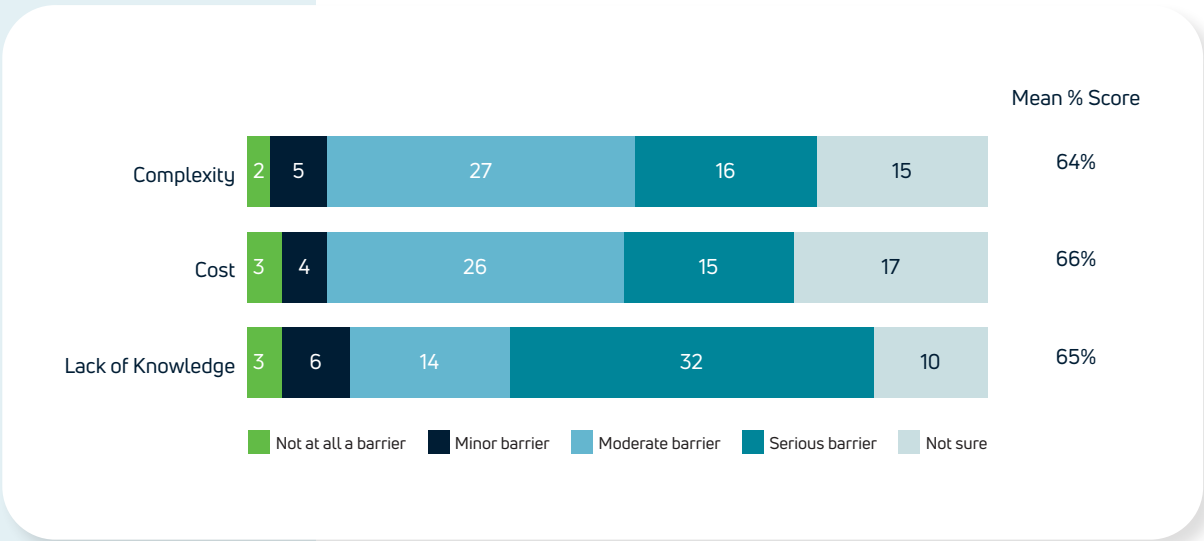
5.0 Summary and Analysis

In this section, the key barriers and enablers to the achievement of decarbonised supply chains and the implementation of solutions to Scope 3 emissions are summarised and analysed.

5.1. SUMMARY OF SCOPE 3 KEY DECARBONISATION BARRIERS

Survey data confirmed the findings from the interviews and focus groups, highlighting lack of knowledge, complexity, and cost as significant barriers in the drive to address Scope 3 emissions. As illustrated in Figure 7, of the three main barriers, a lack of knowledge on Scope 3 emissions is the most serious concern for organisations in meeting their decarbonisation targets, followed by the complexity of the supply chain decarbonisation and cost considerations.

Figure 7: Survey data supports identified barriers to tackling Scope 3 emissions (calculated as number of responses and % mean scores)



Note: Data represents survey responses all participating industries (n = 65)

An additional factor which may be highlighting a lack of knowledge, and influencing the survey results is that approximately one-quarter of the participants indicated that they were 'unsure' about cost and complexity as barriers, which may highlight how a lack of knowledge on Scope 3 emissions is influencing the survey results.

To quantify the perception of barriers with regards to Scope 3 emissions, mean percentage scores were calculated. These scores provide a standardised measure to facilitate comparison of the severity of perceived barriers. A higher mean percentage score indicates a greater barrier, while a lower score indicates a factor is less of a barrier. It was observed that the mean percentage scores for the barriers of cost, complexity, and lack of knowledge are strikingly similar, each within the range of 64% - 66%. This similarity in mean percentages provides important insights into how these barriers are perceived across industries.



Interviewees were consistent on the barriers to decarbonising the supply chain. Alongside knowledge gaps, access to awareness-building programmes which are consistent with the quantitative survey, qualitative interviews also highlight barriers such as the willingness of firms to invest in decarbonisation solutions, the ongoing business need for global effort or mass movement and the sheer complexity of managing global supply chains. Most interviews also touched on the topic of costs as a key barrier.

Political will and the need for global 'buy-in' were also highlighted as barriers from the research findings. Many organisations will not invest in solutions until regulation becomes a business driver. This means that early adopters will scope out the opportunities and pitfalls of new ways of working.

Most decisions, which are not enforced by regulation, will be made based on economics.

Businesses exist to enhance shareholder's wealth. It was noted that Scope 3 initiatives will need a large investment but currently lack a compelling business case.

If adopting environmentally friendly strategies puts a business at a competitive disadvantage, interviewees suggest that their organisation is unlikely to do so. It will adopt those strategies when there is a global movement to do so, encouraged by government regulation. Some interviewees cited the need for everyone to alter their lifestyles and make uncomfortable choices. But media perception and reality are not always aligned. Whilst not necessarily indicative of the entire market, an example from a large food processor that was interviewed was their investment in plant-based food products. Media exposure suggested that there was a big movement in this direction but the resulting sales figures did not fulfil this expectation.

5.2. SUMMARY OF SCOPE 3 KEY DECARBONISATION ENABLERS

Education, supply chain optimisation activities, emerging regulation, government incentives and adherence to voluntary standards as a mechanism for data collection have been identified as amongst the most important enablers of Scope 3 decarbonisation strategies.

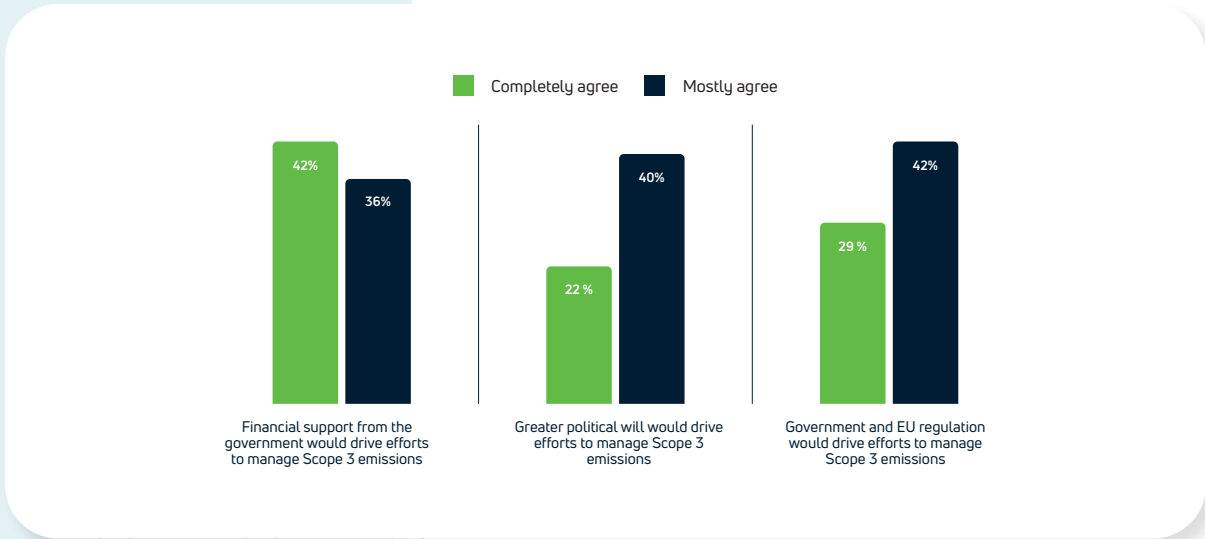
It was noted by interviewees that Ireland does not have enough people trained and skilled in the whole area of ESG. Lack of knowledge is still one of the biggest barriers to decarbonising the supply chain. Sharing of knowledge, from the ground up

may help to sway people in the right direction while government supports to incentivise organisations, both large and small to start the process will be an important enabler.

Some interviewees believe that government and EU regulation is not being pursued with sufficient urgency. Many organisations will do nothing until they are confronted with the economic consequences which will be driven by regulation while others believe the consumers will drive business transformation.

Figure 8: Survey responses indicating required action to support Scope 3 readiness implementation

Findings from interviews and survey data suggest that both financial support and regulatory intervention at the government and EU level along with political will, is required to remove the barriers to decarbonisation and overcome the economic blockage to make it a priority.



(n = 65)

The survey data also indicates that when it comes to greater political will and Government and EU regulation, a higher number of participants ‘mostly’ (26 – 27 participants) rather than ‘completely’ agree (14 – 19 participants) with these types of support. This indicates that industry holds reservations, which have the potential to be insightful to future negotiations of this nature if industry is to be included as a key stakeholder. The Act on Corporate Due Diligence Obligations in Supply Chains in Germany provides one example of how regulatory intervention might proceed in the EU as a whole. The act which came into force at the start of 2023 and requires enterprises that have their principal place of business and administrative headquarters in Germany to carry out due diligence, including the establishment of a risk management system to identify, prevent or minimise the risks of human rights violations and damage to the environment. Initially, the Act would apply to enterprises with over 3,000 employees but gradually will apply to smaller firms.



6.0 Conclusion and recommendations

This section provides a series of recommendations for policymakers and organisations.

6.1. RECOMMENDATIONS FOR POLICYMAKERS AND NATIONAL ENTERPRISE AGENCIES

1. Support competency development initiatives for industry: Skillnet Ireland and the Skillnet Climate Ready Academy have the capability and reach to implement awareness and capacity building campaign and related competency development programmes in Sustainable Supply Chains to inform and educate organisations about Scope 3 emissions management.
2. Encourage the uptake of voluntary sustainability reporting standards for smaller organisations across Ireland through targeted sustainability competency development programmes for SMEs, particularly those who are part of a larger supply chain to enable better monitoring of emissions reporting across a value chain

6.2. RECOMMENDATIONS FOR ORGANISATIONS

1. Effective climate action needs to be driven from the very top and organisations should ensure senior leaders undertake Executive leadership training in climate action and support the upskilling of its key supply chain decision makers in sustainability.
2. To help increase the knowledge and skills of their employees, senior leaders should encourage academic awards with a focus on supply chain sustainability to all involved in supply chains and then foster this initiative throughout the organisation.
3. Establish a dedicated sustainable supply chain team consisting of cross-functional members to bring together the key competencies and skillsets needed to support the development and delivery of transformative supply chain strategies e.g. near sourcing, responsible sourcing, sustainable transport strategies etc.
4. Initiate pilot projects in organisations focused on continuous monitoring, evaluation and improvement of sustainability performance in the supply chain e.g. organisational and / or product lifecycle assessment
5. Work closely with suppliers and customers to promote sustainability and prompt new initiatives throughout the supply chain including the delivery of education.
6. To support stronger cross-departmental responses to enabling sustainable supply chains, encourage key personnel to rotate their roles within related supply chain, procurement and operational areas with a focus on developing a holistic, systematic response to decarbonisation challenges

REFERENCES

ASIF, M. S., LAU, H., NAKANDALA, D., FAN, Y. & HURRIYET, H. 2022. Case study research of green life cycle model for the evaluation and reduction of scope 3 emissions in food supply chains. *Corporate Social Responsibility and Environmental Management*, 29, 1050 - 1066.

BOSTON CONSULTING GROUP 2021. *Net-Zero Challenge: The supply chain opportunity*. Insight Report. Boston: World Economic Forum.

CARBON TRUST. 2024. What are Scope 3 emissions and why do they matter? [Online]. Carbon Trust. Available: <https://www.carbontrust.com/our-work-and-impact/guides-reports-and-tools/what-are-scope-3-emissions-and-why-do-they-matter> [Accessed March 26, 2024].

HANSEN, A. D., KURAMOCHI, T. & WICKE, B. 2022. The status of corporate greenhouse gas emissions reporting in the food sector: An evaluation of food and beverage manufacturers. *Journal of Cleaner Production*, 361.

HOMROY, S. & RAUF, A. 2023. *Climate Policies in Supply Chains*. SSRN eLibrary.

IDE, N. & PUSTEJOVSKY, J. What Does Interoperability Mean, Anyway? Toward an Operational Definition of Interoperability for Language Technology. *The Second International Conference on Global Interoperability for Language Resources*, 2010 Hong Kong, China.

LEHTIMÄKI, H., KARHU, M., KOTILAINEN, J. M., SAIRINEN, R., JOKILAAKSO, A., LASSI, U. & HUTTUNEN-SAARIVIRTA, E. 2024. Sustainability of the use of critical raw materials in electric vehicle batteries: A transdisciplinary review. *Environmental Challenges*, 16.

NEGRI, M., CAGN, E., COLICCHIA, C. & SARKIS, J. 2020. Integrating sustainability and resilience in the supply chain: A systematic literature review and a research agenda. *Business Strategy and the Environment*.

PATCHELL, J., 2018. Can the implications of the GHG Protocol's scope 3 standard be realized? *Journal of Cleaner Production*, Volume 185, 1 June 2018, Pages 941-958

SAJJAD, A., EWEJE, G. & TAPPIN, D. 2015. Sustainable Supply Chain Management: Motivators and Barriers. *Business Strategy and the Environment*, 24, 643 - 655.

SCHMIDT, M., NILL, M. & SCHOLZ, J. 2022. Determining the Scope 3 Emissions of Companies. *Chemical Engineering & Technology*, 45, 1218 - 1230.

SCIENCE BASED TARGETS INITIATIVE. 2023. *CATALYSING VALUE CHAIN DECARBONISATION: CORPORATE SURVEY RESULTS*. Available <https://sciencebasedtargets.org/resources/files/SBTi-The-Scope-3-challenge.pdf> [Accessed March 26, 2024].

STENZEL, A. & WAICHTMAN, I. 2023. Supply-chain data sharing for scope 3 emissions. *npj Climate Action*.

WORLD RESOURCES INSTITUTE 2011. *Corporate Value Chain (Scope 3) Accounting and Reporting Standard*. Supplement to the GHG Protocol Corporate Accounting and Reporting Standard. Washington, USA: World Resources Institute.

WORLD RESOURCES INSTITUTE 2013. *Technical Guidance for Calculating Scope 3 Emissions*. World Resources Institute & World Business Council for Sustainable Development.



Skillnet Climate Ready Academy,
c/o 20FIFTY Partners, Innovation House,
Lonsdale Road, National Technology Park,
Limerick, Ireland, V94 W8K8
T: +353-(0)61-535440
E: climatereadyacademy@20fiftypartners.com
W: www.climatereadyacademy.ie



20FIFTY
PARTNERS

