Scope 3 accounting and corporate sustainability reporting: Change management towards SDG 12

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Abstract

As reaching the Paris Agreement's 1.5°C limit by 2050 draws near, there has been speculation that this target will be missed. Within this, Scope 3 emissions reduction is key, yet complex, and poorly integrated into firms' organizational practices at present. Key barriers include the digitization aspect of the twin digital and sustainable transformations, Scope 3 reporting guidance and resources for firms, and widespread commitment to successful Scope 3 reporting. But what would it take for firms to enact sustainable practices in line with Sustainable Development Goal (SDG) 12 – Responsible Consumption and Production – and specifically target 12.6 – Sustainability reporting practices in companies – which necessarily includes Scope 3 reporting? This thesis unpacks this question for a firm that deals with industrial waste management and complex supply chains. This is a meaningful case study choice as this type of firm would fall under the European Union's Corporate Sustainability Responsibility Directive (CSRD), which requires Scope 3 reporting from 2025 onwards, reporting on the 2024 fiscal year for EU country firms. The case firm, based in a European Economic Area country, will likely have to address Scope 3 reporting mandates in the near future. Within this case, the focus on Scope 3 is approached through a combination of reviewing thematic literature, analyzing pertinent firm operations, and especially information infrastructures related to Scope 3. This study took the form of a semester-long internship within the firm, including everyday observation and expert interviews with three key actors. Combining these empirical and theoretical sources, the analysis offers insights on firm readiness for Scope 3 adoption and the role of mission-oriented innovation ecosystems. In particular, these results reveal the need for countries to fund digitization of Scope 3-relevant processes, for firms to collaborate and cooperate across the value chain and across competing firms, for country- and sector-specific guidance on Scope 3 reporting, for country-specific emission factors, and for firms to proactively take initiative on Scope 3 within their sustainable transformation ecosystem. A thematic analysis of implementing an approach to Scope 3 mapping indicates that firms have adequate time to adopt a Responsible Research and Innovation (RRI) approach to Scope 3 reporting and are likely to benefit from taking a learning approach to RRI. In sum, the thesis highlights the significant challenge of Scope 3 reporting, problematizes the role of specific actors in mobilizing such action, and contributes to understanding how to enact progress on SDG 12 in this challenging and urgent domain.

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This section is addressed specifically to those I want to thank. I am lucky enough to have many people to thank for this thesis.

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List of abbreviations

Titles of places, organizations, and employment positions	
CDP	Carbon Disclosure Project
CEO	Chief Executive Officer
DEFRA	United Kingdom's Department for Environment, Food, and Rural Affairs
EU	European Union
IPCC	Intergovernmental Panel on Climate Change
ISSB	International Sustainability Standards Board
MCE	Ministry of Climate and Environment of Norway
NGO	Non-governmental organization
Sar AS	Sar aksjeselskap
SASB	Sustainability Accounting Standards Board
UK	United Kingdom
UN	United Nations
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

Theoretical and central concepts to this thesis	
CS	Change Steps
EPC	Extended peer communities
MLP	Multi-Level Perspective
PNS	Post-normal science
RRI	Responsible Research and Innovation
R&I	Research and innovation
STM	Sustainability Transformation Model
TS	Transformation Steps

Sustainability Standards and frameworks	
CSRD	Corporate Sustainability Reporting Directive
ESG	Environmental, social, and governance
ESRS	European Sustainability Reporting Standards
GHGP	Greenhouse Gas Protocol
GRI	Global Reporting Initiative
IFRS	International Financial Reporting Standards
IIRF	International Integrated Reporting Framework
SDG	Sustainable Development Goal

Greenhouse gases and units of measurement	
CH4	Methane
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
CO2e/p.km	CO2e per person kilometer
GHG	Greenhouse gas
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons

N20	Nitrous oxide
NF3	Nitrogen trifluoride
PFCs	Perfluorocarbons
SF6	Sulfur hexafluoride

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1. Introduction

1.1 The problem

Background of the problem

Scope 3 emissions account for often over 75% of a firm's greenhouse gas (GHG) emissions (Downie & Stubbs, 2013; Huang, 2009). However, Scope 3 is notoriously neglected in sustainability reporting meaning that our current accounting of global GHG emissions, is likely vastly underestimated. Anthropogenic GHG emissions have accelerated the pace of climate change beyond safe levels for human society, among other flora and fauna, to continue to sustain themselves. To address the Scope 3 problem, GHG emitters are under the societal microscope.

Businesses contribute the most GHG emissions globally, particularly fossil fuel industry firms accounting for 91% of global industrial emissions in 2015 and about 70% of all anthropogenic GHG emissions in 2015 (Griffin, 2017, p.7). The Greenhouse Gas Protocol (GHGP), a GHG emissions reporting standard, encourages entities and businesses to take responsibility of the full breadth of their GHG emissions. The GHGP consists of Scope 1 – direct emissions, Scope 2 – indirect electricity, steam, heating, and cooling emissions which the reporting entity directly purchased and consumed, and Scope 3 – all other indirect and value chain emissions.

Further, the UN Sustainable Development Goals (SDGs) were created to address complex societal issues such as human welfare and climate change. SDG target 12.6, "Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle" (United Nations, 2015, p.22), pushes large entities to take responsibility of their progress in their sustainability transformation. However, SDG target 12.6 does not specifically require the GHGP or any of the GHGP's scopes specifically.

To promote these pushes for sustainable change, landscape regulatory pressure is being applied to the wound, with private entities and businesses facing mandates of sustainability reporting requirements. The European Union (EU) Green Deal has

accepted the CSRD as of late 2022[1] which requires GHGP reporting of all 3 scopes and will enter into the first phase effective 2025 and applies to small to large companies which have 11 or more staff and a turnover or balance sheet total of over 2 million euros[2]. The International Sustainability Standards Board (ISSB) has also mandated the reporting of all 3 scopes of the GHGP as of October 2022[3].

While steps are being taken to promote corporate sustainability transformations, there is a fear that companies are not ready to take on the full GHGP, Scope 3 reporting being the most complex and difficult task to take on (Patchell, 2018, p.944).

Purpose of the study

The purpose of the study that this thesis pursues is to explore the interplay between current regulatory and policy changes, SDG 12.6, and GHGP Scope 3 to further identify weak points and opportunity points for Scope 3 to be able to be successfully adopted into the SDG 12.6 regime.

While imperfect and perhaps incomplete, Scope 3 reporting has grand potential for positive climate change impact as Scope 3 often accounts for the vast majority of a company's GHG emissions and aids in the identification of GHG hotspots and areas of opportunity along a firm's emissions map (Patchell, 2018, p.942). However, SDG 12.6 does not require GHG emissions reporting at all let alone Scope 3 reporting and only focuses on the broad notion of 'sustainability reporting' instead despite business rooted GHG emissions being the primary contributor to the dangerously accelerated pace of climate change. Yet, policy makers and decision makers have recently broken the landscape silence as these makers heard the noise from the Scope 3 reporting niche. The need then arises for the exploration of how the widely accepted SDG 12.6 can symbiotically adopt Scope 3 into its workings. That is, how can 'sustainability reporting' naturally include Scope 3 GHG emission reporting just as naturally as it

[1] https://www.consilium.europa.eu/en/press/press-releases/2022/11/28/council-gives-final-green-light-to-corporate-sustainability-reporting-directive/ (Last accessed on June 11, 2023).
[2] https://single-market-economy.ec.europa.eu/smes/sme-definition_en (Last accessed on June 11, 2023).
[3] https://www.ifrs.org/news-and-events/news/2022/10/issb-unanimously-confirms-scope-3-ghg-emissions-disclosure-requirements-with-strong-application-support-among-key-decisions/ (Last accessed on June 11, 2023).

includes how much a company recycles or invests in greener alternatives? This question is explored employing the Multi-Level Perspective's transformation pathway in Figure 1.1 below.

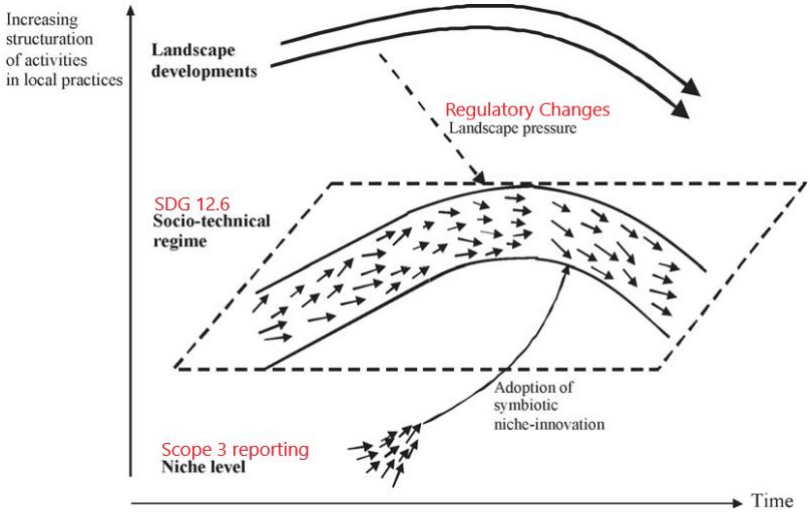

Figure 5.1. *Scope 3 Reporting Transformation pathway. Adapted from (Geels & Schot, 2007, p.407)*

A deeper explanation of what this diagram depicts is detailed in section 3.1 of this thesis. In brief, the Multi-Level Perspective (MLP) is an influential framework in transition studies, that theorizes socio-technical change processes across niche, regime and landscape levels.

Problem statement

The regulatory landscape mandating of Scope 3 has thankfully begun to open a window of opportunity for the Scope 3 niche to jump through in the hopes of merging with the SDG 12.6 regime. However, the problem in this situation and the problem studied is that the Scope 3 niche is underdeveloped as it is currently difficult and complex for entities to undertake the full task which Scope 3 prescribes. However, to endeavour towards a slowing in the pace of climate change, the goal is that the Scope 3 niche is able to be symbiotically adopted into the SDG 12.6 sustainability reporting regime. To achieve this, the following information must be sought: Why and how is Scope 3 difficult for businesses to adopt on an annual basis?

1.2 Research questions

To address the broad question above, the following research questions emerge.

1. How can businesses transition towards the successful adoption of Scope 3 into the SDG 12.6 sustainability reporting regime?
2. How do current business sustainability reporting practices interplay with Scope 3 reporting for businesses keen to embrace it, as shown through a case study?

1.3 Structure of the study

To answer these research questions, the empirical field which must be explored is that of the business perspective.

Chapter 2 discussed the relevant literature and examines the Greenhouse Gas Protocol (GHGP), Scope 3 reporting, Sustainable Development Goals (SDGs), specifically SDG target 12.6 which is business sustainability reporting practices, European Union (EU) mission-oriented policy, and mission-oriented innovation ecosystems.

Chapter 3 details the theoretical frameworks that this thesis employs. The Multi-Level Perspective (MLP) was used to frame and understand the problem and current situation. As the issue of rapid climate change undoubtedly concerns high stakes, high uncertainties, and conflicting ethics thereby rendering so-called 'normal science' insufficient, thus post-normal science (PNS) was used to understand the perspective of relevant stakeholders who are closest to the problem at hand. Lastly, Responsible Research and Innovation (RRI) was utilized to gain deep insight into the current situation at hand as to understand how to ethical and sustainable the current trajectory may be and how to firms may adjust towards a more ethical and sustainable outcome if necessary.

Chapter 4 details the methodology used to conduct the study. Mixed methods were employed to ensure a fuller understanding of the outcomes of the thesis project. This study features a case that allowed for in-depth access to the business perspective. The case studied was that of Sar Aksjeselskap (AS), a mid-cap sized industrial waste chain management company which operates along the Norwegian coast with about 250 employees and a heavy specialization of the oil and

gas industry's waste management. Sar is one such company which falls under the EU's CSRD adoption and will be required to conduct a Scope 3 analysis from the 2024 fiscal year onward. Further details as to why Sar AS was selected feature in section 4.2.

Sar's Scope 3 categories were examined to assess what is required to address the most relevant categories and how well-equipped Sar is at the moment to take on such a task. Not all categories will be examined as thoroughly as the most relevant categories, due to time, space and overall scope constraints of this thesis.

Sar then undertook a self-assessment of the Sustainability Transformation Model (STM), a sustainability change management framework, to assess Sar's progress in their quest for reaching a fully sustainable practice and operation. Further, Sar's progress regarding Scope 3 was also assessed using the same framework to examine the interplay between Sar's sustainability transformation and how this corresponds to their Scope 3 adoption. The STM framework is ideal for this study as it is based off of a previously well-established 10 step change management model with 50 sustainability steps branching off of the broader 10 steps (Sancak, 2023, p.1). There is rigorous published academic research related to each of the 50 sustainability change steps (Sancak, 2023).

Chapter 5 then details the results and empirical analyses, followed by an enriching discussion framed by the theoretical frameworks of this thesis in Chapter 6, to end with the final conclusion in Chapter 7.

2. Literature Review

The literature review embarks on the journey of understanding what Scope 3 reporting is, the importance of Scope 3 reporting, and the situation it currently is in. To discuss Scope 3, the GHGP must first be discussed as the home and creator of Scope 3 reporting. Scope 3 was then able to be discussed more fully. The situation of Scope 3 reporting currently was examined next discussing how the SDGs, and more specifically the SDG 12.6 regime, are in play and how they are presently interacting with Scope 3 reporting. The regulatory landscape was then explored where mission-oriented policy and mission-oriented innovation ecosystems are considered.

2.1 The Greenhouse Protocol

Anthropogenic GHG emissions are the direct cause of rapid climate change with firms contributing to these GHG emissions at the highest level compared to other entities (Griffin, 2017, p.7) There was a need for tools for firms to take action and responsibility for these GHG emissions while still operating at a sustainable financial point. In response, the Greenhouse Gas Protocol (GHGP) was established so companies were able to report their emissions with an internationally recognized GHG accounting and reporting standard. GHG accounting, also called carbon accounting and climate accounting, is a method of measuring how much GHG an organization emits.

The GHGP "establishes comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains and mitigation actions" (World Resources Institute [WRI] & World Business Council for Sustainable Development [WBCSD], n.d.). Essentially, the GHGP is for corporations to employ as a standard and guidance for assessing and analyzing their GHG emissions. It covers the accounting and reporting of the seven major GHGs of the Kyoto Protocol: carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF6), and nitrogen trifluoride (NF3). The primary purpose of the GHGP is to give entities a standardized method of GHG accounting and reporting, to reduce the costs of, to supply an effective strategy of, to provide information about, and to increase consistency and transparency of GHG accounting and reporting (WBCSD & WRI, 2004, p.3). The GHGP's provides a standard for internal management processes and external reporting purposes with a principle-oriented platform (Kasperzak et al., 2023, p.3). Through these calculations, a company can concretely assess its impact and critical opportunity points.

The GHGP consists of three different scopes which are all related to the lifecycle of a product. An example is depicted in Figure 6, Figure 1.2 of the GHGP's Corporate Value Chain (Scope 3) Accounting and Reporting Standard (WBCSD & WRI, 2011, p.8):

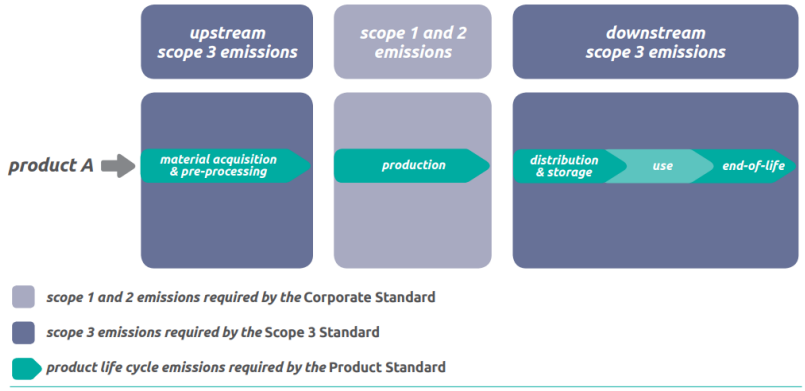

***Figure 6.1**. Relationship between a Scope 3 GHG inventory and a product GHG inventory. Source: (WBCSD & WRI., 2011, p.8)*

The three scopes are briefly defined as follows:

Scope 1: Direct emissions from owned or controlled sources (WBCSD & WRI, 2011, p.5)

Scope 2: Indirect emissions from the generation of purchased energy consumed by the reporting company (WBCSD & WRI, 2011, p.5)

Scope 3: Indirect emissions that occur in the reporting company's value chain that are not included in Scope 1 or 2 (WBCSD & WRI, 2011, p.5)

Scope 1 of the GHGP consists of the direct GHG emissions which occur from sources that are owned or controlled by the company. This may include emissions from combustion in owned or controlled boilers, furnaces, or vehicles for example (World Business Council for Sustainable Development [WBCSD] & World Resources Institute [WRI], 2004, p.25). All seven major Kyoto Protocol gases are to be included in Scope 1, however not all GHGs are included in Scope 1 such as chlorofluorocarbons and nitrogen oxides (WBCSD & WRI, 2004, p.25).

Scope 2 of the GHGP consists of the indirect GHG emissions that stem specifically from the generation of purchased electricity which was consumed by the reporting company directly. This infers that Scope 2 emissions are physically emitted where the electricity is generated, not necessarily at the reporting company's facility (WBCSD & WRI, 2004, p.25). Purchased electricity is one of the largest indirect sources of GHG emissions for many companies hence the individual scope distinction as opposed to grouping all indirect emissions into Scope 3.

According to the Corporate Standard, accounting for Scope 2 allows effective risk management relating to evolving electricity and emissions costs and energy efficiency and conservation (WBCSD & WRI, 2004, p.27).

Scope 3 reporting is discussed in thorough detail in section 2.2.

2.1.1 History: The tools for climate action

GHG accounting and reporting became apparently necessary as a prominent tool for action to the World Resources Institute (WRI) and World Business Council for Sustainable Development (WBCSD) in the late 1990s. In 1997, WRI senior managers together with WBCSD officials agreed to launch a non-governmental organization business partnership to address the necessity for a standardized measurement method of GHG emissions to successfully address climate change. To develop the first edition of the Corporate Standard, the WRI and WBCSD convened a core steering group from environmental groups (such as WWF, Pew Center on Global Climate Change, The Energy Research Institute) and industry (such as Norsk Hydro, Tokyo Electric, Shell) to guide the multi-stakeholder standard development process. In 2001, the first edition of the Corporate Standard was published and has since been updated. Guidance in the Corporate Standard clarifies how companies can measure emissions from electricity and other energy purchases, and account for emissions from throughout their value chains[4].

Later, several more standards have been published including the Corporate Value Chain (Scope 3) Accounting and Reporting Standard, the Product Life Cycle Standard, the Policy and Action Standard, the Global Protocol for Community-Scale Greenhouse Gas Inventories, the GHG Protocol for Project Accounting, and the Mitigation Goal Standard.

The GHGP has since been accepted as the largest and most dominant practice and standard for GHG accounting and reporting (Franchetti & Apul, 2013, p.47). Further, the GHGP has declared itself as the world's most widely used GHG accounting standards for companies, citing the Carbon Disclosure Project (CDP) survey in which >92% of Fortune 500 companies responded stating that they used GHGP directly or indirectly in 2016[5].

[4] https://ghgprotocol.org/about-us (Last accessed on June 11, 2023).
[5] https://ghgprotocol.org/companies-and-organizations (Last accessed on June 11, 2023).

This success is reflected in the GHGP's collaboration with businesses, governments, and environmental groups globally to develop credible and effective programs for addressing climate change. Four key countries currently have national programs utilizing the GHGP including the Brazil GHG Program, the India GHG Program, the Mexico GHG Program, and the Philippine GHG Program[6]. Further, the United States of America (US) government body, the Environmental Protection Agency (EPA), highly encourages corporate leadership to employ the GHGP standard for their respective own GHG inventory accounting[7].

Success may also be attributed to the certain level of flexibility that the GHGP affords to accountants and reporters with a variety of approaches to accounting to fit more scenarios in which certain data may not be available and other data may simply be more readily available. These approaches are the equity share, the operational control, and the financial control approach (Kasperzak et al., 2023, p.1).

The WRI and WBCSD were likely able to make the GHGP become so successful due to their ability to "meet a demand for three benefits to potential users of the standard: reduced transaction costs, first-mover advantage, and an opportunity to burnish their reputation as environmental leaders" (Green, 2010, Abstract).

2.1.2 The five core principles

There are five core principles which are meant to guide the accountant particularly during times of uncertainty in how to proceed with certain calculations "to ensure the reported inventory represents a faithful, true, and fair account of a company's GHG emissions" (WBCSD & WRI, 2011, pp.23-24). The primary objective of instilling these principles are to ensure that the inventory is able to be utilized by internal and external decision-makers and to serve as a method of navigation when balancing tradeoffs dependent on a company's individual business goals (WBCSD & WRI, 2011, p.24). The five core principles are: (1) Relevance, (2) Completeness, (3) Consistency, (4) Transparency, and (5) Accuracy.

[6] https://ghgprotocol.org/country-programs (Last accessed on June 11, 2023).
[7] https://www.epa.gov/climateleadership/ghg-inventory-development-process-and-guidance (Last accessed on June 11, 2023).

Relevance pertains to the concept that the GHG inventory should contain relevant information in regards to determining which activities to include in the inventory boundary. Relevance is meant to serve "as a guide when selecting data sources" which "[depend] on a company's individual business goals" (WBCSD & WRI, 2011, p.24).

Completeness pertains to situations when a company is unable to estimate emissions for a lack of data or otherwise. While companies should attempt to include all categories, in the case that any exclusions should occur, the exclusions must be disclosed, thoroughly documented, and defended so that assurance providers may be able to determine impact and relevance of said exclusion (WBCSD & WRI, 2011, p.24).

Consistency pertains to remaining as consistent as possible in regard to application of accounting approaches, inventory boundary, and calculation methodologies to be able to reliably compare reporting data within an entity and between entities over time (WBCSD & WRI, 2011, p.24). Any changes to the approaches, boundaries, methodologies, or any other factors which could impact the emission estimates, must be disclosed, thoroughly documented, and defended. Changes may necessitate recalculation of base year emissions (WBCSD & WRI, 2011, p.24).

Transparency pertains to the disclosed factors of the GHG inventory and its accounting so that internal and external actors may be able replicate the report if they had access to identical data and to be able to attest to its credibility. These factors may consist of processes, procedures, assumptions and limitations and the communication method of disclosure should be "clear, factual, neutral, and understandable" (WBCSD & WRI, 2011, p.24). Exclusions, assumptions, appropriate references, and data sources must be disclosed, thoroughly documented, and defended with a clear and coherent audit trail (WBCSD & WRI, 2011, p.25).

Accuracy pertains to the quantification of GHG emissions is neither more than or less than the actual GHG emissions and to the reduction of uncertainties as far as practicable (WBCSD & WRI, 2011, p.25). Accuracy is inherently crucial to the GHG accounting and reporting process so that credibility and transparency are enhanced and so that decision-makers may make decisions with reasonable confidence as to the integrity of the report (WBCSD & WRI 2011, p.23, 25).

2.1.3 Approach & boundary

As GHG accounting is highly resource consumptive, it is often impractical for all conceivable emission sources to be accounted for thereby necessitating boundaries to be set (Williams et al.,2012, p.59). Determining the approach and boundary are one of the beginning steps to GHG accounting and is complex itself.

There are at least three types of relevant boundaries to set, all of which are key to determining the necessary data for the inventory and should match the individual company's business goals (Franchetti & Apul, 2013, p.57). The three boundary types are temporal, operational, and organizational, detailed in Figure 2.2 (Franchetti & Apul, 2013, p.57). However, it has been argued for the alternative boundaries of temporal, system, and geographical (Williams et al., 2012, p.59) System boundaries are similar to organizational boundaries as they regard the extent that the population, system, or activity which is under consideration whereas geographical boundaries are the geographic extent that emissions are considered such as a school or a municipality (Williams et al., 2012, p.59). The temporal boundary consists of setting a base year and how the company intends to track emissions over time (Franchetti & Apul, 2013, p.57; Williams et al., 2012, p.59). Firms may elect to select less than one year for intra-annual variability analysis or event-based boundaries may be suitable for other scenarios such as conferences (Williams et al., 2012, p.60). The operational boundary pertains to which scope will be accounted for and reported. The organizational boundary pertains to which type of consolidation approach to use.

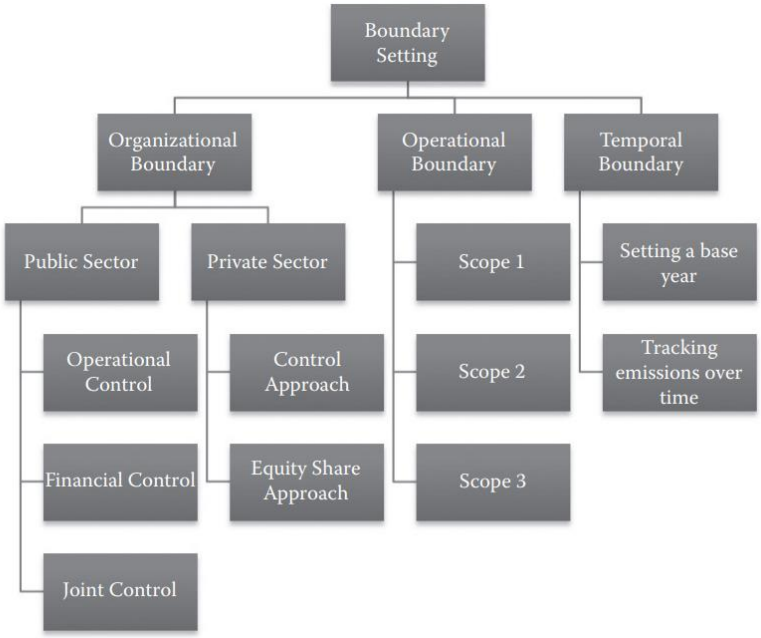

Figure 2.2. Decision levels for boundary setting. Source: (Franchetti & Apul, 2013, p.57).

Setting the consolidation approach and boundaries are of the crucial beginning steps before GHG accounting may take place. The organizational boundary refers to which operations are included in the accounting while the consolidation approach is how each of those operations are consolidated. Companies must use consistent consolidation approaches for Scope 1, 2, and 3 inventories (WBCSD & WRI, 2011, p.28). There are three options for boundary definition, as shown in Table 2.1 which describes each of the three boundaries. As firms have access to different information, have diverse financial situations, and varying ethical stances, firms may prefer one over the other approaches.

Table 2.1.
Consolidation appraoches. Source: (WBCSD & WRI, 2011, p.29)

Consolidation approach	*Description*
Equity share	Under the equity share approach, a company accounts for GHG emissions from operations according to its share of equity in the operation. The equity share reflects economic interest, which is the extent of rights a company has to the risks and rewards flowing from an operation.
Financial control	Under the financial control approach, a company accounts for 100 percent of the GHG emissions over which it has financial control. It does not account for GHG emissions from operations in which it owns an interest but does not have financial control.
Operational control	Under the operational control approach, a company accounts for 100 percent of the GHG emissions over which it has operational control. It does not account for GHG emissions from operations in which it owns an interest but does not have operational control.

As different consolidation approaches exclude different activities, Scope 3 may become relevant when seeking to account for these excluded activities (WBCSD & WRI, 2011, pp.28-29). One example demonstrated in the Scope 3 Accounting and Reporting Standard is if a company selects the operational control approach, emissions from assets that the company wholly or partially own yet do not control (e.g. investments) are excluded from Scope 1 and 2 and therefore should be ensured to be included in Scope 3 (WBCSD & WRI, 2011, p.29).

While having various approaches available affords companies flexibility in their reporting thus making it feasible for companies to conduct a GHG emissions report whereas it wouldn't have been possible otherwise, this also means a decrease in comparability across entities who choose different approaches (Williams et al., 2012, p.60; Kasperzak et al., 2023, p.2). This is largely due to the fact that "the equity share approach links the GHG emissions to be reported to the amount of the participation rights, while the control approach is primarily based on the influence that the reporting firm can exert on the investee" (Kasperzak et al., 2023, p.2).

The equity share approach allocates responsibility of emissions to a company based on that company's share of equity in the investee where the emissions occur regardless of that company's influence over the investee (Kasperzak et al., 2023, p.4). This approach holds firms responsible for their investments whereas the control approach does not. That is, the control approach entails the neglection of taking responsibility of irresponsible investments from a

climate viewpoint. This demonstrates that selecting boundaries based on low resource consumption may result in underestimating emissions (Williams et al., 2012, p.60). The equity share approach will yield the highest reported emissions when a firm has many associated firms, non-controlled joint ventures, or many 100% subsidiaries (Kasperzak et al., 2023, p.5). The equity share approach will yield the lowest emissions when a firm has many subsidiaries with a low share and few associated firms or joint ventures (Kasperzak et al., 2023, p.5).

The control approach will yield the highest reported emissions only when the firm is a part of an unincorporated joint venture (Kasperzak et al., 2023, p.5). This approach will yield the lowest reported emissions given that there is a joint venture and no partner has control (Kasperzak et al., 2023, p.4). The Corporate Accounting and Reporting Standard states that operations controlled by a firm most often does not depend on whether financial control or operation control criterion is used except with the outstanding exception of the oil and gas industry which often has complex ownership and operatorship structures (WBCSD & WRI, 2004, p.17).

According to Kasperzak et al.'s 2023 study of 16,604 firm-year observations from 3830 firms located in 67 different countries from 2009 to 2019, the operational control approach was used at a much greater extent than the financial control approach and the equity share approach was hardly employed at all (Kasperzak et al., 2023, p.9). It was found that 45% of firms changed their approach at least once during the 10 year study period and 11% changed at least twice (Kasperzak et al., 2023, p.9). It was noted that access to which consolidation approach was employed for company reports was very limited (Kasperzak et al., 2023, p.13). However, Scope 3 was omitted from this study as so few firms report Scope 3 emissions (Kasperzak et al., 2023, p.8).

Firms may strategically choose which approach to employ based on the expected level of emissions (Williams et al., 2012, p.59). Some firms may choose the highest expected emission level approach in order to improve credibility and to access as accurate of true GHG emission levels as possible to plan for the future as well as possible. However, if the approach selected is too high in resource consumption despite high accuracy, it may lead to inconsistent or infrequent reports (Williams et al., 2012, p.60). Some firms may choose the lowest expected emission level approach in order to indirectly influence said firm's environmental, social, and governance (ESG) rating in the hopes of improving their score (Kasperzak et al., 2023, p.11).

It was found that no consolidation approach, and thus current GHG reporting practice, is consistent with political and societal goals (Kasperzak et al., 2023, p.12). This is due to none of the approaches allowing for "holistic assessment of a firm's full contribution or harm to environmental sustainability" (Kasperzak et al., 2023, p.12). The question posed is whether GHG accounting and reporting should have the same or similar approaches as financial reporting as the GHGP reporting is modeled after financial reporting methods (Kasperzak et al., 2023, p.14).

2.2 Scope 3

This section first describes what Scope 3 is, the current situation in regards to climate change and GHG emissions, how Scope 3 reporting may aid in addressing rapid climate change, what the limits to actionable Scope 3 reporting are, some possible ways forward in addressing those limits, and where additional support is needed.

Scope 3 of the GHGP is defined as all "indirect emissions that occur in the reporting company's value chain that are not included in Scope 1 or 2" (WBCSD & WRI, 2011, p.5). A value chain is every stage of operations in which a firm adds value to their products from processing to marketing. Scope 3 consists of a total of 15 categories, 8 of which are upstream activities, and 7 of which are downstream activities. The complete list is referenced in Table 2.2 below (WBCSD & WRI, 2011, p.32).

Table 2.2

List of Scope 3 categories. Source: (WBCSD & WRI, 2011, p.32)

Upstream or downstream	*Scope 3 category*
Upstream scope 3 emissions	**1.** Purchased goods and services **2.** Capital goods **3.** Fuel- and energy-related activities (not included in scope 1 or scope 2) **4.** Upstream transportation and distribution **5.** Waste generated in operations **6.** Business travel **7.** Employee commuting **8.** Upstream leased assets
Downstream scope 3 emissions	**9.** Downstream transportation and distribution **10.** Processing of sold products **11.** Use of sold products **12.** End-of-life treatment of sold products **13.** Downstream leased assets **14.** Franchises **15.** Investments

The term '*indirect emissions'* refers to emissions that the reporting company does not emit themselves but are nonetheless responsible for as the emissions occurred as a result of the reporting company's operations. For example, category 7, employee commuting, is likely to play a large role, possibly accounting for 7% to 30% of Scope 3 emissions for a service industry company (Huang et al., 2009, p.8509). Employee commuting, such as when employees might drive their personal vehicles to and from work, may cause GHG emissions from the vehicle operating, however, emissions from employees' personal vehicles are not emissions that a company directly emits.

'Upstream emissions' refers to emissions which occurred before the product and/or service that the reporting company offers was manufactured or performed. '*Downstream emissions'* refers to emissions which occurred as the result of the product and/or service that the reporting company offers being manufactured or performed. For example, company A sells cardboard boxes. Company A's upstream emissions might occur as a result of felling trees. Direct emissions might occur as a result of manufacturing the carboard and assembling the carboard boxes. The downstream emissions might occur from the transportation of the carboard boxes to retail outlet stores where the boxes will be sold to consumers.

Scope 3 may often account for the majority of a company's emissions, on average over 75% (Downie & Stubbs, 2013; Huang, 2009). As such, it is usually the largest and most complex scope as is illustrated in Figure 2.3, Figure 5.2 of the Corporate Value Chain (Scope 3) Accounting and Reporting Standard on page 31.

Yet, Scope 3 is currently optional (WBCSD & WRI, 2004, p.25). However, indirect emissions are substantial and growing (Herwich & Wood, 2018, p.8).

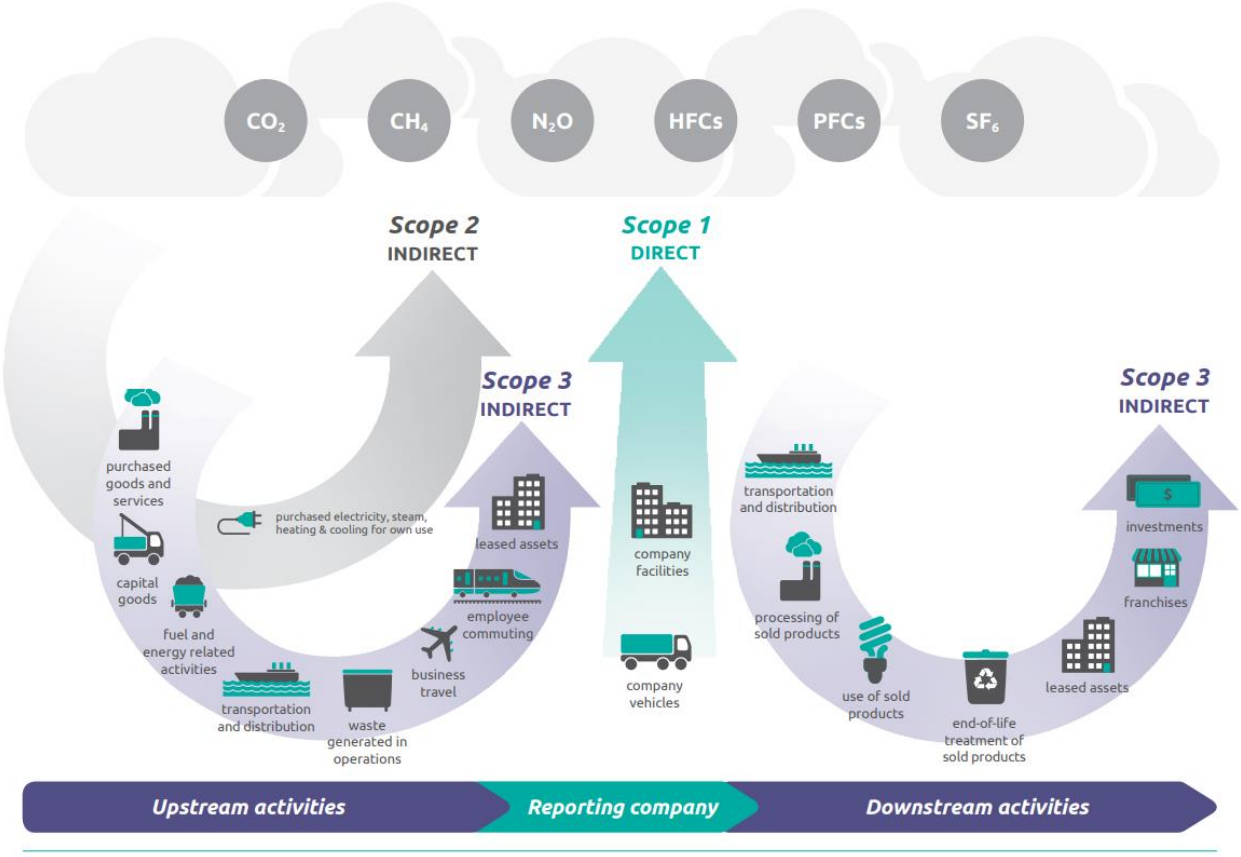

Figure 2.3. Overview of GHGP scope and emissions across the value chain. Source: (WBCSD & WRI, 2011, p.31)

2.2.1 A niche call to action

Scope 3 is a primary call for action towards addressing rapid climate change, however Scope 3 reporting is still in a niche stage of development as it is new and not broadly conducted despite its broad acceptance. With anthropogenic emissions at the root of rapid climate change, it is

apparent that global GHG emissions must be mitigated. Accounting for where and when these GHGs are emitted is an obvious first step towards combating rapid climate change.

Scope 3 accounting and reporting is key for transitions risk management of climate change in a society with an evolving market and a tightening regulations landscape. This is further corroborated by the CDP discussion paper on climate transition plans which identifies Scope 1, 2, and 3 accounting with verification as a key element in constituting a credible climate transition plan[8]. Companies which allow Scope 3 emissions to go unmeasured and ignored are put at a greater risk for major setbacks from imposed regulations or are simply unprepared to rise to new regulations as they come into force.

The measurement of Scope 3 allows for the identification of emission hotspots throughout the value chain and within an organization's own boundary (Huang et al., 2009b, p.8510). Identifying these hotspots highlights what points in the value chain are at a higher resource risk such as with rising prices, carbon taxes, and strengthening efficiency standards. That is, the location of these hotpots determines which third party partners are leading and trailing behind in their sustainability operations. With the ability to identify these emissions hotspots, comes the ability to improve the sustainability rating and standard of products and services overall.

A comprehensive sound understanding of Scope 3 emissions is required to achieve maximum efficient emissions reductions, process and supply improvement strategies, and carbon management strategies (Huang et al., 2009a, p.220; Downie & Stubbs, 2012, p.413). This understanding can also inform efforts in accuracy of purchasing, investing, claiming carbon credits, and policy-making (Huang et al., 2009a, p.217). Further, it can be difficult to discern and pursue the most cost-effective mitigation strategies without this comprehensive understanding of a full footprint analysis (Matthews et al., 2008, p.5839).

These outstanding benefits reveal the criticality of tackling the complex challenges that Scope 3 reporting presents especially regarding SDGs and the waste management sustainability transition.

[8] https://www.cdp.net/en/articles/climate/new-cdp-data-shows-companies-are-recognizing-the-need-for-climate-transition-plans-but-are-not-moving-fast-enough-amidst-incoming-mandatory-disclosure (Please see page 4, Last accessed June 13, 2023).

2.2.2 Limits to action

Despite the catalysis of Scope 3 reporting, there are several limits to the action of addressing rapid climate change via Scope 3 reporting thereby keeping Scope 3 reporting at a smaller niche level. Looking towards Scope 3 carbon accounting and reporting as a solution to this great uncertainty of indirect emissions, tangent challenges come with calculating Scope 3 emissions. Based on the literature, the six main themes of (1) Complexity, (2) Data Accuracy, (3) Methodology, (4) Lack of Participation , (5) Literature Gap, and (6) Insufficiency were discerned as barriers of Scope 3 accounting and reporting.

First, is 'Complexity' as Scope 3 emissions are often excluded from emissions reporting as they are significantly more complex and arduous to calculate than Scope 1 or Scope 2. The reasons for this are several. A primary reason for lack of participation, another major barrier of Scope 3 accounting and reporting, is due to the complexity and thus lack of comprehension of Scope 3 complexities (Huang et al., 2009b, p.8509). Further, Scope 3 emissions accounting stipulates personnel, resources, expertise, and data management and quality processes; aligning all of these can be an ambitious task for organizations, demanding good management and leadership support.

Despite an official general guide and an official calculations guide, the complexity of the Scope 3 requirements is unprecedented and sustainable supply chain management literature does not support the evidence of the extensive coordination required (Patchell, 2018, p.953). How to collect data, calculate the data, and report the data of GHG emissions along the value chain may vary between sectors, industries, geographical locations, organization size, and service vs. product industries. Such complexity further sees other barriers such as "lack of transparency or knowledge of the supply chain, lack of direct connections with the next tier of suppliers, [and] reduced leverage to influence action"[9]. Business Social Responsibility has published a three step approach in confronting such barriers for a holistic value chain decarbonization (in reference to the footnote of the previous sentence).

1. Take a 'reverse sourcing' approach. That is a goal-oriented approach beginning with the areas in the supply chain estimated to have the highest Scope 3 emissions and working all the way down to the areas with the lowest.

[9] https://www.bsr.org/en/reports/scope-3-emissions-science-based-targets-climate-action-value-chain (Please see page 20; Last accessed on June 11, 2023).

2. Pilot projects to ensure the selected method is effective.
3. Scale up and widen collaboration as pilot projects prove successful.

Second is the prevailing challenge of 'Data Accuracy'. Scope 3 emissions data is by nature third party and must be obtained from external sources. Many of these third parties neglect their own carbon accounting. In such a case, the first party must collect relevant information from the third party to perform the carbon accounting itself. However, the information acquired may be incorrect for various reasons. Further, if the third party does its own carbon accounting, they may not be entirely transparent as to how these emissions were calculated thus threatening the accuracy of the Scope 3 calculations of the first party.

Complete accuracy is rarely possible in practice, as the data and information required may be inaccessible or simply unavailable. In these cases, the Scope 3 standard requires that industry average data be used to estimate emissions (WBCSD & WRI, 2013, p.20).

In a study of Australian organizations and their respective assessments of their Scope 3 emissions and their use of emission factors, it was concluded that the use of varying conversion value sources produced wide discrepancies in the reported emissions despite the similarity in activities reported on (Downie & Stubbs, 2012, p.412). As a result, such discrepancies render he reports incomparable across organizations, let alone sectors (Downie & Stubbs, 2012, p.412). This is alarming as it is a challenge for organizations to gain access to Scope 3 relevant data (Downie & Stubbs, 2012, p.413).The Scope 3 standard itself states that "higher uncertainty for Scope 3 calculations is acceptable as long as the data quality of the Inventory is sufficient to support the company's goals and ensures that the Scope 3 inventory is relevant" (WBCSD & WRI, 2011, p.75). However, due to the wide discrepancies found in the assessments and in the third party audited reports as well, the study found that the assessments studies did not adhere to the accuracy principle of the GHGP (Downie & Stubbs, 2012, p.420).

Third is 'Methodology' as methodology is an additional prevalent challenge as there is no standardized methodology for Scope 3 assessment and calculations (Hertwich & Wood, 2018, pp.1-2). With no standardized methodology, companies are left to fend for themselves to produce their own uniquely optimal method. This may yield essentially incomparable results across companies and across sectors as their approaches may be too contrasting. Such was seen in the

Downie & Stubbs (2012) study mentioned in the previous paragraph. Further it leaves a hollow space of time and resources that companies must invest in to assess what method optimally suits them, each of the 15 categories requiring its own unique method. Moreover, with no standardized method, Scope 3 is the only scope in which double emissions counting may occur; the GHG Protocol the Corporate Value Chain (Scope 3) Accounting and Reporting Standard advises for staff to "balance tradeoffs between principles depending on their individual business goals." (WBSCD & WRI, 2011, p.25). Lastly, as many companies begin to embark on this journey for the first time, mistakes are bound to be made and inefficient processes implemented, thus leaving an ocean of opportunity for data inaccuracy as the learning curve and knowledge spillovers extrapolate.

Fourth is the 'Lack of Participation' in Scope 3 emissions evaluations and reporting. As Scope 3 reporting is optional, most organizations which comply with the GHGP do not disclose Scope 3 (Downie & Stubbs, 2012, 414).

The CDP and Business Social Responsibility launched a survey nearly 8000 suppliers of 75 large firms and organizations that are the CDP's closest collaborators in 2016[10]. The goal was to assess the firms and organizations' environmental engagement and programs with their suppliers, yet the results were unfortunate. Only roughly half of the suppliers responded to the survey at all, only 25 – 63% were engaging in emissions management, and only about 33% were actually reducing their emissions (Patchell, 2018, p.943).

Another deterrent of participation is fear (Patchell, 2018, p.954). While certain disruptions of relationships along the value chain are inevitable and necessary to greatly reduce GHG emissions, the method and institutionalization of emissions reporting should not disrupt these relationships beyond the bare minimum (Patchell, 2018, p.954). Fears of permanently damaging relationships, struggles for power, liability shifts, and the varying relationship costs of publishing Scope 3 emissions is not recognized nor addressed by the Scope 3 standard (Patchell, 2018, p.954). Further, there is the fear of once an organization has begun to report their Scope 3

[10] https://www.cdp.net/en/research/global-reports/global-supply-chain-report-2016 (Last accessed on June 11, 2023).

emissions, they cannot stop and they must meet and beat new targets beyond their means (Patchell, 2018, p.954).

The CDP report "Stepping up: Strengthening Europe's corporate climate transition" (CDP, 2023b, p.11) found that only 30-45% of companies surveyed are developing Scopes 1-3 with plans that are below 2°C and only about 5% of companies are developing Scopes 1-3 with plans that are at 1.5°C temperature rating. It was also found that Nordic companies are twice as likely to be transitioning on a 1.5°C pathway (CDP, 2023b, p.12). As indicated in Figure 2 of this report, Norway specifically falls behind Sweden, Finland, and Denmark despite performing above the average geographical trend (CDP, 2023b, p.12).

The same report also found that about 70% of companies had gaps related to disclosure of key Scope 3 emissions categories (CDP, 2023b, p.37). Meanwhile, the CDP Climate transition report stated "of the 4,101 organizations who reported to have developed a climate transition plan, less than half (approximately 43%) of them had a credible and third party verified emissions inventory, which accompanied their plan" (CDP, 2023a, p.19). Further, a detailed bar chart depicts just how dramatically few organizations report on Scope 3 and receive third party verification despite these being key elements in constituting a credible climate transition plan (CDP, 2023a, p.19).

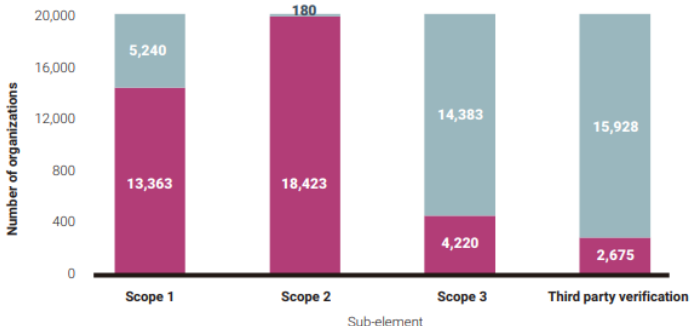

Figure 2.4. Scope 1, 2, and 3 accounting with verification. Source: (CDP, 2023a, p.19)

Fifth is the large 'Literature Gap'. In the pursuit of searching for literature regarding Scope 3 of the GHGP specifically, few articles were found to be relevant.

Regarding the resulting low accuracy of emission factors for Scope 3 in the Downie & Stubbs (2012) study, neither scientific nor the practitioner-oriented literature contains a consistent set of indicators to relate organization's carbon use to their business activities (Hoffmann & Busch,

2008, p.506). “Scholarly literature provides little insight into the accuracy or validity of specific Scope 3 [emission factors]” (Downie & Stubbs, 2012, p.415).

Sixth is ‘Insufficiency’ as the Scope 3 standard may be insufficient as is alone. Patchell goes so far as to argue that organizations cannot conduct a complete Scope 3 report and to attempt to do so would be wasteful (Patchell, 2018, p.954). This is a bold critique, but not one without explanation. The sustainable supply chain management literature nor any empirical research found does not support what the Scope 3 standard expects of participating organizations (Patchell, 2018, p.955). The literature reflects that dependence, interdependence, and independence all widely vary throughout the value chain yet the Scope 3 standard does not reflect this in its construction (Patchell, 2018, p.955).

The CDP Global Supply Chain Report 2016 indicates significant obstacles in achieving the GHGP Scope 3 ambitions of using large intranational organizations to catalyze the value chain towards accelerating emissions reduction and abatement (Patchell, 2018, p.944).

Despite the Scope 3 standard being meant to encourage firms to participate by lowering subsequent transaction costs by having a set standard and guide, the Scope 3 requirements “seem oblivious to the cascading incurrence of transaction costs and their varieties and the heterogeneity according to the type of interfirm relations” (Patchell, 2018, p.953). Further, the sustainability supply chain management literature specifies that a reduction in transaction costs is a significant competitive advantage which is required for firms to select the Scope 3 accounting and reporting pathway (Patchell, 2018, p.954).

With the six thematic barriers emergent from the literature of (1) Complexity, (2) Data Accuracy, (3) Methodology, (4) Lack of Participation, (5) Literature Gap, and (6) Insufficiency, Scope 3 reporting as is alone has presented itself has . These barriers keep Scope 3 reporting at the niche level and are keeping the window of opportunity to join the well-established SDG 12.6 regime narrow. The niche, regime, and window of opportunity are discussed in greater detail in section 3.1.

Yet, one of the many solutions to this dynamic problem particularly revealed itself in the literature: the digital transformation. With focused and purposeful digitization, the six thematic barriers described above may lessen or perhaps disappear altogether if applied appropriately.

2.2.3 The digital transformation solution

Despite the limits to action, a few ways forward have been discerned by scholars, the most prominent being that of the necessity of digital transformation. While this is certainly not the only solution as such a dynamic problem requires many angles of attack, the digital transformation clearly presented itself has possible the solution able to most accelerate Scope 3 reporting adoption.

"Efficient emission reductions and process and supply improvement strategies require an accurate understanding of Scope 3 emissions" (Downie & Stubbs, 2012, p.413). Accurate Scope 3 data has major strategic implications such as the misallocation of resources between different branches or tiers of the supply chain, in external relationship development, inappropriate carbon management, and focusing on inefficient products towards improvement (Downie & Stubbs, 2012, p.420). However, as previously discussed, accuracy is one of the major barriers of Scope 3 accounting.

The difficulty of addressing Scope 3 as a business has been established in section 2.2.2. To offer a comprehensive inventory of Scope 3, organizational needs require trained personnel, expertise, resources, quality processes, and effective data management. Currently, there is a major lack of formal education surrounding the GHGP let alone Scope 3 itself which entails that expertise and trained personnel will largely have to come from self-taught and self-motivated staff. In the CDP's official comment on the European Sustainability Reporting Standards (ESRS) E1, the CDP recommends digitization to ease the rigorous demands of mapping the various categories of Scope 3[11].

The data for value chain accounting is vast and complex. By today's standards, it is highly unreasonable for a company to hire multiple people to calculate Scope 3 by hand. An effective

[11] https://cdn.cdp.net/cdp-production/comfy/cms/files/files/000/006/299/original/CDP's_comment_on_the_European_Sustainability_Reporting_Standards.pdf (Please see page 10; Last accessed on June 11, 2023).

data management system is an absolute requirement. There are several kinds of database management systems, relational-databases being the most commonly used today as they operate based on how data points relate to each other.

There are several cloud services today which store data in a cloud server. A system such as a public cloud server is more practical today than a physical computer which would require a larger physical footprint along with specialty technicians. Further a non-physical cloud type server would make third-party verification easier. However, the GHGP may not be suitable for public cloud environments (Mytton, 2020, p.1).

Blockchain technology has been championed by the United Nations Development Programme with five major benefits of utilizing blockchain to accelerate improvement towards the SDGs further detailed in the section 2.3.3 of this thesis (Wigley & Carey, 2017, p.6).

Blockchain technology differs from cloud technology as blockchain stores data in individual blocks which are encrypted whereas cloud users can easily access data online. Blockchain comes with higher security and less loss and risk than cloud (Memom, 2020, p.574).

The digital transformation solution is but one of several possible solutions, however it was certainly the most prominent throughout the background literature research. Further, there are major limitations and barriers to this solution which are discussed in section 5.1.3.

2.3 UN Sustainable Development Goals regime

2.3.1 Window of opportunity

The window of opportunity is wide open for the Scope 3 reporting niche to jump through and take advantage of, despite the limitations for businesses to take action in reporting their Scope 3 emissions.

In regard to the relationship between the GHGP and the United Nations' (UN) SDGs, none of the SDGs specifically cite greenhouse gas emissions or emissions reporting. However, climate change mitigation, air quality, and sustainability reporting are referenced at least once in seven individual targets. These seven targets are depicted in Table 2.3 with key words in bold.

Table 2.3
SDG targets related with the GHGP. Source: (United Nations, 2015, pp.19-23)

Target	Description
8.4	Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to **decouple economic growth from environmental degradation**, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead
9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with **increased resource-use efficiency** and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
11.6	By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to **air quality** and municipal and other waste management
11.b	By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, **mitigation and adaptation to climate change**, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels
12.6	**Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle**
13.2	Integrate **climate change measures** into national policies, strategies and planning
13.3	Improve education, awareness-raising and human and **institutional capacity on climate change mitigation**, adaptation, impact reduction and early warning

The Scope 3 parameter is reflected in how the reduction of GHG emissions is vital for SDG target 13.2 ‘Integrate climate change measures into national policies, strategies, and planning’ (Elsheekh et. al, 2021, p.11).

The SDG Guidance on core indicators for entity reporting on contribution towards implementation of the SDGs notes the GHGP specifically and states that Scope 1 and 2 are aligned with the indicator 9.4.1 which is defined as ‘CO2 emission per unit of value added’ (United Nations, 2019, p.37-38). However, there is no mention of Scope 3 if the SDG guidance on core indicators (United Nations, 2019).

Despite the 9.4.1 indicator measurement method, target 12.6 is perhaps the most relevant to the GHGP as it cites company sustainability reporting directly: “Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle” (United Nations, 2015, p.22). This is the only target which

specifically monitors private entities. Target 12.6 is measured by the indicator 12.6.1 which is the number of companies which are publishing sustainability reports (United Nations, 2023, p.1)

SDG 12.6 accepts carbon accounting GHG emissions accounting following the Global Reporting Initiative (GRI) as a criteria of sustainability reporting, thus entailing that Scopes 1, 2, and 3 are accepted, however it is not required (United Nations, 2023, p.5). The SDG 12.6 indicator 12.6.1 custodian agencies, the UN Environmental Programme and the UN Conference on Trade and Development, attempted to align the 12.6.1 standards with the following sustainability reporting frameworks: GRI, Sustainability Accounting Standards Board (SASB), and the International Integrated Reporting Framework (IIRF) (United Nations, 2023, p.2)

The GRI specifically cites the GHGP and requires that the reporting company report how it manages its Scope 1, 2, and 3 emissions and provide target setting towards improving their current situation[12].

SASB does not specifically cite the GHGP or require it specifically per the SASB Implementation Supplement: GHG Emissions and SASB Standards[13]. However, on page 3 of this supplement, SASB claims that Scope 1 disclosures are required in 22 of the 77 SASB industry standards, Scope 2 disclosures are required in 35 of the 77 SASB industry standards, and that Scope 3 topics are included "many other industry Standards". This lack of Scope 3 requirements may soon change as the International Financial Reporting Standards foundation (IFRS) organized has now assumed the responsibilities of the SASB. The IFRS has further created the International Sustainability Standards Board (ISSB) which is now mandating Scope 3 reporting. The IFRS' commitment to requiring Scope 3 may hopefully be reflected further in the SASB standards.

The IIRF is an overarching framework to encourage integrated reporting. The IIRF recommends GHG emission reporting for maintaining comparability, presenting business activity outputs, and to identify Key Performance Indicators[14]. However, it does not specifically recommend the

[12] https://www.globalreporting.org/how-to-use-the-gri-standards/gri-standards-english-language/ (Please see pages 134 and 193; Last accessed June 11, 2023).
[13] https://sasb.org/knowledge-hub/sasb-implementation-supplement-greenhouse-gas-emissions-and-sasb-standards/ (Last accessed June 13, 2023).
[14] https://www.integratedreporting.org/resource/international-ir-framework/ (Please see pages 37, 42-43, and 46; Last accessed June 11, 2023).

GHGP, Scope 1, 2, or 3, nor does it recommend any other specific GHG accounting and reporting framework[15].

2.3.2 Limits to action

The SDG 12.6 regime must take action to aid in the successful adoption of Scope 3 reporting. While SDG 12.6 currently accepts GHG emissions reporting as a form of sustainability reporting, it is not required.

The report of the Secretary-General 'Progress towards the Sustainable Development Goals' states that profound transformation of business practices along global value chains is still required (United Nations, 2018, p.13). However, unfortunately, the SDG Report 2022 completely excluded addressing target 12.6 or sustainability reporting at all (United Nations, 2022). The UN practicing such exclusion thereby puts a limitation to Scope 3 adoption action on itself. Further, this effectively by default may indirectly discourage firms from focusing on SDG 12.6. This may be reflected in that as of 2020, the SDG 12 Hub found that Norway had only 49 companies meet the minimum requirement of publishing sustainability reports and only 19 companies went above expectations and met the advanced requirement[16]. The North America and Europe region had the most published sustainability reporting companies in 2020 by far[17].

However, these numbers may be inaccurate. Yet another limitation to Scope 3 adoption action is that there are significant data gaps regarding geographic coverage, timeliness, and level of disaggregation (United Nations, 2022, p.4). This makes it difficult to be able to coherently comprehend global sustainability progress. Available data coverage is referenced in Figure 2.5 below. Without sufficient sustainability progress coverage, it is difficult to ascertain the need for Scope 3 reporting, the UN thereby again limiting itself from Scope 3 reporting adoption action.

[15] https://www.integratedreporting.org/resource/international-ir-framework/ (Please see page 202; Last accessed June 11, 2023).
[16] https://sdg12hub.org/sdg-12-hub/see-progress-on-sdg-12-by-country (Last accessed on June 11, 2023).
[17] https://sdg12hub.org/sdg-12-hub/see-progress-on-sdg-12-by-target/126-sustainability-reporting-businesses (Last accessed on June 11, 2023).

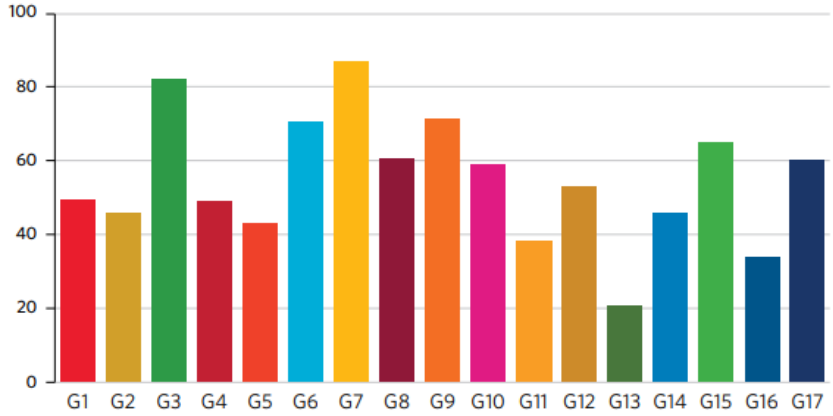

***Figure 2.5**. Proportion of countries or areas with available data since 2015, by Global percentage. Source: (United Nations, 2022, p.4)*

2.3.3 Potential solutions to limits of SDG 12.6 action

Possible solutions to the limits described in section 2.3.2 are dependent upon activation of the threshold between inaction and Scope 3 reporting uptake. Governments across the globe may describe the threshold as 'initiative'. There is currently a great policy push for action underway to enforce entities of a certain size to undertake the responsibility of sustainability reporting including Scope 3 reporting which is discussed in section 2.4. Further, this then encourages other entities to follow suit as they may soon fall under the same requirements as well.

As to the lack of aggregate data on global sustainability progress, technological innovation is one way to address the struggle with access to comprehensive, accurate, and complete data. One such proposed innovation is blockchain technology. Blockchain technology is described in section 2.2.3. According to the UN Development Programme, the five major benefits of blockchain technology to accelerate progress of the SDGs are immutability, security, resilience, transparency, and verifiability (Wigley & Cary, 2017, p.6). These benefits are detailed in Table 2.4 below.

Table 2.4
Blockchain benefits. Source: (Diniz et al., 2021, p.3)

Blockchain benefit	Description
Immutability	It is not possible to change past transactions since multiple copies of a blockchain are kept across a peer-to-peer (P2P) network.
Security	The cryptographed storage guarantees security due to the fact that what is relatively easy for a network of computers to do (e.g, a cryptographic protocol), in practice, is impossible to undo.
Resilience	Not relying in a single point of storage eases recovering and even if many peers are not available, the information remains accessible.
Transparency	All transactions are available to peers, so these agents can assure the origin and destiny, and its encrypted nature assures privacy.
Verifiability	The combination of transparency and immutability allows full public verifiability: anyone not involved in a transaction can check the integrity of the system.

Source: Wigley and Cary (2017).

Yet, neither blockchain technology nor enforced reporting regulation are infallible solutions to this dynamic problem. Blockchain technology is still relatively young and has major innovation leaps to make before it is ready to solve this huge problem.

Simply mandating firms to complete Scope 3 reporting may not be sufficient if they are unable to complete Scope 3 reporting regardless. Further, in this policy pushing, the Scope 3 reporting niche may not be ready to be adopted. Scope 3 still has major improvements that could be made to make it easier for businesses to undertake it.

2.4 The regulatory landscape of emission reporting

Finally, to conclude the literature review, the regulatory landscape was examined. The literature presented the aspect the ‘mission’ toward climate neutrality. With this mission at the forefront, it became apparent that a mission-oriented policy mix has been established to promote mission-oriented innovation ecosystems in society to endeavor to accomplish said mission of climate neutrality. This policy mix includes the policy push toward requiring Scope 3 reporting thereby creating a wide window of opportunity for the Scope 3 reporting niche to jump through to be symbiotically adopted into the SDG 12.6 regime.

The terms ‘mission’ and ‘landscape’ are used frequently utilized with various meanings in academic literature. Missions, for this thesis, will pertain to the EU’s take on missions as ‘missions’ in the context of this thesis pertain primarily to the mission-oriented approach to climate neutrality discussed in the next section below. Landscape will pertain to the MLP and as the highest level, it is the most stable; it is exogenous to the lower regime and niche levels, and is defined by its relationship with the regime (Geels, 2011, p.26)

2.4.1 A mission-based approach to climate neutrality

The most relevant policy area for this thesis, is the European Union, hence the EU and European policy will be the primary focus of this section.

Horizon Europe, the funding program for the research and innovation of the EU missions, will allocate €95.5 billion to the realization of these missions from 2021-2027[18].

EU missions are meant to bring concrete solutions to the EU's greatest challenges and will deliver concrete results by 2030 to these ambitious goals through research and innovation, governance and collaboration, and by engaging citizens. The EU missions inform European Commission priorities such as the European Green Deal and are a coordinated effort by the European Commission to pool necessary resources for program funding, policies, and regulations. They further aim to mobilize and activate public and private actors such as regional and local authorities, research institutes, entrepreneurs, and investors to further uptake new solutions and approaches.

In September 2020, the European Commission set forth five missions towards Europe becoming the first climate-neutral continent. These missions, hosted through the Directorate-General of Research and Innovation, are consistently compared to the American moon landing of 1969 as it required collaborative leadership and efforts to achieve a defined concrete target (European Commission, 2022a, p.6).

The Climate-Neutral and Smart Cities mission is the only mission which primarily aims towards climate neutrality. This mission's strategy is to focus on 100 European cities which have the intent to be climate neutral by 2030.

The primary indicator of success will be each city's Scope 1 and 2 emissions equaling net zero carbon equivalent emissions. Scope 3 is also a proposed indicator but was only mentioned as a 'proposed indicator' and not mentioned again in the proposed mission again (European Commission, 2021, p.23). While the GHGP was not mentioned at all in this document, the definitions of the three scopes and the infographic used to describe the three scopes was pulled directly from the GHGP guide for cities and states (European Commission, 2021, p.23). The

[18] https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe_en (Last accessed on June 11, 2023).

GHGP guide for cities and states repeatedly states that a city's Scope 1-2-3 data can be sourced from business' emissions reporting (WRI, 2021, pp.37, 161). Entity Scope 3 reporting is thus beneficial for the Climate-Neutral and Smart Cities mission which directly informs European policy objectives and priorities.

Each city has its own unique climate and environmental action plan to meet this goal. While the government at the city-level may not require business GHG emission reporting, these missions may have catalyzed the national government level to implement business GHG emission reporting as these missions directly inform European policy priorities.

The Climate-Neutral and Smart Cities mission informs all of the policy objectives detailed in Table 2.4.1.1 below with the most relevant objectives bolded.

Table 2.5
Policy objectives informed by the Climate-Neutral and Smart Cities European mission.
Source: (European Commission, 2021, pp.11,14,20)

Digital policy objectives	Territorial, Regional, and Urban and Policy Objectives	European Green Deal policy objectives
European data strategy	Energy transition, mobility, and housing	Climate action (including Climate Pact and Adaptation)
European industrial strategy	Circular economy	Sustainable industry
Digital transformation of businesses	Jobs and skills in the local economy	Clean energy
Connectivity	Air quality	Sustainable mobility
Digital skills	Sustainable land use	Eliminating pollution
	Climate adaptation and mitigation	New European Bauhaus
	Digital transition	
	Territorial Agenda, Post-2020 Urban Agenda, and Interreg	
	Urban poverty and inclusion of migrants and refugees	

The European Commission has taken a mission-oriented policy approach to addressing major societal challenges and quotes "Mission-oriented policies can be defined as systemic public policies that draw on frontier knowledge to attain specific goals or 'big science deployed to meet big problems'." (Mazzucato, 2018, p.804).

Further, it may be critical for European competitiveness to take a mission-driven approach as Europe has a fragmented and diverse set of innovation systems which can hinder scale growth

and may create a messier environment (European Commission, 2018, p.5). A mission-oriented policy approach may enable European countries to turn these liabilities into assets to create a common market of diverse economies (European Commission, 2018, p.5). Figure 2.6 illustrates how a mission-based policy can address societal challenges (European Commission, 2022a, p.7).

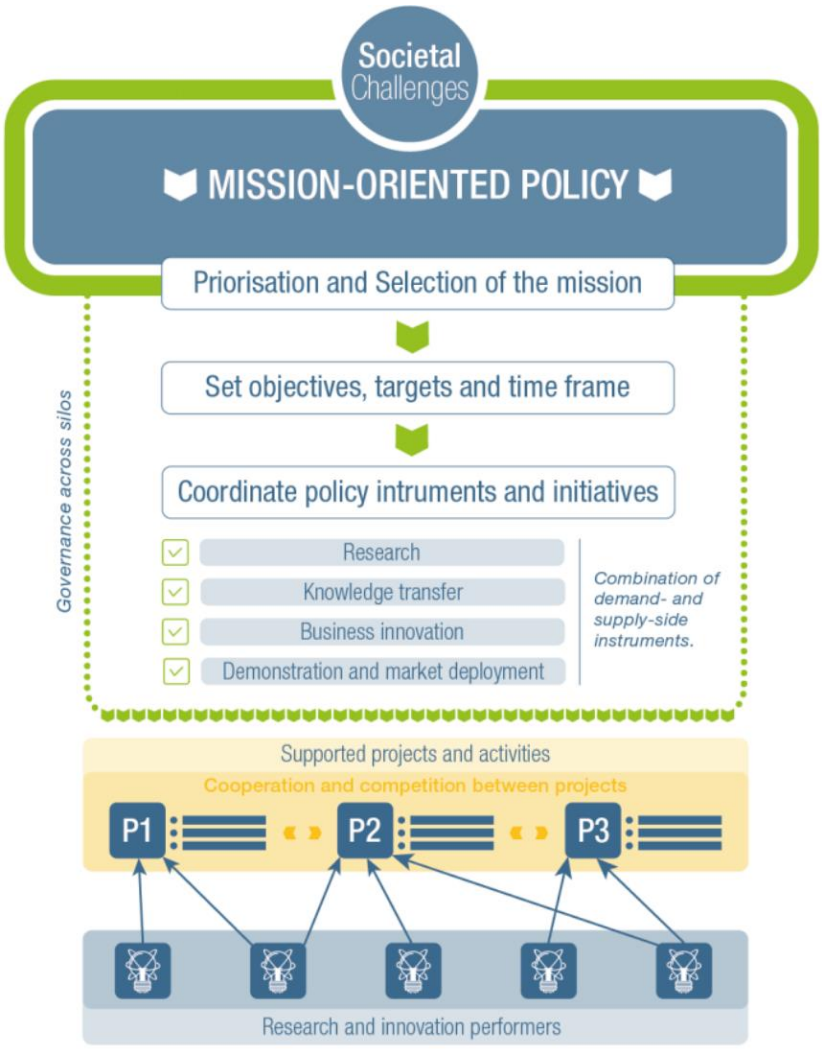

Figure 2.6. How mission-oriented policy addresses societal challenges. Source: (European Commission, 2022a, p.7)

Figure 2.6 further illustrates how the EU missions inform mission-oriented policy which then leads to governments setting policy instruments and initiatives to spur research, knowledge transfer, business innovation, and demonstration and market deployment (European Commission, 2021, p.6).

In the context of this thesis, the Climate-Neutral and Smart Cities mission has set the objective, targets, and time frame of these 100 European cities to be climate-neutral and 'smart' by 2030. Climate-neutrality will be measured by each city's Scope 1, 2, and 3 emissions. To collect the emission information, data can be sourced from business' Scope 1, 2, and 3 data. This then has led to the European Commission implementing policy instruments and initiatives such as the CSRD which requires businesses of a certain size to report on their individual Scope 1, 2, and 3 emissions.

2.4.2 The innovation policy push

People are looking to governments for guidance. The 'federal government' was the most common response when participants were asked who should provide Scope 3 emission factor information (Downie & Stubbs, 2012, p.420). Further it was found that the GHGP substantially depends on overarching policy framework at the intergovernmental level and the business sector needs a palpable regulatory stimulus for corporate action (Hickmann, 2017, p.94).

Further, governments may need to intervene in innovation markets due to market failures such as knowledge spillovers and financial constraints (Van Reenen, 2020, p.9). This is especially the case for challenges such as climate change where decentralized markets are unlikely to provide sufficient technological improvement within the necessary timeline (Van Reenen, 2020, p.16).

A policy push for actionable change of business uptake of Scope 3 reporting is occurring throughout the EU resulting from the mission-based approach of EU policy, particularly regarding the climate-neutrality mission. The CSRD which requires Scope 3 reporting through an auditing or certification type system and will be implemented and obligatory from June 2023 by the EU Green Deal. With such a close relationship with the CSRD, the ESRS will also require Scope 3 emissions[19].

Innovation policy consists of three primary policy instruments: (1) regulatory instruments such as standards and requirements; (2) economic and financial instruments such as taxes and subsidies; and (3) soft instruments such as voluntary non-coercive programs (Borrás & Edquist, 2013, pp.1515-1516). It is recommended that these policy instruments are employed in a policy-

[19] https://www.efrag.org/lab6 (Please see ESRS EI page 11; Last accessed June 11, 2023).

mix, that is, multiple instruments are used to address the same problem, as complementary approaches to the multi-dimensional dynamics of innovation-related problems are crucial to solving said problems (Borrás & Edquist, 2013, p.1519).

The CSRD is a regulatory instrument and is but one of the policy instruments utilized by the EU in a policy-mix to address climate change and aim towards climate-neutrality. Such initiatives are the activation catalyst for action regarding climate-neutrality and Scope 3 reporting.

And the EU is not alone.

Indeed, policy has now taken a mission-based approach towards addressing Scope 3 reporting on a global scale causing the regulations landscape to push down and propel the sustainability transition on a subnational and local scale. Large Scope 1 emitters has been the focus of climate change policy in Europe, Australia, and North America (Downie & Stubbs, 2012, p.413). However, multiple regulations are soon mandating Scope 3 emission reporting to some extent. Most notably is the International Sustainability Standards Board (ISSB) which officially voted to mandate Scope 3 reporting (Kasperzak et al., 2023, p.1).

Other international organizations are beginning to include Scope 3 emissions in their studies, analyses, and reports. For example, the Intergovernmental Panel on Climate Change (IPCC) took Scope 3 emissions into account for the first time in their fifth assessment report of the Working Group III on climate change mitigation albeit Scope 3 was addressed sporadically (Hertwich & Wood, 2018, p.2).

On an even wider global scale, the Securities and Exchange Commission in the United States of America will be requiring Scope 3 reporting 2023 fiscal year emissions from as soon as 2024 if "material or if the registrant has set a GHG emissions target or goal that includes Scope 3 emissions"[20]. Other countries are now strongly encouraging Scope 3 reporting such as the United Kingdom (UK) which subsumes Scope 3 as predominately voluntary, however large companies and limited liability partnerships are required to disclose Scope 3 categories of energy use and business travel and employee commuting[21].

[20] https://www.sec.gov/news/press-release/2022-46 (Last accessed on June 11, 2023).
[21] https://www.gov.uk/government/publications/environmental-reporting-guidelines-including-mandatory-greenhouse-gas-emissions-reporting-guidance (Please refer to p.50 of the environmental reporting guidelines; Last accessed on June 11, 2023).

Norway's Climate Change Act has set targets of a reduction of GHG emissions by a minimum of 50% to 55% by 2030 and by 90% - 95% by 2050 with 1990 as the reference year[22]. Norway has three participating cities in the 100 Climate-Neutral and Smart Cities mission: Oslo, Stavanger, and Trondheim (European Commission, 2022b, p.3). While Norway itself will not be requiring Scope 3 reporting, it is highly encouraged in the Norwegian Climate Action Plan (Ministry of Climate and Environment of Norway [MCE], 2021, p.198). Further, many companies which have operations in Norway are anchored in the EU territory which will then be obligated to report their Scope 3 emissions. PricewaterhouseCoopers produced a climate index of the largest 100 companies in Norway and as of 2019, almost all employed the GHGP and 44 included Scope 3 emissions in their GHG inventories (MCE, 2021, p.198).

According to Figure 2.6 of the pathway of mission-oriented policy, this great policy push will catalyze and activate research, knowledge transfer, business innovation, and demonstration and market deployment. Catalyzed through this policy push, how will these research and innovation ecosystems optimize Scope 3 reporting deployment?

2.4.3 Mission-oriented innovation ecosystem activation threshold: Sustainable transformation ecosystem

If mission-oriented innovation policy instruments are action catalysts for Scope 3 reporting towards climate-neutrality, then mission-oriented innovation ecosystems are the collective who guide the Scope 3 reporting niche into the SDG 12.6 regime. The aim of mission-oriented policy is to create mission-oriented innovation ecosystems which can be described in the context of this thesis as the activation threshold for action regarding Scope 3 reporting. What a mission-oriented innovation ecosystem precisely is, is described below.

The primary purpose of the Climate-Neutral and Smart cities EU mission is to create city-scale innovation hubs (European Commission, 2021, p.5). These hubs are meant to serve as protected spaces for successful innovation. As innovation policy mixes may spur knowledge transfer and business innovation as per Figure 2.6, the CSRD's emphasis of Scope 3 reporting combined with other related policy instruments may also assist in the development of these innovation hubs

[22] https://lovdata.no/dokument/NLE/lov/2017-06-16-60 (Last accessed on June 11, 2023).

evolving further into innovation ecosystems with actors creating joint value through coopetition and co-evolution.

To understand what an innovation ecosystem is, ‘innovation’ and ‘ecosystem’ must be separately defined.

Compiling 60 different cross-disciplinary definitions, Baregheh et al. (2009) define ‘innovation’ as “the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace.” (Baregheh et al., 2009, p.1334). This definition is illustrated in Figure 2.7 below further drawing the divisions of the multiple stages, social groups, means, natures, types, and aims that the innovation process may have (Baregheh et al., 2009, p.1333).

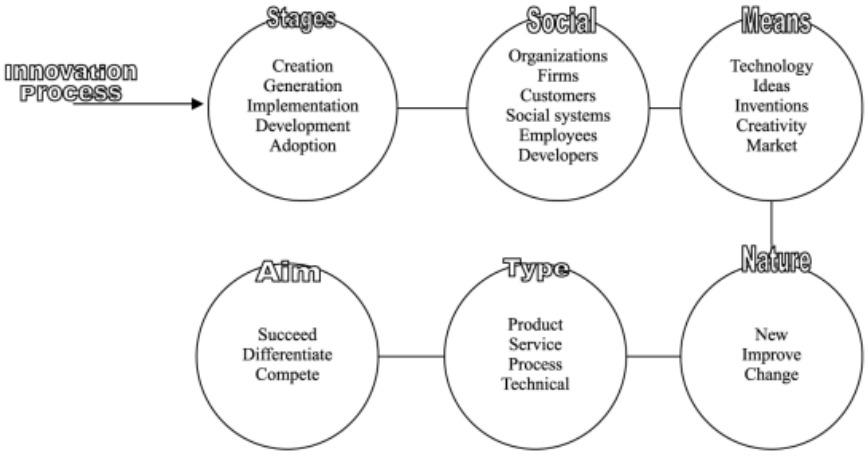

Figure 2.7. Illustration of definition of innovation. Source: (Baregheh et al., 2009, p.1333)

The ecosystem concept incorporates co-evolution and interdependency among different actors, interdependent components such as actors, organizations, or entities which are yet independent of other systems in which both space and time play a role (Ritala and Almpanopoulou 2017, p. 39).

However, there is no widely agreed upon definition of ‘innovation ecosystem’ (Klimas & Czakon, 2022, p.254). Nor are the scope, boundaries, or theoretical roots agreed upon either (Ritala and Almpanopoulou 2017, p. 39). The field of innovation ecosystem studies is too recent to carry out an extensive literature review, however, relevant articles from 10 separate literature reviews were able to be aggregated (Klimas & Czakon, 2022, pp.264-265). After careful analysis of these articles, Klimas & Czakon (2022, p.254) arrived at the definition of “a cooperation

environment surrounding the innovation activities of its co-evolving actors, organized across co-innovation processes, and resulting in co-creation of new value delivered through innovation".

Song (2016, p.27) claims that innovation ecosystems enhance cooperative innovation performance. More specifically, when members exit an innovation ecosystem, the cooperative innovation performance decreases especially if the exited member is an upstream partner due to the direct negative impact this will have on final product delivery capability downstream farther down the value chain (Song, 2016, p.27). Further, a well-defined and implemented innovation ecosystem strategy can form new business opportunities for the different types of innovations and can help companies grow new markets (Pellikka & Ali-Vehmas, 2016, p.17).

Additionally, Bouncken et al. (2018, p.45) note that coopetition was positively correlated with incremental innovation and with radical innovation in the post-product-launch phase likely due to near proximity to end markets prompts clarity, reduced uncertainty, and lowers tensions thus enabling radical innovation.

The state plays an increasingly vital role for system-level transformation realization in which civil society involvement and research entities' adaptation to new state requirements are equally vital (Jütting, 2020, p.1). The partner and hopeful result of mission-oriented innovation policy is the development of mission-oriented innovation ecosystems. Figure 2.8 below illustrated a conceptualization of a mission-oriented innovation ecosystem (Jütting, 2020, p.11).

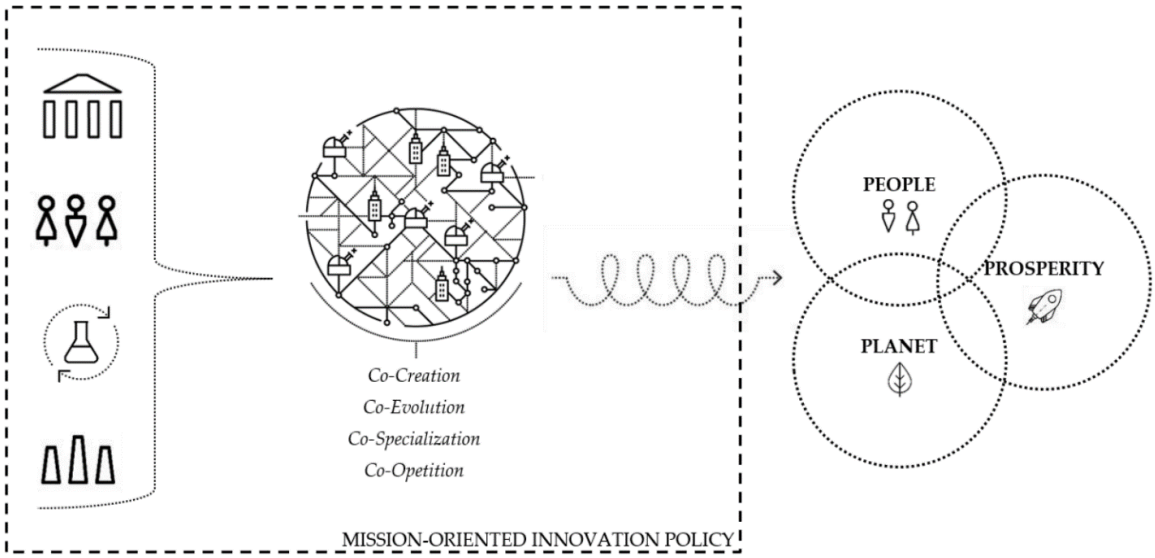

Figure 2.8. Illustration of a Mission-Oriented Innovation Ecosystem. Source: (Jütting, 2020, p.11)

A mission-oriented innovation ecosystem is namely depicted by its focused aim, particularly of innovation towards sustainability challenges such as the UN SDGs and combat of the grand challenges by bringing relevant cross-sectoral actors from politics, science, industry, and civil society for joint value creation (Jütting, 2020, p.11). Further, key characteristics of mission-oriented innovation ecosystems are directionality, value co-creation, co-evolution, and co-specialization (Jütting, 2020, p.11).

Out of the eight mission-oriented innovation ecosystem types, the most relevant for the Scope 3 problem was the fourth type, the 'sustainable transformation ecosystem' which takes a holistic perspective on sustainability and integrates the dimensions of people, planet, and prosperity (Jütting, 2020, p.14). A primary example of the sustainable transformation ecosystem is smart city projects which integrate the well-being of its citizens (i.e., people), the reduction of CO2 footprints (i.e., planet), and increasing the competitiveness of the city in the region through smart innovation (i.e., prosperity) (Jütting, 2020, p.14). This mirrors the EU's mission of Climate-Neutral and Smart Cities.

With this in mind, specifically the sustainable transformation ecosystem emerges from the literature as the activation threshold of Scope 3 reporting action.

3. Theoretical Frameworks

The theoretical frameworks chapter includes the three frameworks of the Multi-Level Perspective (MLP), Post-normal science (PNS), and Responsible Research and Innovation (RRI). These theories situate the case study analysis in sustainability and societal transitions broader literature by providing a frame for the Scope 3 reporting problem at the niche, regime, and landscape levels, allowing for the relevant stakeholders closest to the problem to offer deep insight, and by providing a presentation of how Scope 3 reporting innovation may produce an ethical and sustainable outcome thereby showcasing the analyses' significance beyond the Sar AS case.

3.1 Multi-Level Perspective

With the myriad challenges the globe currently faces, a great transformation at the societal level must arise to address the grand challenges which the SDGs aim to solve along with the grand challenge of rapid climate change itself. These big grand challenge transformations then catalyze smaller transformations such as the digital transformation and business practices such as sustainability reporting which incites GHG accounting. This then begets the need for technology which aids and accelerates the ensuing transformation. A few of the many names of how technological artifacts or systems change and are disseminated or embraced by society are 'diffusion', 'technological transition', 'social acceptance' or 'sustainable innovation' (Sovacool & Hess, 2017, p.707).

Transitions may be defined as co-evolution process that require multiple changes in sociotechnical systems or configurations (Grin et al., 2010, p.11). Transitions are macroscopic and thus require cross-sector, cross-discipline, and multi-actor collaboration such as firms, policy makers, special interest groups, social movements, and scientists cooperating (Grin et al., 2010, pp.11-12). Such transitions may take 40-50 years, innovation journeys through which new sociotechnical systems emerge may take 20-30 years, while breakthroughs may take 10 years (Grin et al., 2010, p.11).

Markard et al. (2012, p.954) note the four primary theoretical approaches to sustainability transitions: (1) Transition management, (2) Strategic niche management, (3) MLP, and (4) Technological innovation systems. The MLP was utilized for this thesis as it offers a singular approach so as to have a clear intention and definition of terms such as 'landscape' and 'socio-technical transition' and the MLP offers a more rounded and holistic approach for understanding socio-technical transitions processes, drivers, and actors (Osazuwa-Peters et al., 2021, p.2). Further, the MLP is one of "the founding theoretical frameworks in the field of sustainability transition studies" according to the Sustainability Transitions Research Network which had over 1750 members as of March 2019 (Köhler et al., 2019, p.4; Geels, 2020, p.1).

The MLP suits the study of a sustainability transition as it goes beyond the study of single technologies and encompasses many, if not, all of the related technologies in a socio-technical regime; it looks at transition patterns with a technology-push substitution pathway and other patterns in which regime destabilization precedes technical substitution (Geels, 2011, p.25).

Further, it does not employ a single cause and effect framework for transitions; it identifies the many drivers of the many causes and effects to build a holistic framework of a transition. Further, the MLP focuses on learning and coevolution with the coalescence of many aspects and levels thus challenging linear justifications of transformation (Sovacool & Hess, 2017, p.711).

The MLP is a middle-range framework for analyzing sociotechnical transitions to sustainability and works to identify trajectories, path dependence, science and technologies studies, and innovation as a social process shaped by broader societal contexts, and rules and institutions as 'deep structures' on which knowledgeable actors draw in their actions (Geels, 2011, pp.24,26). The MLP incorporates aspects of a variety of disciplines such as evolutionary economics, Social Construction of Technology theory, Neo-institutional theory, history, science and technology studies (Geels, 2020; Sovacool & Hess, 02017, p.709).

The MLP takes a holistic approach at understanding sustainability transitions and understands them as non-linear processes of interactions and relationships at three levels: niche, regime, and landscape.

The niche is "the locus for radical innovations" (Geels, 2011, p.26) and refers to said innovations' emergence, diffusion, or adoption prior to full market acceptance (Grin et al., 210, p.11). Once a niche has gained full market acceptability and diffusion, it gains regime status as a deep structure and may push incumbent regimes aside or cause them to alter. Geels & Schot define 6 indicators as to what the development stage and readiness of a niche may be:

> *a) learning processes have stabilised in a dominant design, (b) powerful actors have joined the support network, (c) price/performance improvements have improved and there are strong expectations of further improvement (e.g. learning curves) and (d) the innovation is used in market niches, which cumulatively amount to more than 5% market share* (Geels & Schot, 2007, p.405).

Albeit niche readiness may be in the eye of the beholder and vary based on regime or niche actors' perceptions (Geels & Schot, 2007, p.405). In the case of this thesis, a first look suggests that Scope 3 accounting, private firm sustainability reporting, and the specific SDG target of 12.6 are all at the niche level as all three are relatively rare and uncommon despite the great need for these niches to break into the regime level.

The regime is “the locus of established practices and associated rules that stabilize existing systems” (Geels, 2011, p.26) and refers to the incumbent sociotechnical system (Grin et al., 2010, p.11). Regimes are a deep structures consisting of a semi-coherent set of three types of rules which are linked together in which if one rule is modified, the other rules must also be altered (Geels, 2004, p.904). The core of the regime is the imposition of logic and direction for incremental socio-technical change along established pathways of development (Markard et al., 2012, p.957). The first rule type is regulative which refers to “explicit, formal rules, which constrain behaviour and regulate interactions” (Geels, 2004, p.904) including government regulations or police enforcement for example. The second type of rule is cognitive which refers to the “nature of reality and the frames through which meaning or sense is made” (Geels, 2004, p.904) including symbols such as myths, signs, and gestures which shape the meanings assigned to objects and activities for example (Geels, 2004, p.904). The third type of rule is normative which refers to the conferring of values, norms, role expectations, duties, rights, and responsibilities which have been argued to be internalized through socialization processes (Geels, 2004, p.904). The interlinkage and alignment of all three rule types within a deep structure grants a regime stability and strength (Geels, 2004, p.904). At first glance, the emergent regimes related to this thesis are the GHGP and the waste management sector sustainability transition.

The landscape is exogenous and may consist of grand developments or shocks such as climate change, economic crises, or war (Sovacool & Hess, 2017, p.709). Landscape pressures may persuade regimes towards evolution in turn opening windows of opportunity for radical niche innovations to disseminate (Sovacool & Hess, 2017, p.709). However, many niches fail in the long run and are unable to replace or merge with a regime causing sociotechnical systems to dominate and suppress niche innovations which threaten to replace them (Sovacool & Hess, 2017, p.710).

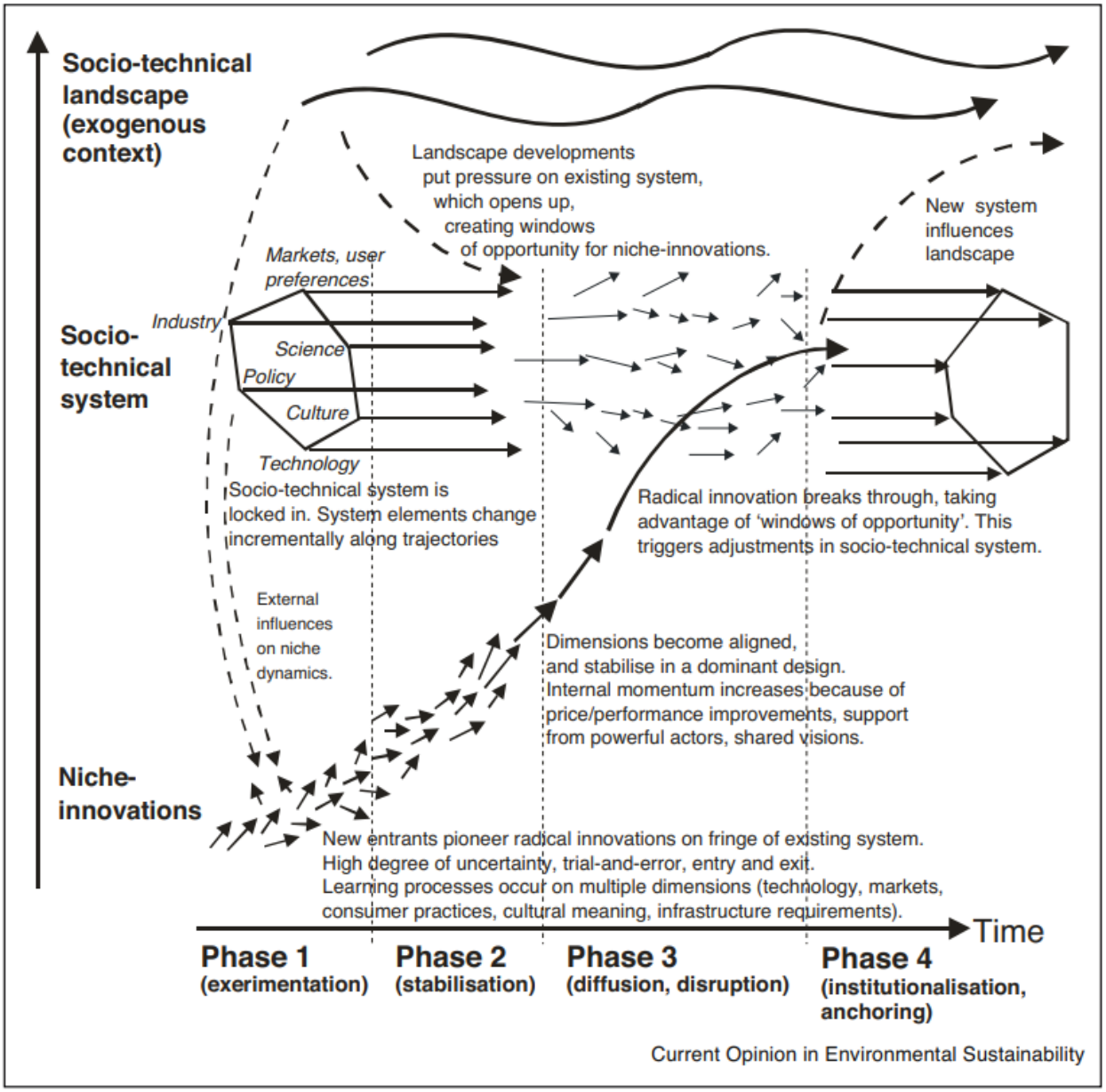

Figure 3.1. *The Multi-Level Perspective. Source: (Geels et al., 2019, p.191)*

Table 3.1
The Multi-Level Perspective of the Scope 3 situation. Source: (Author's contribution).

Landscape level	Climate change
	Global sustainability transition
	UN Sustainable Development Goals
	EU Green Deal
Regime level	Greenhouse Gas Protocol
	Waste management sector sustainability transition
Niche level	Private firm sustainability reporting
	SDG Target 12.6
	Scope 3 accounting and reporting

3.1.1 Transition pathways

The narrative of exponential niche innovation momentum bombarding weakening incumbent regime systems due to significant exogenous landscape pressure does not always hold fast and true. Geels & Schot (2007) discern 4 distinct transition pathway types. Since this landmark paper, published articles on transition pathways increased with many authors distinguishing their own unique or adapted versions of the 4 transition pathway types (Osazuwa-Peters et al., 2021, p.7). Further, later studies have nuanced this primarily bottom-up perspective by exploring how niches grow, stabilize, and decline in relation to prevailing regime dynamics (Markard et al., 2012, p.957).

The timing and nature of the relationship and alignments between levels affect which pathway type a transition may be on. Timing entails when pressure is applied, especially in the case of landscape pressure pushing and opening new windows for change; dependent on the timing, a niche innovation may or may not be developed enough to take advantage of the open window (Geels & Schot, 2007, p.405). The nature of the relationship refers to whether niche innovations and landscape developments have reinforcing or disruptive relationships and whether niche innovations have a competitive or symbiotic relationship with the incumbent regime (Geels & Schot, 2007, p.406). With the criteria of timing and nature of relationships, the 4 pathways are (1) transformation, (2) reconfiguration, (3) technological substitution, and (4) dealignment and

realignment (Geels & Schot, 2007, p.406).

The baseline pathway is the reproduction process in which no landscape pressure exists therefore entailing that niche innovations will not be able to break through. Meanwhile, regimes remain stabilized (Geels & Schot, 2007, p.406).

The transformation pathway occurs when there is disruptive change, i.e. moderate landscape pressure, with the timing of niche innovations being under developed in which case, regime actors will gradually alter development pathways and innovation activities (Geels & Schot, 2007, p.406).

The reconfiguration pathways occurs when niche innovations are fully developed and symbiotic in nature with the incumbent regime leading to the adoption of the niches into the regime triggering modifications of the architecture of the regime (Geels & Schot, 2007, p.411).

The technological substitution pathway occurs when there is 'avalanche change' which is rapid, abrupt, and significant at a time when the regime is deeply stable and the niche innovation is fully developed (Geels & Schot, 2007, p.408). Despite the regime's stability, the landscape shocking avalanche results in destabilization in which the fully developed niche will replace the incumbent regime (Geels & Schot, 2007, p.409).

The dealignment and realignment pathway occurs when there is 'avalanche change' which causes early regime destabilization and dealignment (Geels & Schot, 2007, p.408). Dependent upon niche innovation readiness, a niche may or may not replace or merge with a current regime, possibly competing with several other niches for a prolonged period resulting in a winner niche replacing the incumbent regime (Geels & Schot, 2007, p.408).

It is possible for a transition to begin on one path and shift to another (Geels & Schot, 2007, p.406) just as it is possible for the feasibility of a transition pathway to shift as events unfold (Turnheim & Nykvist, 2019, p.780).

While it is important to consider the pluralizing of pathways when setting transition roadmaps and scenarios (Turnheim & Nykvist, 2019, p.779), this thesis is set through the frame of the transformation pathway as depicted once again in Figure 1.1 below.

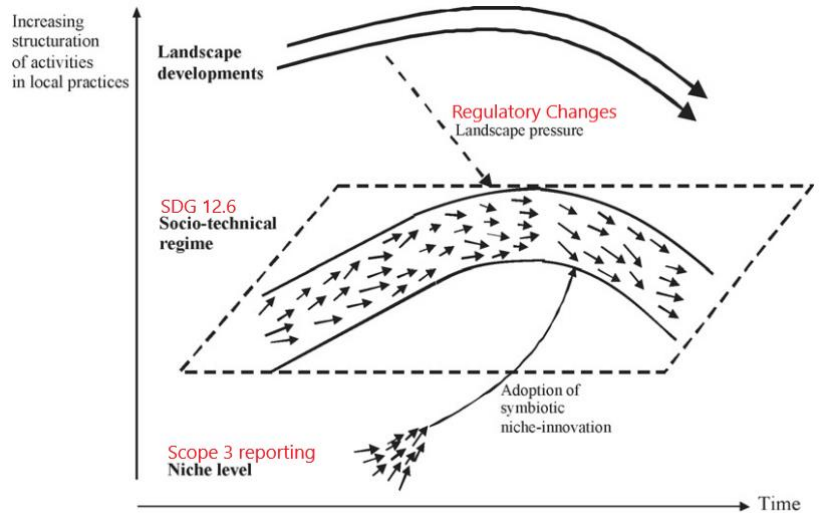

Figure 1.1. *Scope 3 Reporting Transformation pathway. Adapted from (Geels & Schot, 2007, p.407)*

However, as mentioned above, there have been many takes on the subject of transition pathways since the Geels & Schot (2007) paper. However, Geels & Schot's (2007) version of the transformation pathway has been utilized in this thesis as it was determined to be the most fitting for the Scope 3 reporting situation. However, Turnheim & Nykvist (2019, pp.780-781) note that conditions for transition pathway feasibility include (1) maturity of options, (2) system integration and infrastructure, (3) social acceptability, and (4) political feasibility.

The maturity level of transition pathway options such as technical, social, organizational, or institutional innovation must have reached a certain maturity level else they will not be able to follow through with the necessary steps of that pathway (Turnheim & Nykvist, 2019, p.780). For example, with the long lead times to actual climate mitigation, carbon capture storage has a lower maturity level compared to the reliance on carbon capture storage technology in mitigation scenarios (Turnheim & Nykvist, 2019, p.780).

System integration and infrastructure must be able to function for the transition pathway's intents and purposes. For example, if a transition pathway is highly dependent on electrification, then the electricity grid must be large enough, expansive enough, and able to bear the demand load for said transition pathway to be successful. This extends further to system chains and processes as well (Turnheim & Nykvist, 2019, p.780).

Social acceptability must be high enough to see a transition pathway through. For example, public opposition and outcry against nuclear power has rendered that transition pathway scenario

void in many areas (Turnheim & Nykvist, 2019, p.780).

Lastly, political feasibility must be able to overcome obstacles from resistance of certain actors and be likely to be supported and is thus significantly dependent on actors with substantial influence, power, and vested interests (Turnheim & Nykvist, 2019, p.781)

As described in the literature review, there are currently landscape regulatory changes which have opened a window in the SDG 12.6 regime for the Scope 3 reporting niche to jump through to symbiotically be adopted into and become one with the SDG 12.6 regime. However, as discussed, there are constraints to this as Scope 3 reporting is notoriously complex and has been non-mandatory until recently for the European Union, and in most countries, it is still not mandatory. This thesis uses the MLP as a viewing framework to understand the problem at hand.

3.1.2 Limitations and criticisms

7 major criticisms were initially addressed by Geels (2011) and further critique reviewed later (Geels, 2019). To briefly summarize the criticisms which are most relevant to this thesis:

Previously, the MLP has paid little attention to politics, power, cultural discourse, and cultural framing (Geels, 2011). Several scholars have introduced combining the MLP with current theories and frameworks to support the study of these sub streams such as Sabatier's advocacy coalition framework for power studies and discourse theory for cultural narrative studies (Geels, 2019, pp.191-193).

Further, regime destabilization and decline and policy-relevant dimensions and processes were all under addressed or insufficiently analyzed which has all been addressed via further in-depth study (Geels, 2019). For example, transition-oriented policy mix research has enabled the investigation of synergies and mismatches between policies (Geels, 2019, p.196) and regime destabilization and purposeful phase-out policies may accelerate sustainability transition by leaving space for niche innovations to further stabilize and diffuse (Geels, 2019, p.195).

Grassroots innovation was previously understudied in a transitionary context (Geels, 2011). Many attempts have been made to correct this, however there are still challenges and limitations such as contextual mismatches with the broader regime (Geels, 2019, p.193).

Originally the singular bottom-up transition pathway was examined, however, Geels & Schot

(2007), developed 4 transition pathways to correct this. These pathways are discussed in the previous section.

Various critics asked for further clarification on what constitutes a 'regime' as the concept often found itself interchanged with 'system' making it difficult for scholars to empirically conceptualize a 'regime' (Geels, 2011, p.31). Later, it was commented and corroborated that regimes are resistant to change as a defining factor (Geels et al., 2017, p.1242). This resistance has been further acknowledged (Geels, 2019, pp.194-195).

As the Scope 3 reporting niche fights for adoption into the SDG 12.6 sustainability reporting regime via the transformation pathway, it was decided that gaining insider access to regime actors, those who must conduct the Scope 3 reporting itself, was crucial for this study. This is discussed in the following section.

3.2 Post-normal science

The focus of this thesis is to put a spotlight on the Scope 3 niche and zoom into those closest to the problem at hand. As Scope 3 bears uncertainties, the emergence of post-normal science (PNS) is taking strides out into the light. Some view this as a transition from 'truth' to 'quality assurance' (Peters & Besley, 2019, p.1294).

In Kuhn's (1962) book, *The Structure of Scientific Revolution*, Kuhn dubbed 'normal science' as unexciting routine puzzle solving traditional science where "uncertainties are managed automatically, values are unspoken, and foundational problems unheard of" (Funtowicz & Ravetz, 1993, p.4). Normal science is the positivist traditional method of science which divides nature into facts and phenomena with reductionist, mathematical explanations, independent of values, norms, and goals and studies nature under the pretense of how it may have behaved had idealized conditions ensued (Haag & Kaupenjohann, 2001, p.53). Normal science places a great deal of trust into the inviolability of its objective understanding of facts on nature (Turnpenny et al., 2011, p.292).

However, when conditions become complex and uncertain, the normal approach is no longer sufficient (Funtowicz & Ravetz, 1993; Haag & Kaupenjohann, 2001; Nogueira et al., 2021). The

precautionary principle is often utilized to explain this which details that if there is an uncertain threat, then action is commanded; yet normal science excludes values, threats, uncertainty, a code for the selection of action, nor justifications of these actions and is thus unable to competently address these issues. (Haag & Kaupenjohann, 2001, p.53)

To embrace the cases in which 'facts are uncertain, values in dispute, stakes high, and decisions urgent' Funtowicz and Ravetz (1993) developed the concept of PNS. PNS facilitates the completeness of information with a range of epistemological and ontological positions hence PNS promotes quality (Turnpenny et al., 2011, p.292). PNS incorporates the concept of 'systems' described below as knowledge itself is systemic and exists within determinate technical, social, cultural, and historical frameworks characterized by quality as opposed to an absolute standard (Ravetz, 2006, p.280). PNS is highly relevant to science and technology studies, public policy analysis, political science, and evidence-based policy making (Turnpenny et al., 2011, p.288), due to its acceptance and adjustment for situations which have high uncertainties, conflicting ethics, and high stakes which normal science lacks.

Haag and Kaupenjohann (2001, p.54) developed a table which distinguishes the primary differences between normal science and PNS. Table 3.2 highlights the marked differences between the normal and post-normal sciences and showcases how PNS is adjusted for such uncertain situations by allowing for a plurality of perspectives, uses transdisciplinary methods, and is problem-driven for example.

Table 3.2
Normal science and Post-normal science compared. Source: (Haag & Kaupenjohann, 2001, p.54)

	Normal science	Post-normal science
Epistemology	Essentialist	Constructivist
	Exo-perspectives	Endo-perspectives
	Abstraction	Context
	Universal knowledge	Reconfiguration of knowledge in context (local)
	Regularities	Singularities
	Objective scientific truth	Plurality of perspectives
	Single description	Non-equivalent descriptions
Rationality	Instrumental/strategic	Communicative
Methods	Disciplinary	Transdisciplinary
	Established, universal	Problem-driven, specific
Peer community	Closed expert system	Extended peer community (stakeholders)
Quality control	Disciplinary	Transdisciplinary
	Universal	Context specific
Problems/issues	Puzzles	Ill-defined issues
	Disciplinary definition	Real-world formulation
	Analysis frames deliberation	Deliberation frames analysis
Uncertainty	Technical	Epistemic
	Low	High
Risk	Scientific –technical	Social construction
Stakes	Low	High

PNS is multifaceted, without a precise definition, and is not a watertight theory of 'how to do science' or 'how to solve complex problems' and is thus interpreted and applied in various ways (Turnpenny et al., 2011, p.300). The graph below offer the most popular depiction of PNS. Rarely is any one problem solved entirely within one single zone as many situations are dynamic and various aspects of a situation may be addressed in different zones, interact, and result in an eventual solution (Funtowicz & Ravetz, 1993, p.19).

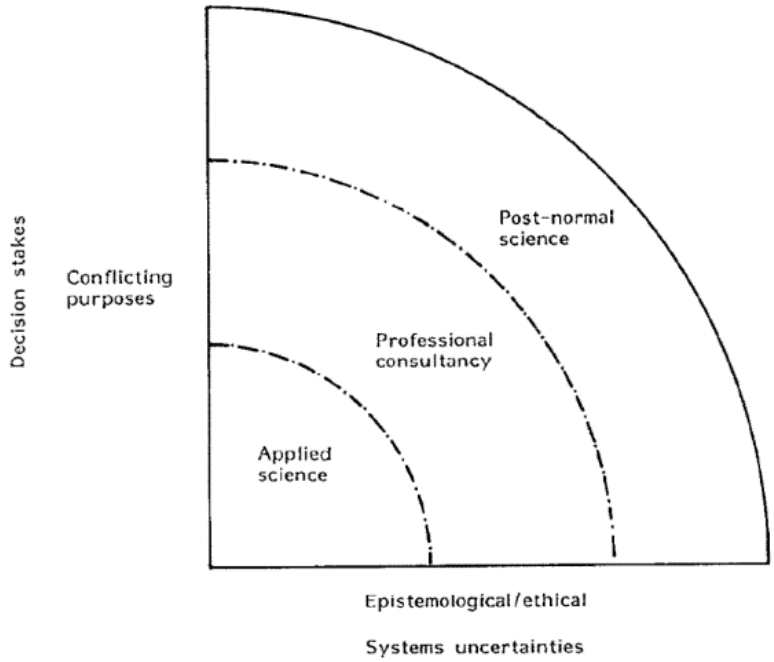

***Figure 3.2**. Post-normal science. Source: (Funtowicz & Ravetz, 1993, p.17).*

'Decision stakes' refers to the various costs, benefits and value commitments regarding the situation at hand meanwhile 'systems uncertainties' refers to the comprehension and management of an inherently complex reality (Funtowicz & Ravetz, 1993, p.10). 'Systems' was updated to entail an intellectual construct which intends to improve understanding of the complex world and a 'complex system' entails a structure of sets with the relational ordering of super- sub-, and co- where each subsystem has a plurality of relationships with the other subsystem types (Ravetz, 2006, p.279).

'Applied science' refers to the most familiar form of science which is applied when circumstances are stable, well defined and well understood, and when the stakes are low (Funtowicz & Ravetz, 1993, p.11). 'Professional consultancy' refers to a middle ground when uncertainties and stakes raise to a level where consultation of an expert becomes warranted as the usual routine methods are no longer fully reliable (Funtowicz & Ravetz, 1993, p.13).

PNS rises when epistemological or ethical uncertainties and stakes are at their highest such as is commonly seen on the policy and environmental landscapes (Funtowicz & Ravetz, 1993, p.17). In PNS, 'soft values' take precedence over 'hard facts' contrary to the normal practices as values become so inherent to the decision-making process that values may even become the

independent variable as is seen in the case of climate change for example (Funtowicz & Ravetz, 1993, p.18).

However, PNS has faced several criticisms since its emergence (Turnpenny et al., 2011, p.295) such as that the limited cross-disciplinary utilization of PNS results in the confusion of the associated terminology, methodology, theory, and normative prescription (Turnpenny et al., 2011, p.288).

It has been found that concepts within PNS that are utilized in other areas of social science may not necessarily lead to better or different decisions (Turnpenny et al., 2009, p.355). Without the presence of institutional structures to assist PNS-type approaches, preexisting rules and norms may make it challenging to fully adopt PNS-type approaches (Turnpenny et al., 2011, p.296).

There has been the critique of quality assurance of PNS and to address this, Ravetz (2006, p.278) notes that PNS produced scientific material is not to be mistaken for 'hard facts' but rather is to be understood as 'evidence' to be taken into account towards the dialogue of the study. The relevance of this evidence to the case studied may be contested and the evidence may garner various legitimate interpretations (Ravetz, 2006, p.278).

A dialogue has taken shape as to the future of PNS (Ravetz, 2006; Turnpenny et al., 2011) as the societal grand problems of today are no longer technological risks, but rather contradictions of sustainability and survival (Ravetz, 2006, p.283). The cross-disciplinary ability of PNS utilization entails many that there will never be one singular fixed version of PNS, but many (Ravetz, 2006, p.279).

3.2.1 Post-normal science for sustainability

GHG mitigation is inherent to climate change. The complexities and urgencies of climate change span the issues of migration as sea levels rise, health as warmer temperatures spread disease further and release old disease from permafrost to safety as extreme weather events such as hurricanes, wildfires, and drought rise in frequency. Further, all life is impacted, more than just the anthroposphere. Yet, climate change, among myriad environmental issues, is uncertain in an epistemic nature with future system development uncontrollable and unpredictable; PNS provides a framework for such issues (Haag & Kaupenjohann, 2001, pp.56-57). Further, a PNS

approach is well established in Norway and within the EU from Norwegian scientists researching wildlife to the European Commission calling for a multi-actor approach (Nogueira et al., 2021, p.3).

PNS terminology became popular in studying climate change among other complicated issues in the 1990s (Turnpenny et al., 2011, p.288). Noguieria et al. (2021) particularly calls attention to the role of social scientists for harnessing science, technology, and innovation for sustainability as depicted in Figure 3.3. Social scientists play the key role of weaving collaborations which maintain the ties between credibility, legitimacy, and salience in research (Nogueira et al., 2021, p.12).

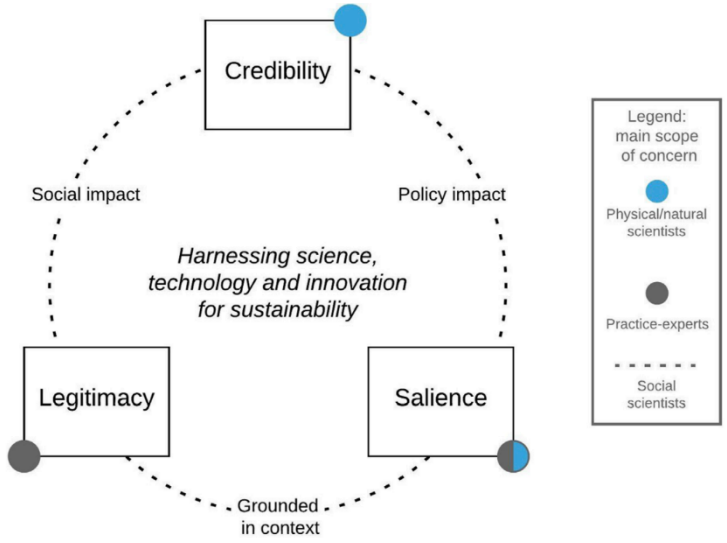

***Figure 3.3**. Harnessing science, technology, and innovation for sustainability. Source: (Nogueira et al., 2021, p.11)*

The fourth mission-oriented innovation ecosystem type, the sustainable transformation ecosystem, is particularly prone to tensions as the simultaneous pursuit of diverse goals adds complexity with competing priorities, value creation vs. value capture mechanisms, or possible hi-jacking through interest groups (Jütting, 2020, p.14).

As PNS has the ability to bridge academic disciplines from policy to medicine and has thus produced myriad conceptualizations, applications, and implications hence establishing PNS as key to a sustainable future (Turnpenny et al., pp.287, 293, 301).

3.2.2 Extended peer communities

The extended peer community (EPC) is the primary focus of how PNS is utilized in this thesis as the EPC is where the epistemological data is gathered from for this thesis project. As the EPC itself include those who are closest to the problem at hand, it was crucial to gain their perspectives. This thesis takes on a case study of Sar AS, who is a member of the Scope 3 reporting EPC. As Sar AS is observed and relevant stakeholders are interviewed, acknowledging and viewing Sar AS as a member of the Scope 3 reporting EPC is crucial.

"An extension of peer communities, with the corresponding extension of facts, is necessary for the effectiveness of science in meeting the new challenges of global environmental problems" (Funtowicz & Ravetz, 1993, p.22).

PNS advocates for the democratization of knowledge for quality assurance of scientific inputs; that is, PNS calls for diverse social actors to be embedded into the research process (Funtowicz & Ravetz, 1993, p.19; Nogueira et al., 2021, p.3). Co-production of knowledge acknowledges that science and society are intertwined as science (i.e. 'fact) cannot be fully separated from the socio-political word (i.e. 'values') (Nogueira et al., 2021, p.2). The social world shapes which issues are researched, how they're researched, what angle they're observed through, and the process of funding such projects (Nogueira et al., 2021, p.2). Prior to PNS, externalities which may have interfered with the quality of scientific research, particularly environmental, societal, and ethical aspects, were assumed to be dealt with by society at large (Funtowicz & Ravetz, 1993, p.21). The democratization of knowledge and the scientific process may aid in the reduction of such externalities.

The EPC includes all stakeholders other than technically qualified researchers who can contribute to an effective problem-solving strategy for complex and highly uncertain issues (Funtowicz & Ravetz, 1993 p.9). Stakeholder involvement may range from exclusion, cooperation, responsibility for the function or question at hand, to ownership (Nogueira et al., 2021, p.5). The EPC will have 'extended facts' which may consist of anecdotes, informal surveys, and official information published via unofficial means all of which enriches the process of scientific research (Funtowicz & Ravetz, 1993, p.20).

EPCs delivers what normal science processes may not such as participant competencies which incorporate broader societal and cultural institutions and movements such as how a person who

is directly impacted by an environmental problem may have a fuller and deeper sense of symptoms and perspectives of said environmental problem that a third-party scientist (Funtowicz & Ravetz, 1993, p.19). Further, the voices of marginalized and otherwise voiceless groups may reach the surface with an EPC approach (Turnpenny et al., 2011, p.300).

However, this method must be carefully employed as to not obscure the nature of scientific knowledge, rather it should strength scientific integrity (Nogueira et al., 2021, p.3). The EPC approach's limitations can be argued to be that the EPC lack theoretical knowledge and are biased with self-interest; however it may also be debated that scientists and experts equally have their own unconscious biases and lack the practical knowledge that EPC members may have (Funtowicz & Ravetz, 1993, p.20).

Nogeuira et al. (2021, p.6) produced five key recommendations for successful co-production of knowledge which will aid project leaders in developing soft skills for coordinating collaborative work while instilling trust and goodwill despite conflicting values and interests (Nogueira et al., 2021, p.12).

First, unite diverse participants through a shared objective and manage divergent motivations. Constructive results will not be achieved through simply putting several people in a room to discuss, but rather through participants which address opposing worldviews, worries, vocabularies, and interests (Nogueira et al., 2021, p.2).

Second, beware of holding consensus as the holy grail. A consensus should be reached with open doors in a space free from manipulation and without the voices of political agendas, personal hopes, or power, etc. (Nogeura et al., 2021, p.7).

Third, cultivate understanding and appreciation for distinct types of expertise. Overlooking the implicit diverse qualities of the EPC can create barriers to a successful project. The unique perspective and knowledge for each participant, their epistemological background and legitimacy, ontological world views, axiological values, and how those all inform the participants' attitudes and contributions is imperative to address prior to commencing research to ensure that all participants are on equal footing (Nogueira et al., 2021, p.7).

Fourth, pay attention to struggles in sharing preliminary work and potentially harmful information. The post-normal paradigm disrupts the appearance of linearity and information

must be exchanged prior to its finished state which may cause the researcher to feel overly cautious and uncomfortable to share incomplete unpolished work (Nogueira et al., 2021, pp.8-9).

Fifth, address scientists' wish to convey neutrality in politically charged territory. Scientists equally require the allowance of a safe space to discuss their early work without the fear of prematurely stating policy implications; else the conversation will be diluted with edited responses (Nogueira et al., 2021, p.10).

The post-normal response is to see the challenge and step towards it with the acceptance of uncertainty and welcoming of diversity (Funtowicz & Ravetz, 1993, p.23).

3.3 Responsible Research & Innovation

The MLP is utilized in this thesis to aid in depicting the current Scope 3 reporting situation in society as a whole. PNS is utilized to gain deep insight into the perspectives of the EPC close to the problem being studied at hand. Responsible Research and Innovation (RRI) is utilized to frame and gain deeper understanding of business' research and innovation of Scope 3 reporting niche adoption as the EU encourages RRI as it can ensure a successful, ethical, and sustainable research outcome and is an integral part of accomplishing mission-oriented goals such as the grand challenges described farther along in this section.

Expanding the concept of the consultation of the EPC into full collaboration with non-expert researchers or scientists, comes the concept of RRI. RRI is meant to respond to the current deficit of science and innovation lacking established capacities to anticipate and guidance toward socially desirable outcomes such as vaccines or that which pushes the sustainability transition forward (Von Schomberg et al., 2022, p.4).

There is no formal agreed upon definition of RRI (Thapa et al., 2019, p.2471; von de Poel, 2021, p.350). This thesis will proceed with RRI defined as "a democratization process leading to connecting science to the values and interests of European citizens by means of participatory processes" (Mazzonetto & Simone, 2018, p.1).

While the EU's official RRI website does not offer a strict definition of RRI, it does offer the dual descriptions of "involving society in science and innovation 'very upstream' in the processes of research and innovation (R&I) to align its outcomes with the values of society" and

"a wide umbrella connecting different aspects of the relationships between R&I and society: public engagement, open access, gender equality, science education, ethics, and governance"[23]. The latter of which is known as the EU's six policy agendas regarding RRI and is discussed in further detail below.

As previously discussed in section 2.4, the European Commission has set out on a mission to tackle European society's grand challenges. Specifically, the European Commission defined 7 grand challenges that society faces: (1) Health demographic change and wellbeing, (2) Food agriculture & forestry and water, (3) Secure, clean, and efficient energy, (4) Smart, green, and integrated transport, (5) Climate action, environment, and resources, (6) Europe in a changing world: inclusive, innovative, and reflective societies, & (7) Secure societies: freedom and security of Europe and its citizens.

Through the implementation of a mission-oriented policy mix, the goal is for mission-oriented innovation ecosystems to arise. R&I is meant to tackle these grand challenges; however R&I has growing concerns regarding its negative externalities and rising disparities within and between regions (Thapa et al., 2019, p.2470). RRI is meant to improve upon traditional R&I by engaging all actors through inclusive participatory methodologies throughout the R&I processes to produce enhanced science, diversify research, and accounting for real-world complexities appropriately for a more ethical and societally prudent outcome.

A key observation is that RRI is not the visible distinct element in the Horizon Europe funding program that it was in the Horizon2020 funding program and is instead integrated as an overarching principle (Robinson et al., 2020, p.210). Further, Horizon Europe appears to replace the 'RRI policy experiment' with a new policy experiment which focuses on open innovation 2.0 and mission-oriented programs, the focus shifted towards responsibility, inclusiveness, and participation in the innovation processes (Robinson et al., 2020, p.210).

This thesis utilizes the six EU policy agendas, also described as the EU's six 'keys' to RRI, and Stilgoe et al.'s (2013) four dimensional framework as the criteria for the RRI impressions taken of the observational study and the interviews. Through taking these RRI impressions, how ethical and sustainable the Scope 3 reporting innovation outcome would be should current

[23] https://rri-tools.eu/about-rri (Last accessed on June 11, 2023).

practices remain constant was able to be discerned. More specifically, the Scope 3 reporting innovation trajectory was able to be discussed.

3.3.1 The six EU policy agendas

The 'keys' of the EU's RRI framework, are the European Commission's six policy agendas of public engagement, open access, gender equality, science education, ethics, and governance (European Commission, 2015, p.10). Figure 3.4 below is the EU's depiction of its RRI approach. Extrapolating outward from the core keys, the primary actor groups to be included are the research community, civil society organizations, business and industry, education community, and policy makers. Farther out is the overarching frame with clear notes of Stilgoe et al.'s (2013) four dimensional framework discussed in detail in section 3.3.2 and includes an anticipative and reflective dimension, a responsive and adaptive dimension, an open and transparent dimension, and a final diverse and inclusive dimension as an overarching frame.

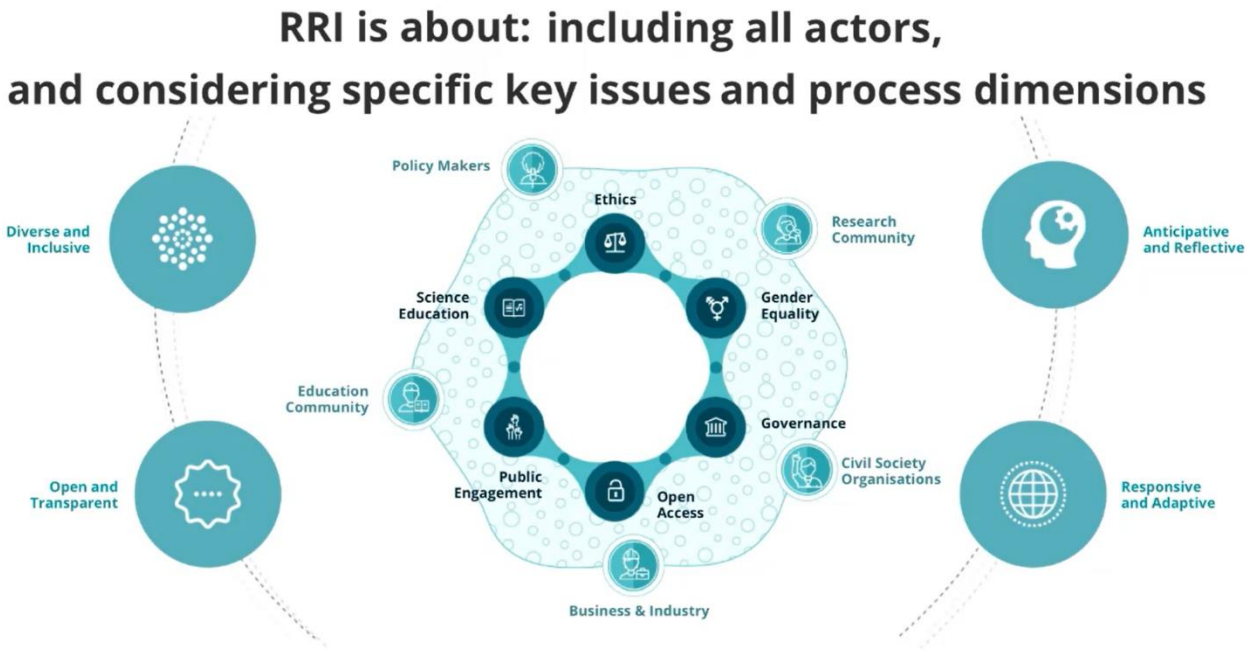

***Figure 3.4**. Responsible Research and Innovation actors, issues, and dimensions. Source (RRI Tools, n.d.).*

The six keys and two broader concepts of 'sustainability' and 'social justice and inclusion' are proposed as the eight primary criteria for RRI indicators (European Commission, 2015, pp.10-

11). However, the six keys are the core criteria focused on for this thesis as the two latter concepts belong to the key of 'ethics' proper and are simply an extension of the ethics key (European Commission, 2015, p.34).

Governance entails multiple processes of control and management, directing and setting goals, selecting means, regulating their operation, and verifying results with a heavy focus on reaching a consensus within the network of relevant stakeholders (European Commission, 2015, p.18). It is also viewed that the other five keys are the keys to governance with the governance key being perhaps the most important of the six keys as the other five are all for not if governance does not take action on them (European Commission, 2015, pp.5-6).

Public engagement functions as a societal commitment to provide encouragement, opportunities, and competences so citizens may gain agency and participate in discussions of R&I, scientific knowledge production, and assessment and governance processes (European Commission, 2015, p.21). Examples of public engagement include citizen science, science in transition, do-it-yourself, fablabs, hacker spaces, and maker spaces, many of which are supported by digitization and digital culture (European Commission, 2015, p.22).

Gender equality is described has including two dimensions: (1) Promoting the equal participation of women and men in research activites, and (2) Promoting the inclusion and integration of gender perspectives in R&I content (European Commission, 2015, p.26). In the RRI context, gender equality is not merely about percentages on paper, but about addressing the unconscious gender bias, informal institutional practices and organizational cultures, and a lack of clarity in decision-making (European Commission, 2015, p.26).

Science education is narrowly defined as research activities which aim to promote interest in science education, particularly aimed at young people, by involving practices and institutions that organize such activities, i.e., science education remits such as science museums and schools (European Commission, 2015, p.28). The goal of science education is to enhance science education so that future researchers and other societal actors become good RRI actors and so that an interest in science among young people is boosted so more become researchers or science-literate scientific citizens (European Commission, 2015, p.29).

Open access, also known as 'open science', is namely the access to and preservation of scientific information (European Commission, 2015, p.31). More deeply, open science includes the public

sharing of the scientific process in completion and in real time on the internet with the support of information flow, collaboration, and dialogue between experts and non-experts (European Commission, 2015, p.32).

Ethics is a complex field with internal norms and values of conduct, practice, culture, and organization coincide with imposed societal norms and values through various methods and includes three subfields: (1) Research integrity and good research practice, (2) Research ethics for the protection of the objects of research particularly animals and humans, and (3) Societal relevance and ethical acceptability of R&I outcomes (European Commission, 2015, pp.33-34).

3.3.2 The four dimensional framework

The European Commission views the six keys of RRI as anticipatory, inclusive, reflexive and responsive which is adopted from Stilgoe et al.'s (2013) framework (European Commission, 2015, p.11).

Stilgoe et al. (2013) offers a broader definition of RRI compared to the definition which the European Commission previously heavily used: "Responsible innovation means taking care of the future through collective stewardship of science and innovation in the present" (Stilgoe et al., 2013, p.1570).

Stilgoe et al. (2013) produced a well utilized framework for RRI that, when introduced, set itself apart from the European Commission's original frame. However, with the popularity of this four dimensional framework, it has now been integrated into the EU's six policy agendas as seen in Figure 3.4 further above. This framework consists of the four dimensions of anticipation, reflexivity, inclusion, and responsiveness and is aimed at discussing and responding to larger RRI focused questions such as those included in Table 3.3 below (Stilgoe et al., 2013, p.1570).

Table 3.3
Lines of questioning on responsible innovation. Source: (Stilgoe et al., 2013, p.1570).

Product questions	Process questions	Purpose questions
How will the risks and benefits be distributed?	How should standards be drawn up and applied?	Why are researchers doing it?
What other impacts can we anticipate?	How should risks and benefits be defined and measured?	Are these motivations transparent and in the public interest?
How might these change in the future?	Who is in control?	Who will benefit?
What don't we know about?	Who is taking part?	What are they going to gain?
What might we never know about?	Who will take responsibility if things go wrong?	What are the alternatives?
	How do we know we are right?	

The questions of Table 3.3 above are based on Machnaghten and Chilvers' (2013) analysis of cross-cutting issues of the United Kingdom public regarding science and technology with the questions organized as to how they relate to products, processes, or purposes of innovation (Stilgoe et al., 2013, p.1570). Product questions have a conventional governance focus, process questions focus on ethical governance and research integrity, and purpose questions approach responsible innovation through questioning uncertainties, directions, purposes, and motivations (Stilgoe et al., 2013, p.1570).

None of the four dimensions are strictly defined, however detailed descriptions are offered along with Table 3.4 further below which details indicative techniques of application and factors which affect implementation (Stilgoe et al., 2013, p.1570).

Anticipation involves recognizing the future for what it might be while taking into consideration the multiplicative factors of the complexities and uncertainties of the coevolution of science and society, implications of new technologies, contingency, opportunities for innovation, and socially-robust risk research (Stilgoe et al., 2013, pp.1570-1571).

Reflexivity encompasses rethinking prevailing conceptions on the moral division of labor in science and innovation, challenging assumptions of scientific amorality and agnosticism, blurring the boundary of role responsibilities and moral responsibilities, openness and leadership, reflecting upon one's own actions, commitments, and assumptions, awareness of knowledge limits, minding that there is no universally held frame of any one issue, and scrutiny of the value systems and theories which shape science and innovation governance (Stilgoe et al., 2013, p. 1571).

Inclusion refers to the small group processes of public dialogue including multi-stakeholder partnerships, forums, lay folk, among other hybrid methods for dialogue, input, and innovation governance diversification (Stilgoe, et al., 2013, p.1571). Effective inclusion will force the questioning of power hence public dialogue must allow for the public and stakeholders to question the framing assumptions in addition to policy issues and the participation process itself (Stilgoe et al., 2013, p.1572). Stilgoe et al. (2013, p.1572) cite Callon et al.'s (2009, p.l60) three criteria of intensity, openness, and quality of a possible set of criteria to assess inclusive dialogue processes (Stilgoe et al., 2013, p.1572).

Lastly, responsiveness is the capacity to change in response to shifting stakeholder values, public values, circumstances, new knowledge, emerging perspectives, views, and norms; and includes the consideration of the shaping of systems of innovation to be as responsive as possible (Stilgoe et al., 2013, p.1572). Responsiveness thereby requires the science and governance political economy to consider both products and purposes and attention as to metagovernance which is the values, norms, and principles which shape policy action (Stilgoe et al., 2013, pp.1572-1573).

Table 3.4 below notes these four dimensions, their indicative techniques and approaches, and factors which may affect implementation of the respective dimensions (Stilgoe et al., 2013, p.1573).

Table 3.4
Four dimensions of responsible innovation. Source: (Stilgoe et al., 2013, p.1573).

Dimension	Indicative techniques and approaches	Factors affecting implementation
Anticipation	Foresight	Engaging with existing imaginaries
	Technology assessment	Participation rather than prediction
	Horizon scanning	Plausibility
	Scenarios	Investment in scenario-building
	Vision assessment	Scientific autonomy and reluctance to anticipate
	Socio-literary techniques	
Reflexivity	Multidisciplinary collaboration and training	Rethinking moral division of labour
	Embedded social scientists and ethicists in laboratories	Enlarging or redefining role responsibilities
	Ethical technology assessment	Reflexive capacity among scientists and within institutions
	Codes of conduct	Connections made between research practice and governance
	Moratoriums	
Inclusion	Consensus conferences	Questionable legitimacy of deliberative exercises
	Citizens' juries and panels	Need for clarity about, purposes of and motivation for dialogue
	Focus groups	Deliberation on framing assumptions
	Science shops	Ability to consider power imbalances
	Deliberative mapping	Ability to interrogate the social and ethical stakes associated with new science and technology
	Deliberative polling	Quality of dialogue as a learning exercise
	Lay membership of expert bodies	
	User-centred design	
	Open innovation	
Responsiveness	Constitution of grand challenges and thematic research programmes	Strategic policies and technology 'roadmaps'
	Regulation	Science-policy culture
	Standards	Institutional structure
	Open access and other mechanisms of transparency	Prevailing policy discourses
	Niche management[a]	Institutional cultures
	Value-sensitive design	Institutional leadership
	Moratoriums	Openness and transparency
	Stage-gates[b]	Intellectual property regimes
	Alternative intellectual property regimes	Technological standards

To integrate and embed these four dimensions of responsible innovation into governance, they must be integrated as a unified whole as they mutually reinforce each other (Stilgoe et al., 2013, pp.1573-1574). However, the four dimensions may strain tension between each other possible causing new conflicts which must be addressed through subsequent negotiation thereby rendering the commitment to a framework which integrates all four dimensions without a priori instrumental conditioning is crucial (Stilgoe et al., 2013, p.1574).

3.3.3 Limitations of RRI

Scope 3 reporting is one of a kind and a new concept thus requiring innovation. As an RRI approach is indicative of a more successful, ethical, and sustainable innovation outcome and is meant to address the grand challenges and produce a more ethical and sustainable outcome of research and innovation, RRI is employed in this thesis as insight into the indications of current firm innovation processes. Yet, it has its own shortfalls.

Perhaps the most protruding limitation of RRI is that it is highly normative and leaves actors uncertain of how precisely to proceed and integrate RRI into their processes with each successive step: credible research, responsive research, and responsible research all of which requiring their own respective implementation framework for good practice (Von Schomber et al., 2022, pp.1-2). "In theory, [RRI's] conceptualization and operationalization remain ambiguous." (Thapa et al., 2019, p.2470)

Further, RRI may be implemented through namely publicly funded research and has not been adapted for the business context and the myriad approaches to this field such as responsible innovation, sustainable innovation, social innovation, open innovation, among others, have caused confusion and contributes to why businesses have not widely taken up RRI (Martinuzzi et al., 2018, p.3).

If the EU claims that RRI is the appropriate and most effective pursuit of research and innovation, then do their mission-oriented policies, which aim at stimulating and catalyzing mission-oriented innovation ecosystems, catalyze RRI pursuit as RRI is an essential ingredient to ethical and sustainable innovation? While an exploration as to firms' RRI approach will give deeper insight into the innovation processes outcome of the current mission-oriented policy mix, RRI is not wholly representative of a 'successful' innovation process. RRI supports the societal values aspect of innovation, however this is not the only aspect which is important and crucial to successful innovation. It is but one of the many aspects.

Further, RRI impressions are sought in the emergent data described in the methods chapter of this thesis. Such impressions aided in the garnering of deep insight, yet fuller, more in-depth methods exist for reviewing and evaluating a project or a firm's RRI level. However, this thesis utilizes RRI as an expansion to gain a fuller picture of the research questions at hand and is not the primary focus of this thesis, thus a lighter method was employed.

4. Research methodology

With the comprehensive picture the literature review paints of the Scope 3 reporting problem and the scope of insight and understanding that the theoretical frameworks provide, the research methodology was then able to draw on these to form a solid foundation for the empirical analyses.

This section dives into the philosophical stance taken, the case study of Sar AS, and how the data was collected, analyzed, and quality ensured. The mixed methods of an observational study of Scope 3 carbon accounting and an assessment of Sar's current sustainability reporting transformation and Scope 3 reporting transformation with the Sustainable Transformation Model (STM) followed with interviews. How these methods aid in answering the two central research questions that drive this thesis are discussed as well.

4.1 Abductive philosophy

This thesis is exploratory and descriptive with the goal to pursue what a situation currently is. The data collected will consist of empirical data; that is, data that I, the researcher, observed and collected myself. A portion of the data collected, namely the Scope 3 accounting data, also consists of secondary data which is data that another researcher, not myself, collected empirically. It is important to note here that the 'secondary data' used is not in reference to the Scope 3 Standard's definition of 'secondary data' as the secondary data referenced here is beyond the Scope 3 Standard's definition.

The research strategy involves collecting operations and GHG emissions data from third party companies involved in Sar's value chain. The research strategy involved an observational study with collecting operations and GHG emissions data from third party companies involved in Sar's value chain followed with a thematic analysis. Further, Sar's transformation progress was assessed via a sustainability-oriented organizational change management model followed with interviews and grounded theory analysis. The data collected included primarily A posteriori statements which are statements that cannot be known to be true or false independently of experience (Baehr, n.d). This means that I, the researcher, can never know the statements made by the participants to be true or false as I cannot experience exactly what they are experiencing. I

can only trust and believe that what they have told me is true and not false. With this in mind, I utilized abductive reasoning and arguments which are "arguments to the conclusion that a given hypothesis is correct from statements of certain facts, and the statement that the hypothesis provides the best explanation of those facts." (Douven, 2021).

While grounded theory is traditionally thought of as inductive or deductive, the Corbin & Strauss (1990) method actually aligns with abductive logic, or rather, "allows" for abductive logic (Reichertz, 2010, p.12). This is due to grounded theory's intellectual operations of finding similarity (coding in known codes) and development of the new (creating new codes) which includes an intellectual jump of stating what is in common between known codes and the second intellectual jump of adding something new which is not existing as a concept or theory (Reichertz, 2010, p.12). Reichertz (2010) argues that this formulation of the new is abductive logic. Abduction proceeds from a known quality to two unknowns and is therefore an intellectual jump and a cognitive logic of discovery which brings together things which had not been associated prior (Reichertz, 2010, p.7).

Reichertz (2010) addresses the critique that abductive logic is unreliable through the metaphor of 'lightning' as 'logical abductive conclusions' by describing abduction's weakness of the abductive discovery of new things being dependent on chance as still relevant because "if discovery is truly related to accidents, then one can either give accidents a chance or deny or reduce the possibility" (Reichertz, 2010, p.7). Essentially, by avoiding abductive logic, the researcher is eliminating or reducing the reaching of the conclusions and discoveries that could have been reached, had abduction been employed.

Further, the critique that abductive logic is invalid is addressed with the claim that "abductively discovered orders are neither (preferred) constructions nor (valid) reconstructions, but usable (re)constructions" (Reichertz, 2010, p.9) in the sense that abductive efforts do not target construction, rather abductive efforts target the discovery of an order, thereby not resembling true reality or the best possible rationality; instead abductive orders produce mental constructs which the researcher can live more or less comfortably with (Reichertz, 2010, p.9).

4.2 Case study design

A case study design was employed as the focal point of the methodology to begin answering the research questions.

One definition of 'case study' is that they are intensive analyses and descriptions of a contemporary phenomenon of a single unit or system in its natural context bounded by space and time (Hancock & Algozzine, 2017, pp.9, 15).

Another well accepted definition by Yin (2018, p.15) containing multiple parts is as follows:

1. *A case study is an empirical method that*
    - *Investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when*
    - *The boundaries between phenomenon and context may not be clearly evident*
2. *A case study*
    - *Copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result*
    - *Benefits from the prior development of theoretical propositions to guide design, data collection, and analysis, and as another result*
    - *Relies on multiple sources of evidence, with data needing to converge in a triangulating fashion*

Case study research is particularly useful when the research questions are 'how' or 'why' questions, when the case is focused on the contemporary and not the purely historical aspect, when the boundaries between phenomenon and context may not be clear, and when the researcher has little or no control over behavior events (Yin, 2018, p.9). This thesis aligns with this description to a T and thus a case study is well suited for this thesis.

The type of case study selected was an intrinsic case study as the aim of this thesis is to learn more about a particular organization and not necessarily in examining or creating general theories or attempting to apply the findings of this case study to the general population (Hancock & Algozzine, 2017, p.38). While the particular case selected was selected due to its commonality with other organizations in a similar predicament, the aim is rather to gain deep insight into the situation at hand and not to postulate that this case will be the identical to most other similar cases with any degree of certainty.

For this reason, a descriptive method was employed as opposed to explanatory or exploratory as the aim is simply to detail the situation at hand for this particular case. While it may or may not

be applicable to the greater population, it still offers invaluable insight as to a single organization's situation regarding the upcoming policy changes now requiring scope 3 reporting.

The single holistic case of Sar AS was studied.

Data collection was employed via an observational study and via interviews. A mixed method was employed to collect a diverse array of data to promote validity of the study. The observational study was in the form of a thematic analysis of a participant-observation conduction of the first five steps of Scope 3 accounting over the course of 4 weeks. 3 semi-structured interviews followed the Sustainability Transformation Model (STM) to discuss the STM and topics related to the research questions. These methods are all thoroughly detailed in the rest of this chapter.

***Figure 4.1**. Sar AS's official company logo.*

The case study for this thesis focused on Sar AS which is headquartered at Tananger, Norway. The official Sar AS logo is in Figure 4.1 for the reader's reference. Sar AS is a waste chain management company specializing in treating hazardous and industrial waste along Norwegian coastal and shoreline waste streams. With 9 locations across the western Norwegian coastline and about 280 employed persons and a turnover of over 50m€ as of 2022[24], Sar is considered a middle sized enterprise, otherwise called a 'mid-cap' enterprise, according to the European Commission.

A mid-cap firm is ideal for this particular study as these firms are in a position where becoming more sustainable and cutting emissions is no longer considered a major challenge[25]. Meanwhile innovation and digitization are imperative for growth and competitiveness which incites a catalyst need and ability for action in sustainability improvement.

[24] https://www.proff.no/selskap/sar-as/tananger/avfallsbehandling-og-gjenvinning/IFM50L0002C/ (Last accessed June 13, 2023).
[25] https://op.europa.eu/en/publication-detail/-/publication/ad5fdad5-6a33-11ed-b14f-01aa75ed71a1/language-en/format-PDF/source-277396461 (Please see page 2; Last accessed June 13, 2023)

Sar aligns with this need and has successfully demonstrated the ability for sustainability improvement as Sar published a Climate Emissions Report which included a scope 1 and 2 analysis (Sar, n.d.). However, they were unable to congruently pursue a scope 3 analysis as there is no standard in the waste management industry for scope 3 analyses. Yet, Sar wishes to pursue scope 3 reporting as they would fall under the CSRD which is currently under consideration to be adopted with the same timeline as the EU by the Norwegian government[26].

While not a formal EU member state, to mirror the European Green Deal, Norway has set a target of reducing GHG emissions by a minimum of 55% by 2030 from 1990 levels (MCE & Ministry of Foreign Affairs, 2022). Yet, with high uncertainty levels and so many companies with no sustainability reports at all, let alone GHG reports, accomplishing this 55% GHG reduction target demands scope 3 data.

With the CSRD on the horizon, it is imperative for Sar to remain a step ahead and embrace the CSRD as Norway is expected to make similar mandates in the near future. With Sar's size, industry, and demonstrated need and desire to pursue a scope 3 analysis, Sar is an ideal candidate for this case study.

4.3 Mixed method

Mixed methods were used of both qualitative observation and interviews and quantitative Scope 3 carbon accounting and STM assessment.

Yin (2018) describes six recommended sources of evidence (i.e. data) for case studies and notes that it is optimal to use two or more sources of evidence where possible as this leads to a more robust and thorough study (Yin, 2018, pp.126-127). Yin further notes that "by developing convergent evidence, data triangulation helps to strengthen construct validity of [the] case study" due to the multiple sources of evidence conducting multiple measures of the same phenomenon (Yin, 2018, p.128). Nowell et al., (2017, p.3) further note that data collection triangulation improves upon the credibility of the study.

[26] https://www.regjeringen.no/no/dokumenter/horing-om-nou-2023-15-barekraftsrapportering-gjennomforing-av-direktivet-om-barekraftsrapportering-csrd/id2977831/ (Last accessed June 14, 2023).

Triangulation is indeed one of the commonly recommended methods of implementing mixed methods, albeit the term often lacks explicit concrete definition and is debated as a term (Morgan, 2019, p.6). For the purposes of this proposal, triangulation is defined as the simultaneous yet independent execution of data synthesis and analysis. If only one method is used, then it may lead to bias towards the result of the method used while neglecting the possible results of the neglected method. Triangulation improves upon validity by using both methods simultaneously yet independently in order to counter their biases.

4.4 Scope 3 accounting observational study

The observational study primarily aims at answering the first research question of how can firms transition toward successful Scope 3 adoption into the SDG 12.6 regime. Observing Scope 3 accounting in action was determined to be an effective data collection method as it is as close as possible to the phenomenon being studied.

The Scope 3 observational study was done via 'participant-observation' which is when the researcher is also an active participant in the actions being studied and not a passive observer (Yin, 2018, p.123). This technique is most frequently used in anthropological studies of cultural or social groups; however it can also be used in other settings such as a large organization (Yin, 2018, p.124). This method allows for a unique opportunity because it gives access to study the phenomenon of collecting Scope 3 data in a mid-cap sized organization that otherwise could not have been accessed. This is due to the fact that Sar was not previously collecting Scope 3 data, but the company is interested in what it would look like if they activated the resources to do so. As no Sar employees were previously collecting Scope 3 data for or with Sar, but the research questions and Sar's interest regarding Scope 3 data collection remain, the only option is to conduct participant-observation.

Yin (2018) notes the strengths of participant-observation as immediacy, contextual, and insightful as participant-observation allows for the covering of actions in real time and the case's context, and it provides insight into the interpersonal behavior and motives of the participants (Yin, 2018, p.114).

However, participant-observation's weaknesses include that it is time-consuming, selective, reflexive, costly, and prone to bias as such a study demands a large amount of time to conduct which costs man hours, is difficult to conduct broad comprehensive coverage without multiple observers, and participants and observers may adjust their behavior and choices due to inherent bias and knowing that they are being watched (Yin, 2018, p.114).

To address these weaknesses, as discussed below, a trustworthy thematic analysis was conducted with a reflexivity journal kept to limit researcher bias. While participant observation may range from total participation to mainly observation (Blaikie & Priest, 2019, p.2020), the 'mainly observation' method was selected as to limit participant behavior adjustments. However, I was the only observer as this master thesis is required to be done alone.

The Scope 3 accounting observational study consisted of completing the first five steps below in figure 4.2: (1) Define business goals, (2) Review accounting and reporting principles, (3) Identify scope 3 activities, (4) Set the scope 3 boundary, and (5) Collect data.

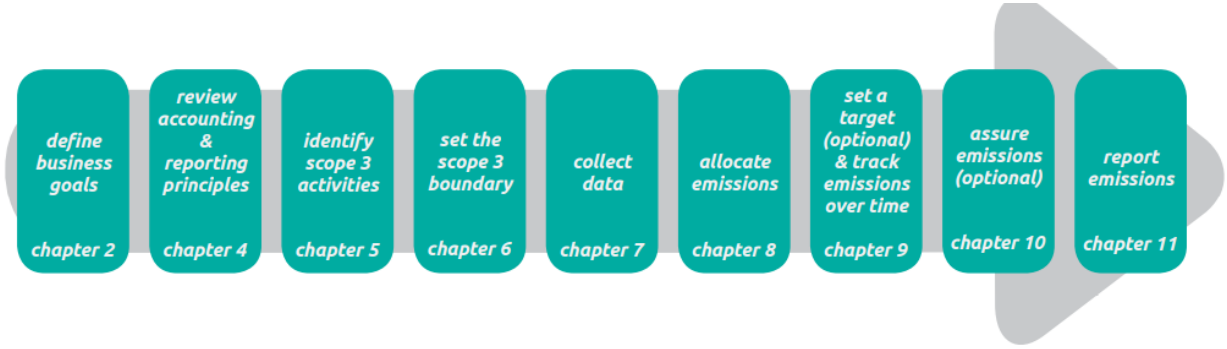

Figure 4.2. *Overviewing of steps in scope 3 accounting and reporting. Source: (WBSCD & WRI., 2011, p.5, p.19).*

The study began with the first and second steps of the definition of the business goals by Sar's strategy department and the principles were reviewed accordingly. This was completed via discussions with Sar personnel.

Per the Scope 3 Standard, the third step consisted of the use of the six criteria to discern the relevant categories. The six criteria are defined by the Scope 3 Standard in Table 4.1 (WBCSD & WRI, 2011, p.61):

Table 4.1
Criteria for identifying relevant categories. Source: (WBCSD & WRI, 2011, p.61).

Criteria	*Description*
Size	They contribute significantly to the company's total anticipated scope 3 emissions (see section 7.1 for guidance on using initial estimation methods)
Influence	There are potential emissions reductions that could be undertaken or influenced by the company (see box 6.2)
Risk	They contribute to the company's risk exposure (e.g., climate change related risks such as financial, regulatory, supply chain, product and customer, litigation, and reputational risks) (see table 2.2)
Stakeholders	They are deemed critical by key stakeholders (e.g., customers, suppliers, investors, or civil society)
Outsourcing	They are outsourced activities previously performed in-house or activities outsourced by the reporting company that are typically performed in-house by other companies in the reporting company's sector
Sector guidance	They have been identified as significant by sector-specific guidance
Other	They meet any additional criteria for determining relevance developed by the company or industry sector

With Rouven Uzelmaier, Sar's Business Developer for ESG and Energy Management as the primary interlocutor, each category was ranked by priority level and briefly assessed for each of the six criteria. Once all 15 categories are fully assessed, the relevant categories were discerned.

Once the categories were assessed, the fourth step entailed the scope boundary setting with the previous steps and core principles in mind. The list of requirements for setting the scope 3 boundary are that companies shall account for scope 3 emissions of CO2, CH4, N20, HFCs, PFCs, SF6, and NF3 that are emitted in the value chain and emissions from each scope 3 category according to the minimum boundaries detailed in table 5.4 of the Scope 3 Accounting and Reporting Standard (WBCSD & WRI, 2011, p.21). However, biogenic CO2 emissions from the value chain shall not be included in any of the 3 scopes inventories but must be included separately in the public report (WBCSD & WRI, 2011, p.21). Biogenic CO2 emissions refers to CO2 emissions from combustion or biodegradation of biomass, other GHGs from these instances must be included (WBCSD & WRI, 2011, p.61). Removals such as biological GHG sequestration may be included in the public report but are not included in any of the scopes (WBCSD & WRI, 2011, p.61).

Following the first four steps, the fifth step consisted of Scope 3 data collection for 4 weeks.

4.4.1 Observation data collection procedure

Throughout this process, the data for the observational study was collected in an observation journal which was detailed daily. According to Hancock & Algozzine (2017), the case study researcher should consider five factors during observational studies: (1) Identification of what must be observed to attempt to answer the research questions, (2) An observation guide should be created which includes a list of features to be addressed during observations such as time, date, location, names, name of positions of the persons being observed, specific activities and events, initial impressions and interpretations of said activities and events, (3) Gain access to the research setting, gaining participants' trust and being as unobtrusive as possible, (4) Recognition of the researcher's own personal role and biases as immersion and closeness to those observed give way to more frequent opportunities for bias and prejudice to seep into the data interpretations – steps to impartiality achievement must be explained and ensured, and (5) All ethical and legal requirements must be followed regarding the research and research participants (Hancock & Algozzine, 2017, pp.53-54).

These five factors were taken into consideration and implemented into the study. The observation guide included Hancock & Algozzine's (2017, p.56) recommendations of basic details of the observation, descriptions and reflections of the observations, and guiding questions regarding scope 3 relation and impact and RRI observations were additionally included. The observation guide can be referred to in the Annex. The kept observation journal includes over 4,500 words.

Yin (2018, p.114) notes 'reflexivity' as a weakness of participant-observational data due to participants behaving differently as they are aware that they are under a microscope so to speak. To address this, the observation journal will include reflexive writing as to "record the researcher's personal reflections of their values, interests, and insights information about self" (Nowell et al., 2017, p.3) to allow personal thoughts and idea evolution to be brought to light and thus allowing deeper engagement with the data (Nowell et al., 2017, p.7). Reflexive writing contributes to the establishment of an audit trail in tracking emergent impressions of data meaning and relationships between the data points and emergent impressions which can support trustworthiness of the study (Nowell et al., 2017, p.7).

4.4.2 Scope 3 data collection procedure

Scope 3 data was collected on the previously determined relevant categories.

Each category has varying methods of calculation. With the five core principles reviewed and in mind, the more specific quantitative calculation method was used for the estimation of Sar's value chain hotspots as opposed to the financial spend or revenue route as it is more rigorous and accurate (WBCSD & WRI, 2011, p.66). Depending on the category, the most accurate calculation method varies in name. As this was meant to be an as accurate accounting procedure as possible, primary data was sought as opposed to secondary data. Primary data, which is "provided by suppliers or other value chain partners" (WBCSD & WRI, 2011, p.71), is more uniquely accurate to the reporting company than secondary data which, in the context of scope 3 calculation, consists of industry-average data from published databases, government statistics, literature studies, and industry associations, financial data, proxy data, and other generic data (WBCSD & WRI, 2011, p.71).

The basic general equation used for calculation will be as follows (WBCSD & WRI, 2011, p.68):

$$GHG = Activity\ data\ \times Emission\ factor\ \times GWP$$

By category, this formula expands and becomes more complicated. However, this is the base form of every equation.

Activity data is a "quantitative measure of a level of activity that results in GHG emissions" (WBCSD & WRI, 2011, p.68). Examples of activity data include liters of fuel consumed, kilograms of material consumed, and hours of time operated (WBCSD & WRI, 2011, p.68).

An emission factor is a "factor that converts activity data into GHG emissions data" (WBCSD & WRI, 2011, p.68). Examples of emission factors include kg CO2 emitted per liter of fuel consumed, kg PCF emitted per kg of material consumed, and kg SF6 emitted per hour of time operated (WBCSD & WRI, 2011, p.68). Life-cycle emissions factors will be used wherever possible, apart from category 3, as life-cycle emissions factors are more comprehensive (WBCSD & WRI, 2011, p.70). For category 3, life-cycle emissions factors which exclude combustion will be used.

Global Warming Potential (GWP) is the value which describes "the radiative forcing impact… of one unit of a given GHG relative to one unit of [CO2]" (WBCSD & WRI, 2011, p.70). Firms

should use GWPs from the IPCC or the United Nations Framework Convention on Climate Change. Firms should use the latest GWP, however, if a scope 1 or 2 report have already been completed, then firms should use the same GWP as was used for the scope 1 or 2 reports (WBCSD & WRI, 2011, p.70).

To uphold the core value of consistency, the operational control approach was used to remain consistent with Sar's scope 1 and 2 report.

The primary scope 3 activities were pinpointed following the criteria from the scope 3 standard's criteria for identifying relevant scope 3 activities. The criteria are the size, influence, risk, criticality level deemed by stakeholders, whether they are outsourced, significance level deemed by sector guidance, and any other criteria which may fall specific to any particular sector or industry (WBCSD & WRI, 2011, p.61).

4.4.3 Thematic analysis

Thematic analysis was selected as the analysis method of the observational study at the recommendation of Hancock & Algozzine (2017, p.67) as thematic analysis is an appropriate choice for researchers with limited experience of conducting qualitative analysis (Hancock & Algozzine, 2017, p.67; Newall et al., 2017, p.2)

Thematic analysis arguably has theoretical freedom in that it does not abide by nor fall within one or any specific theory thus making thematic analysis flexible and a useful research tool for a wide variety of studies (Braun & Clarke, 2006, p.78). Thematic analysis can potentially provide a richly detailed, yet complex account of the data collected (Braun & Clarke, 2006, p.78).

Hancock & Algozzine (2017) describe thematic analysis as each piece of information (i.e. data) being examined in light of the research questions to form tentative answers to the research questions; tentative answers are thereby categorized into themes, the researcher repeating this process sometimes going over the same data multiple times to ensure all gaps in the analysis are closed; themes are then formed from the solidified tentative answers, these themes forming at least a part of the final answers to the research questions (Hancock & Algozzine, 2017, p.67).

For the case study researcher, there are at least five major criteria to formulate accurate and comprehensive themes of the case study: (1) The themes must reflect the purpose of the research

and appropriately answer the research questions, (2) The themes must be formed from the analysis of the exhausted and entirety of the collected data, (3) Themes may be hierarchical and interconnected, however novice researchers should strive for separate and distinct categories with contradictory themes being thoroughly examined and adjusted as necessary, (4) All themes should be as sufficient and explanatory as possible as is allowed by the data collected, and (5) All themes should be of comparable complexity (Hancock & Algozzine, 2017, p.67).

However while thematic analysis is commonly employed, little academic literature has been published on how to conduct a rigorous and trustworthy thematic analysis study (Nowell et al., 2017, p.1). Having adapted the original and widely accepted Lincoln and Guba's (1985) concept of trustworthiness incorporated into a study through the criteria of credibility, transferability, dependability, and confirmability, Nowell et al. (2017) produced a step-by-step model for conducting trustworthy and rigorous thematic analysis (Nowell et al., 2017, p.4). However, the model was geared towards the professional academic and was not suited for a master's thesis study. Therefore, the model has been adapted to exclude collaboration with other researchers such as 'peer debriefing', 'team meetings', and 'researcher triangulation' as this study was required to be conducted solo and without the conference of other researchers.

Table 4.2
Establishing Trustworthiness During Each Phase of Thematic Analysis
Source: Adapted from (Nowell et al., 2017, p.4)

Phase of Thematic Analysis	Means of Establishing Trustworthiness
Phase 1: Familiarizing yourself with the data	Prolong engagement with data Triangulate different data collection modes Document theoretical and reflective thoughts Document thoughts about potential codes/themes Store raw data in well-organized archives Keep records of all data field notes, transcripts, and reflexive journals
Phase 2: Generating initial codes	Reflexive journaling Use of a coding framework Audit trail of code generation
Phase 3: Searching for themes	Diagramming to make sense of theme connections Keep detailed notes about development and hierarchies of concepts and themes
Phase 4: Reviewing themes	Test for referential adequacy by returning to raw data
Phase 5: Defining and naming themes	Documentation of theme naming
Phase 6: Producing the report	Member checking Describing process of coding and analysis in sufficient details Thick descriptions of context Description of the audit trail Report on reasons for theoretical, methodological, and analytical choices throughout the entire study

Phase 1 begins with data engagement and familiarization. Qualitative data may stem from recorded observations, focus groups, texts, field notes from participant observations, reflexive journal entries, stories, and narratives, documents, multimedia, public domain sources, policy manuals, and photographs (Nowell et al., 2017, p.4). However, this thesis takes data from observations, field notes from participant observations, reflexive journal entries, and interviews, the latter of which is detailed in section 4.5. To maintain a sufficient audit trail, the entirety of the raw data will be archived in a well-organized manner for ease of later tests of adequacy if such tests become possible in the future (Nowell et al., 2017, p.4). Any prior knowledge of the data and initial analytic thoughts were documented during data collection and the data was dived in to deeply engage and immerse in and with the data which involves actively reading and re-reading through the data for meanings and patterns (Nowell et al., 2017, p.4). To address bias, the witness account will be honest and vigilant regarding personal perspectives, preexisting thoughts

and believes, and developing theories all of which will be detailed in the reflexive journaling (Nowell et al., 2017, p.4)

Phase 2 is the generation of initial codes. Again, reflexive journaling was used throughout to keep track of the coding process and to ensure a sufficient audit trail of emergent impressions and how thoughts and ideas evolved during data engagement. The use of a coding framework is imperative as a consistent approach throughout the coding process is necessary (Nowell et al., 2017, p.6). The coding framework was selected based on the salient issues that arose in the text itself within relevance to the research questions and was thus not pre-established prior to engagement with the data. The text was dissected using the coding framework by segmenting the text into meaningful and manageable pieces such as quotes, single words, or other criteria judged as necessary (Attride-Sterling, 2001, p.391). Code generation was thoroughly kept track of and archived for ease of access for later testing and auditing.

Phase 3 involved diagramming to make sense of theme connections and maintain detailed notes of the development and hierarchies of concepts and themes. The coding method used was 'thematic networks' which is a method of organizing thematic analysis, not the analysis itself (Attride-Sterling, 2001, pp.388-389). Thematic networks consist of three levels of themes: (1) Basic Themes which are the lowest-order premises evident in the text and are simple premises which are characteristic of the data and have little to no meaning without the wider context of the other two theme types; however, a group of basic themes represent an Organizing theme and a stronger clearer picture is painted (Attride-Sterling, 2001, pp.388-389). (2) Organizing Themes which group the basic themes together and summarize abstract principles, simultaneously representing the underlying concept behind a group of basic themes whilst dissecting the primary assumptions of the wider theme of the text as a whole (Attride-Sterling, 2001, p.389). (3) Global Themes which group organizing themes together and super-ordinate themes by capturing principal metaphors of the text as a whole; they summarize the lower-order clusters of themes, interpret the entirety of the texts, and represent the core of the analysis (Attride-Sterling, 2001, p.388). Themes are organized in a web-like structure to represent salient themes and the illustration of their relationships as referenced in Figure 4.3 below (Attride-Sterling, 2001, p.388). Note that despite the Figure 4.3 reference, more than one global theme may occur although they will be in significantly fewer number than the lower-order themes (Attride-Sterling, 2001, p.389).

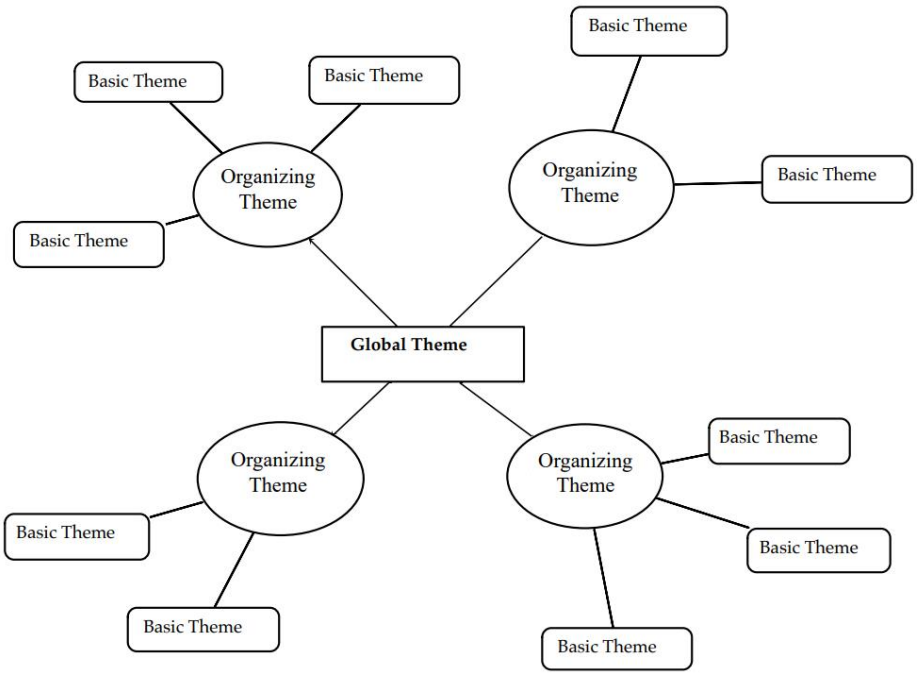

Figure 4.3. *Structure of a Thematic Network. Source: (Attride-Sterling, 2001, p.388).*

The method of thematic networks provides a method of data reduction and finding explicit rationalizations and their implicit signification (Attride-Sterling, 2001, p.388). Again, detailed notes were maintained throughout the diagramming and theme-identifying process.

Phase 4 consists of refining the identified themes and examining them for inconsistencies, validity, and coherency. Many themes will need refining while others may break down into further divided themes or need combining, while others may be removed altogether due to a lack of evidence (Nowell et al., 2017, p.9). Themes were refined into themes which were specific and unrepetitive yet broad enough to capture a set of ideas contained in multiple text segments (Attride-Sterling, 2001, p. 392). It was ensured that the themes accurately reflected the meanings evident of the data (Nowell et al., 2017, p.9).

Phase 5 was the defining and naming of themes which was thoroughly documented. Theme names are crucial as they are representations of core ideas of the data and analysis. Theme names were selected with careful consideration, and each has documentation of how the name surfaced and evolved throughout the study (Nowell et al., 2017, p.10). Each theme was examined as to how it fit into the overarching story of the data itself (Nowell et al., 2017, p.10).

Phase 6 was the final phase and the production of the report itself. The report was clearly communicated to be accessible to a critical reader to enhance credibility with the reflexive journaling notating methodological notes, trustworthiness notes, and audit trail notes referred to throughout the reporting process (Nowell et al., 2017, p.11). To construct merit, all of the relevant results were included, literature was referenced throughout the report to notate whether the literature supported the identified themes and findings, and the assumptions under the themes were clearly described (Nowell et al., 2017, p.11). The final analysis aims toward articulating an overall story as to how the themes connect and what they reveal regarding the research questions and member checking was the final step of phase 6 to establish the fit between Sar's views and the emergent themes' representation of Sar (Nowell et al., 2017, p.11).

4.4.4 Data quality

A major limitation to this study is that the true source material of the observation journal cannot be made public or sent to any private requests as it contains confidential information regarding Sar's operations and innerworkings. To address this, a separate document was created to document the evolution of theme identification.

The Scope 3 accounting data quality will be ensured as activity data will come from Sar itself or direct value chain partners and the emission factors came from trustworthy sources such as the UK's Department for Environment, Food, and Rural Affairs (DEFRA).

Internal validity is defined as "the validity of inferences about whether the relationship between two variables is causal" (Shadish et al., 2002, p.508) and may be addressed by the researcher asking themselves "How can cause-and-effect relationships between variables best be established?" (Hancock & Algozzine, 2017, p.39). Internal validity is assured in the observational study as the variables in question are the observations made during the beginning stages of Scope 3 reporting and Sar's ability to adopt Scope 3 reporting currently. The observations were made reflexivity imposed to ensure a lack of bias. Further, the observations made were causal with Sar's ability to adopt Scope 3 reporting as the conduction of the beginning stages of Scope 3 reporting are inherently connected to Sar's ability to adopt Scope 3 reporting, without question.

External validity is defined as “the validity of inferences about whether the causal relationship holds over variations in persons, settings, treatment variables, and measurement variables” (Shadish et al., 2002, p.507) and may be addressed by the researcher asking themselves “What factors may lead to the generalizability of a study’s findings?” (Hancock & Algozzine, 2017, p.39). External validity was ensured as the causal relationship remains consistent even with varying persons, settings, and variables. This case was regarding Sar AS with Sar personnel, however the causal relationship would remain if the firm type, firm size, and personnel changed.

Internal and external validity, used only as a dyad, concern the portrayal of background knowledge and assumptions, thereby construct validity demands particular attention (Jiménez-Buedo & Russo, 2021, pp.9552-9553). Construct validity is defined as “the degree to which inferences are warranted from the observed persons, settings, and cause-and-effect operations sampled within a study to the constructs that these samples represent” (Shadish et al., 2002, p.506) and may be addressed by the researcher asking themself “What are the best operational measures for the topics being explored?” (Hancock & Algozzine, 2017, p.39). Construct validity was ensured as evidence was convergent with data triangulation as multiple sources of evidence was conducted to measure the same phenomenon (Yin, 2018, p.128).

Reliability may be addressed by the researcher asking themselves the questions “Under what conditions may the operations of a study be repeated with consistent results?” (Hancock & Algozzine, 2017, p.39). Reliability was ensured by conducting the data collection and thematic analysis by following Nowell et al.’s (2017) guide for establishing trustworthiness, modified to suit this master thesis and followed steps such as reflexive journaling and heavy documentation.

4.5 Sustainability Transformation Model & Interviews

The primary objective of utilizing the STM and interviews was to examine how Sar’s sustainability reporting and Scope 3 reporting transformations interplay to best answer the second research question while still being able to pull insight as to the first research question.

The STM is an organizational change management framework aimed at businesses and was developed by Sancak (2023). The STM is based off of the well-established 10 key evidence-based steps model developed by Stouten, Rousseau, and Cremer and then divides each of the 10

overarching steps into a grand total of 50 sustainability-specific Transformation Steps (TS) each of which corresponds to an ESG factor (Sancak, 2023, p.1). 23 of the 50 steps are based off of existing research studies to legitimize their place. The remaining steps were developed by Sancak or are well ingrained steps already such as step 7 'Identify key performance indicators (KPIs)' (Sancak, 2023, pp.8-9). To view all 50 change steps and their sources, please refer to Sancak (2023, pp.8-9). The ten overarching broader change steps (CS) are (Sancak, 2023, pp.8-9):

CS 1. Assess the opportunity or problem is
CS 2: Select and support a guiding change coalition
CS 3: Formulate a clear and compelling vision
CS 4: Communicate the vision
CS 5: Mobilize energy for change
CS 6: Empower others to act
CS 7: Develop and promote change related knowledge and ability
CS 8: Identify short-term wins and use them as reinforcement of change progress
CS 9: Monitor and strengthen the change process
CS 10: Institutionalize change in company culture, practices, and management succession

The STM was utilized as a lens to gain an understanding of Sar's sustainability transformation and its Scope 3 transformation as the STM breaks it down into steps which makes it clearer to understand and forces an obvious comparison so possible themes and streams may emerge and be identified to form relevant questions for the interviews. Further, the STM is supported by a large amount of academic literature and is based on a well-established change management model thus making the STM more legitimate.

While the STM allows for the examination of the current situation and offers assessors, such as Sar's top management, to gain insight and reflection onto their current practices, the STM does not shed light on the past or future. To remedy this, interviews were conducted post STM assessment for deeper insight into the how's and why's of the current situation and what the projections for the future might be to gain a more complete and comprehensive picture.

PNS was employed with Sar top management and sustainability employees as EPC members and assessing the STM and the interviews which are discussed in the following section 4.5.2. To follow Nogueira et al.'s (2021, p.6) five key recommendations for the successful co-production of knowledge, this project did not require an open dialogue between parties but rather an investigation as to the ability of Sar to meet upcoming policy changes. Various members of Sar

top management and sustainability employees were consulted as to their thoughts on this and ensured their answers remained anonymous so as to collect diverse opinions and diverse expertise members. The consensus was not held as the holy grail but rather as an arrow guide. Each participant was selected carefully as to their legitimacy and knowledge. Top management may have power over the sustainability employees; however, answers were collected separately to allow for a safe space and encouraged unbiased and unmotivated answers. No scientists were asked to share incomplete work so the fifth recommendation is not applicable here.

4.5.1 Sustainable Transformation data collection procedure

The Chief Executive Officer (CEO), Sustainability Director, and the Business Developer for ESG & Energy Management assessed at which stage Sar was at for all 50 steps for both Sar's sustainability reporting transformation and its Scope 3 reporting transformation. A Microsoft Excel spreadsheet was utilized to organize the information. Each step was assessed at one of the four following stages: (1) Not started; (2) In start-up phase; (3) Started; (4) Fully implemented. The 4 stages were to gauge a thorough understanding of where Sar's current situation stands. The sustainability reporting transformation and the Scope 3 reporting transformation were assessed individually.

4.5.2 Interview data collection procedure

The Grounded Theory approach was applied to the interview data collection procedure and interview data reduction and analysis. While this thesis uses an abductive logic and philosophy, the discussion and defense of employing Grounded Theory with an abductive logic was explained in section 4.1 above. Pidgeon et al.'s (1989) model, referenced in Figure 4.4 below, was followed as it tailors Grounded Theory analysis towards knowledge elicitation, that is, interviews.

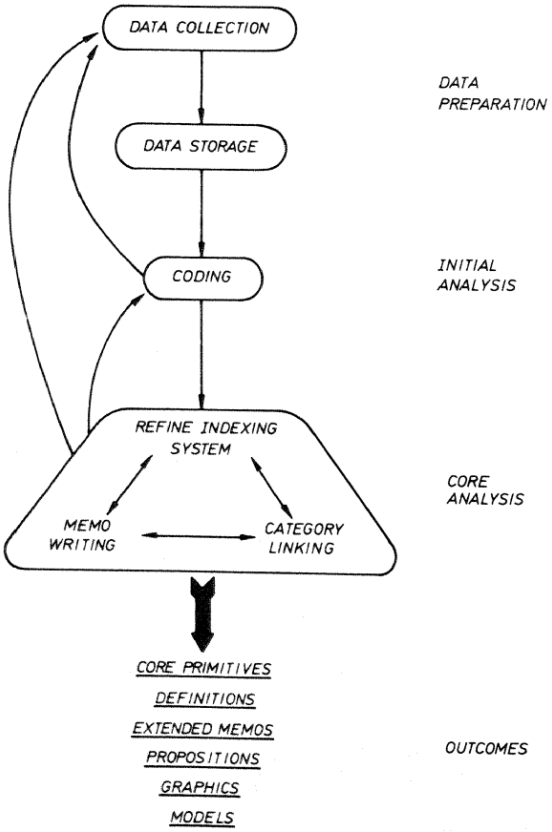

Figure 4.4*. Steps in Grounded Theory Analysis. Source: (Pidgeon et al., 1989, p.158).*

During data collection, rapport was established. The session was not dominated as the interviewee did the vast majority of the talking, and no 'leading' questions were asked (Pidgeon et al., 1989, p.159). Notes were taken during the interviews, a secure audio recording of each interview was taken so the raw data could be repeatedly referred to for production of rich thick descriptions of the phenomena of business' sustainability transitions and Scope 3 reporting transition (Pidgeon et al., 1989, p.159). The interview guide can be referred to in the Annex.

The interviews were each transcribed and stored in Microsoft Excel spreadsheets for easy access when it came time for the analysis (Pidgeon et al., p.159). To improve upon auditability thus reliability, raw data should then stored in a permanent secure location, however due to confidentiality and privacy concerns, the data will be permanently deleted upon completion and submission of this thesis on June 15th, 2023.

Following the STM assessment, three interviews were completed to gain a fuller comprehension of the interplay between Sar's sustainability and Scope 3 transformations. Yin (2018) notes that

interviews are on of the most crucial sources of case study evidence (Yin, 2018, p.118).

The interviews were semi-structured with an interview guide. As the interviews were shorter case study interviews (less than one hour), the interview guide was followed relatively closely as time did not allow for veering off into a conversational unstructured interview style (Yin, 2018, p.119). A consistent line of inquiry was followed and the conversational questions were verbalized in an unbiased manner (Yin, 2018, p.118).

Fluid conversational style interviews may be at risk of reflexivity which is when the interviewee is influenced by the interviewer's perspective, and the interviewee's influenced perspective then thereby influences the interviewer's perspective, and the cycle continues until the evidence is colored and negatively impacts the validity of the dataset (Yin, 2018, p.120). While reflexivity may not have been able to be completely overcome, sensitivity and caution was taken to lessen this effect (Yin, 2018, p.120).

The interview method was selected as it allows for a direct focus on the case study topics and research questions, it provides insightful explanations and person views such as perceptions, attitudes, and meanings which may not have been accessed through exclusively conducting the observational study detailed above (Yin, 2018, p.114).

However, the interview method subjects the data to several drawbacks which may negatively impact the dataset (Yin, 2018, p.114). Questions were articulated to avoid response bias due to the interviewee's perceptions of the interviewer. However, little can be done regarding inaccuracies due to poor recall.

Each interview was conducted separately to allow for privacy and to curb social desirability bias (i.e. when an interviewee adjusts their response to fit the perceived desire of those in the room/social acceptance). Further, the settings selected were the private, neutral, and distraction-free locations of the interviewees' respective private offices (Hancock & Algozzine, 2017, p.46).

Hancock & Algozzine's (2017) recommendations for conducting interviews was followed. First, the key participants were identified (Hancock & Algozzine, 2017, p.46) of Sar's CEO, the Sustainability Director, and the ESG & Energy Business Developer all of whom conducted the STM assessment. Only these three were interviewed as Sar did not have any other employees who were knowledgeable enough on Scope 3 and were not in a high enough position to be able

to speak with authority on Sar's business strategies.

Second, an interview guide including open-ended questions which captured the essence of the research questions was developed (Hancock & Algozzine, 2017, p,46)

4.5.3 Grounded Theory analysis

Corbin and Strauss' (1990) open, axial, and selective coding approach as this method provides more structure and is more active than Glaser and Strauss' (1967) original approach which uses substantive and theoretical coding and takes a more passive approach. Open-axial-selective coding is the merging of both data reduction and analysis (Blaikie & Priest, 2019, p.204).

The method of analysis was to code the data found with Corbin and Strauss' (1990) open, axial, and selective coding approach as this method provides more structure and is more active than Glaser and Strauss' (1967) original approach which uses substantive and theoretical coding and takes a more passive approach.

The first step was open coding as, as the name suggests, it allows for wider examination and measurement. Open coding is to break down data analytically with the purpose of revealing new insights by comparing things such as events, actions, and interactions for similarities and differences (Corbin & Strauss, 1990, p.12). These insights are then given conceptual labels and then broken down into further codes through theoretical sampling. All of this is to promote productive and comparative guiding questions for the researcher (Corbin & Strauss, 1990, p.12). Through constant questioning and comparison, the research is about "break[ing] through subjectivity and bias" by forcing "preconceived notions and ideas to be examined against the data themselves" (Corbin & Strauss, 1990, p.13).

Once open coding is complete, the second step was to conduct axial coding which consists of coding categories related to their respective subcategories and testing their relationships to avoid gaps in the theory. At this stage, more categories may surface. What subcategory conditions, context, strategies, and consequences are related and how they're related to their macro category were then examined (Corbin & Strauss, 1990, p.13). These relationships were repeatedly tested and verified. However, if an instance did not match the expected outcome, *why* perhaps there was an unexpected outcome was examined in order to modify and condense the hypothesis as

opposed to immediately claiming the hypothesized relationship as false (Corbin & Strauss, 1990, pp.13-14).

The third step is selective coding. While open coding was about identifying categories and subcategories, axial coding was about defining all of their relationships with each other. Lastly, selective coding is about identifying a core category to unify all of the data: the common umbrella of the entire research project. This is useful as it helps to reveal any missing gaps, inconsistencies, and attention-needing areas of the analysis (Corbin & Strauss, 1990, p. 14). The core category will have direct conditions, action and interactional strategies, or consequences relating to the other categories and subcategories. Corbin and Strauss (1990, p.14) recommend creating a diagram to assist in visualizing all of the categories. Further, selective coding assists in identifying poorly developed categories which are lacking in relationship with the other categories. A strong theory will facilitate each category and subcategory to have thick "conceptual density" (Corbin & Strauss, 1990, p.14).

4.5.4 Data quality

Internal validity was assured in the observational study as the variables in question are the emergent themes of the interviews and STM self-assessment and Sar's needs regarding Scope 3 reporting. Questions were focused on Sar's needs and the STM self-assessment highlights which Scope 3 reporting steps are not yet taken. Therefore, the two variables are unquestionably causal.

External validity was ensured as the causal relationship described above would hold regardless of a change in varying persons, settings, cases, or other variables.

Construct validity was ensured with data triangulation as multiple sources of evidence were conducted to measure the same phenomenon (Yin, 2018, p.128).

Reliability was ensured by articulating interview questions so that interviewees felt safe to answer as truthfully as possible.

4.6 Limitations of methods

As there were several methods for this thesis to unpack, the methods are visualized below in Figure 4.5.

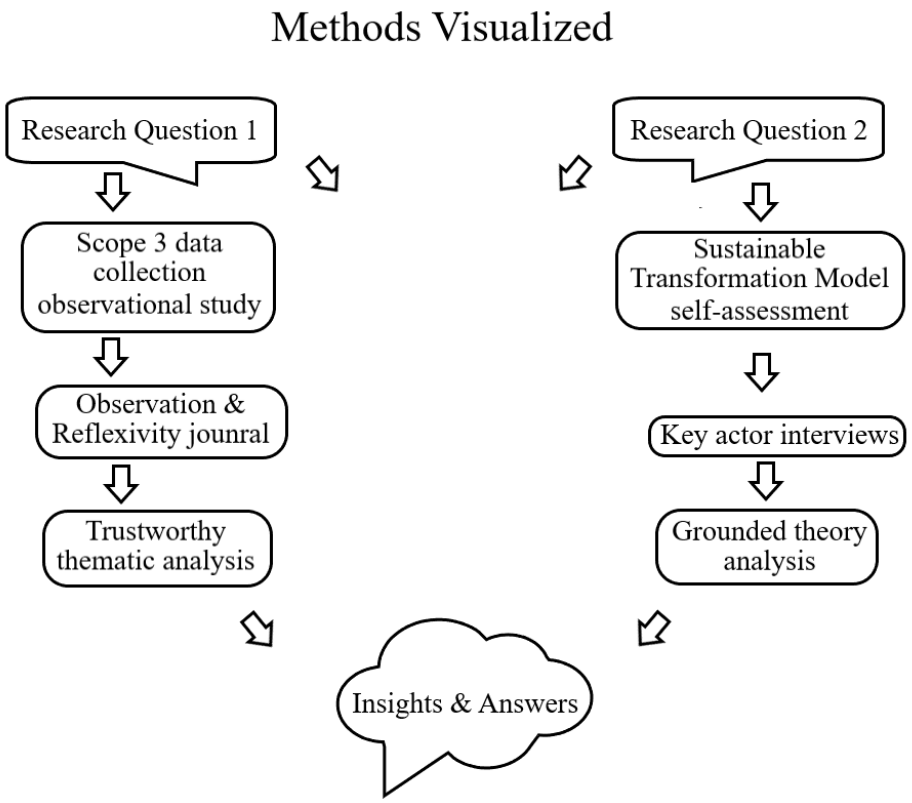

***Figure 4.5**. Methods visualized. Source: (Author's contribution).*

The primary method of data collection for the first research question is the observational study and thematic analysis as this method gave first-hand knowledge as to the situation at hand. The primary method of data collection for the second research question is the STM self-assessment and interviews as this method gave second-hand knowledge. However, both research questions drew on both methods. These methods were selected to be as diverse as possible. Data was ascertained from the researcher point of view and the EPC point of view.

However, there are a few limitations to these methods, despite the broad scope of coverage.

These methods include but one case study thus lowering external validity. While these methods may be applicable to this particular case, this may not be true for all cases or even most cases.

The purpose of this thesis is to describe Sar AS's situation at hand regarding Scope 3 reporting and is not meant to produce a novel research format.

Further, only three interviews were able to be conducted regarding Sar's Scope 3 perceptions and strategy and the STM self-assessment as no other personnel knew enough of Scope 3 to participate in such an interview. Fortunately, the interviews were able to be with key actors and top management allowing for a hearty discussion.

Finally, the time limit of this study was quite short as far as Scope 3 reporting is concerned. The Scope 3 reporting process typically takes months or perhaps longer for first time reporting firms. This then entails that only a small snapshot was able to be taken of Sar's situation as opposed to a proper fuller picture which would have been ideal. However, such a snapshot still gives meaningful insight into the problem at hand, albeit it paints a less complete picture.

5. Empirical analyses

5.1 Scope 3 accounting observational study

5.1.1 Business goals & Relevant category discernment

Sar has defined its business goals along with two of the scope 3 standard's listed common business goals:

Table 5.1.
Common business goals. Source: (WBCSD & WRI, 2011, p.12).

Business goal	*Description*
Identify and understand risks and opportunities associated with value chain emissions	• Identify GHG-related risks in the value chain • Identify new market opportunities • Inform investment and procurement decisions
Identify GHG reduction opportunities, set reduction targets, and track performance	• Identify GHG "hot spots" and prioritize reduction efforts across the value chain • Set scope 3 GHG reduction targets • Quantify and report GHG performance over time

These business goals were selected as Sar is at the earliest stages in engaging with the scope 3 value chain. There is a desire to understand the cruciality of scope 3 and to understand what the primary areas of the value chain are and what that means for Sar in terms of goals and what future business strategy may look like. With these business goals in mind, the 6 criteria were used to discern the relevant categories.

Table 5.2
Relevancy Criteria Priority Ranking. Source: (Author's contribution).

Criteria	Priority Ranking
Risk	1
Size	2
Stakeholders	3
Influence	4
Sector Guidance	5
Outsourcing	6

Risk takes the highest priority as reputation and regulatory risk are perceived as most important regarding GHG emissions reporting.

5.1.2 Scope 3 map

In this section, the steps taken, major events, and outcomes of data collection for the following categories will each be described to provide a general picture of where the thematic analysis stems from.

Category 1 & 2: Upon determining that Category 1: Purchased Goods and Services and Category 2: Capital Goods were likely the most relevant categories, I began by aiming to collect a list of all such goods and services. The list was available with a purchasing software program and contained 3,800 unique products which were purchased in the fiscal year 2022, however the list was arduous to read. Product names were in code or shortened. Item descriptions were often very similar or exactly the same as the product name, all of which made it difficult to discern exactly what the item was and what it was used for thereby presenting a large barrier in proceeding with data collection. After many rounds of the game tag and speaking with several people, it became clear that we could not continue and had to put a hold on these categories until the data management situation had progressed.

Category 10, 11, & 12: Category 10: Processing of Sold Products, Category 11: Use of Sold Products, and Category 12: End-of-Life Treatment of Sold Products were determined to be the second most relevant. While awaiting news on the proceedings of categories 1 and 2, categories 10, 11, and 12 were prioritized next. There were about 200,000 sold goods and services in the fiscal year of 2022. With the allotted timeframe, thermomechanical cuttings cleaner (TCC) generated waste oil of high quality, which has now been officially approved as a quality-assured product named CapOil by Sar, was focused on as it is the top selling product. Once the two purchasers of Sar's CapOil were contacted requesting Scope 3 relevant information regarding the CapOil, one company responded stating that they could not and would not supply the requested information. The other company did not respond at all as their business relationship with Sar has dissolved as of 2023. Both were contacted via their usual primary contact Sar representative so as to have a familiar voice reach out. However, this did not prove sufficient to garner the desired response.

Category 6: Despite being less relevant, Category 6: Business Travel and Category 7: Employee Commuting were prioritized next as these were categories that many other companies finalize and publish first as they have relatively accessible data.

For Category 6, the travel agency company which Sar uses (which will remain unnamed and will be simply referred to as 'Travel Agency') was contacted requesting the relevant Scope 3 information. Travel Agency had already sent Sar a report which included CO2e emissions, so the information was readily available. The emission factors used were stated to be several years old, there was no specifications of where the emission factors were sourced from, however.

While there was sufficient information to collect GHG emissions data on air travel, both land-based and sea-based travel were lacking in crucial data points, such as distance traveled, thereby making it impossible to calculate the emissions.

The following paragraphs dissect differing sources of emission factors and calculation. While the numbers calculated were produced from Sar's information, these figures were solely calculated by me, the author of this thesis, and discussed and reviewed with Rouven Uzelmaier, Sar's Business Developer for ESG and Energy Management. However, the figures were not calculated by an official Sar employee nor were these figures verified and audited by a third party. As this thesis is written in American English, all figures use the American decimal and not the European comma to distinguish between the ones and tenths places. That is, where Norwegian would write 1,25 to mean one and a quarter, I write 1.25. These figures were produced to give Sar insight and essential information regarding their Scope 3 map and for the research purposes of this thesis. Sar's final figures in their upcoming 2022 annual sustainability report may differ from the figures produced here.

The GHGP has a Transport Tool which allows the carbon accountant to fill in information, and the tool calculates the emissions automatically. As this tool is from the official GHGP, it would be easy to preconceive this tool to likely be the most accurate. However, the tool excludes CH4 and N2O, and only accounts for CO2 and resulted in the result of 37.180 metric tons of CO2e/p.km.

The difference of excluding these gases became clear when the same information was used to calculate the emissions with the UK's DEFRA and resulted in the much greater output of 70.9202 metric tons CO2e/p.km. DEFRA has a substantial set of reliable and up-to-date emission

factors, however they are uniquely adjusted to the UK situation. Ideally, every country would have its own set of emission factors. However, as this is not the case, DEFRA's emission factors were used as a comparison to the GHGP Transport Tool.

As air travel emission factors were not available for Norway, emissions factors from Chalmer's University of Technology in Sweden were also utilized for comparison and resulted in 64.05328 metric tons CO2e/p.km. However, it was not made clear whether the emission factors did or did not include CH4 and N2O.

Meanwhile, the Travel Agency, with the outdated emission factors, produced the result of 47.367 metric tons CO2e/p.km. Where they sourced these emission factors from, how old they were, and which GHGs they included were not known as the travel agent who originally sourced the emission factors no longer works for Travel Agency and the information was not shared with the current travel agents. Travel Agency did not have emission factors for any travel type apart from air.

Chalmer's University of Technology additionally had emission factors for hotel stays. While this is optional per the GHGP, Sar intends to include it in their final report for the Scope 3 reporting principles of accuracy and completeness. The Swedish university's emission factors resulted in an output of 0.7788 metric tons of CO2e/night. Again, it was unclear whether these emission factors included CH4 and N2O or not.

However, this is quite a marked difference when compared to the result using DEFRA's 2022 hotel stay emission factors which produced the output of 2.7051 metric tons of CO2e/night. The primary difference in the emission factors of hotel stays per night between the Chalmer's University and DEFRA was that Chalmer's University had separate emission factors for low climate impact hotels, carbon neutral hotels, and regular climate impact hotels. There are no strict guidelines as to what constituted a low climate impact hotel and therefore it was left to my discretion to decide. This may explain the wide gap of 2 metric tons of CO2e/night.

Further, this may not include all the hotel nights of Sar's business travel as all hotels were in Norway or the UK despite several air travel flights to countries that were not Norway nor the UK. It is unlikely that the Sar employees who took those flights never stayed in a single hotel as a part of the business trip.

Lastly, most business travel data went through the Travel Agency. However, other employees paid for the travel and were reimbursed later. While the financial department could send over the amount of money employees spent on business travel, specific travel information regarding Scope 3 relevant factors such as travel method, distance traveled, and so on was not previously collected and thus unavailable. The total amount spent was the only data point available. As this became known, Sar now plans to implement an information page of Category 6 information which Sar employees must fill out prior to being able to be reimbursed for their travels.

Table 5.3
Category 6: Business Travel emissions results. Source: (Author's contribution).

Data Source	Travel Type	Metric tons CO2e/unit	CO2	CH4	N2O
GHGP Transport Tool	Air	37.180	Included	Excluded	Excluded
DEFRA	Air	70.9202	Included	Included	Included
Chalmer's University	Air	64.05328	Included	Unknown	Unknown
Travel Agency	Air	47.367	Included	Unknown	Unknown
DEFRA	Hotel	2.7051	Included	Unknown	Unknown
Chalmer's University	Hotel	0.7788	Included	Unknown	Unknown
Travel Agency	Car	Missing Data: distance traveled, vehicle type, fuel type			
Travel Agency	Ferry	Missing Data: distance traveled, passenger type			

As depicted in the table above, different emission factor sources greatly influence the outcome and thus the final published Scope 3 report. This may heavily influence the Scope 3 reporting principle of accuracy.

These substantially differing results bring about several causes for concern for Sar's Scope 3 reporting endeavor: (1) How can Sar know which is truly the most accurate emission factor source? (2) How should Sar decide which emission factors to use? (3) How will this decision impact Sar as a business and the climate change landscape?

Category 7: For Category 7: Employee Commuting, a survey was created and distributed to all Sar employees after several rounds of revision and approval. As there was no template offered for such a survey from the GHGP – despite the GHGP recommending conducting a survey to collect Category 7 data – the survey was created from scratch, thereby consuming more time than desirable.

141 out of 280 employees responded, meaning that the final results are significantly lower than the true figure. Nonetheless, this is a relatively strong response rate of well over 50%. The results of the survey are reproduced in Table 5.4 below. The figures were calculated by myself and have not been verified by Sar nor by a third party.

Table 5.4

Category 7: Employee Commuting results. Source: (Author's contribution).

Vehicle Type	For GHGP Tool	Emission Factor (UK)	Final Results
Vehicle Type Options on Employee Survey	Car engine size/Other specification	Total kg CO_2e per km	Total kg CO_2e per km
Work From Home	No option in GHGP for work from home	0.340753315	4240.078685
Walk	No option in GHGP for walking	N/A	0
Bicycle, other non-fuel-powered vehicle types	No option in GHGP for bicycles, etc.	N/A	0
Car - unknown fuel type - small	No option in GHGP Tool for 'unknown' fuel	0.1444	0
Car - unknown fuel type - medium	type	0.17588	0
Car - unknown fuel type - large		0.22733	0
Car - unknown fuel type - unknown		0.17067	200.53725
Car - petrol - small	<1.4 liters	0.14652	1893.771
Car - petrol - medium	1.4-2.0 liters	0.1847	5876.9693
Car - petrol - large	>2.0 liters	0.27639	4221.85725
Car - petrol - unknown size	Unknown	0.17048	0
Car - diesel - small	<1.4 liters	0.13989414	8251.655848
Car - diesel - medium	1.4-2.0 liters	0.16800414	30147.83891
Car - diesel - large	>2.0 liters	0.20953414	11522.28236
Car - diesel - unknown size	Unknown	0.17082414	1196.281452
Car - hybrid - small	<1.4 liters	0.10332	971.208
Car - hybrid - medium	1.4-2.0 liters	0.10999	4200.760078
Car - hybrid - large	>2.0 liters	0.15491	5679.0006
Car - hybrid - unknown size	Unknown	0.12004	0
Car - plug-in hybrid electric - small	No option in GHGP Tool for Evs	0.05255	N/A
Car - plug-in hybrid electric - medium		0.08597	N/A
Car - plug-in hybrid electric - large		0.10148	N/A
Car - plug-in hybrid electric - unknown size		0.09349	N/A
Car - battery electric - small		0.04416	8578.12416
Car - battery electric - medium		0.04878	7929.393876
Car - battery electric - large		0.0555	4262.289
Car - battery electric - unknown size		0.0514	0
Car - LPG - small	medium	0.17823	0
Car - LPG - medium	medium	0.17823	0
Car - LPG - large	large	0.2668	0
Car - LPG - unknown size	average	0.19775	0
Car - CNG - small	1.4-2.0 liters	0.15803	0
Car - CNG - medium	1.4-2.0 liters	0.15803	0
Car - CNG - large	>2.0 liters	0.23578	0
Car - CNG - unknown size	Unknown	0.17517	0
Taxi	No option in GHGP Tool for Taxis	0.14876	0
Motobike - small	≤125 cc	0.08306	0
Motobike - medium	>125 to ≤500 cc	0.1009	398.3532
Motobike - large	>500 cc	0.13245	0
Motobike - unknown	Unknown	0.11355	346.89525
Bus - local	Bus - local	0.10778	861.1622
Bus - coach	Bus - coach	0.02733	0
Bus - unknown	Bus - unknown	0.0965	0
Train - national rail	Train - national rail	0.03549	0
Train - international rail	Train - international rail	0.00446	0
Subway	No option in GHGP Tool for subways	N/A	0
Ferry - walk-on	Ferry - foot passenger	0.018738	0
Ferry - drive-on	Ferry - car passenger	0.129517	0
Ferry - unknown	Ferry - unknown	0.112862	0
Airplane - less than 463km	Domestic	0.24587	0
Airplane - over 463km - economy class	Short-haul - economy	0.15102	0
Airplane - over 463km - first/business class	Short-haul - first/business	0.22652	0
Airplane - over 463km - unknown seat class	short-haul seating unknown	0.15353	0
		Grand total kg CO2e/km:	100778.4584
		Grand total metric tons CO2e/km:	100.7784584
	Adjusted to 280 employees, grand total metric tons CO2e/km:		200.1274352

From the above results, despite the GHGP Transport Tool being what one would believe to be the most reliable tool, proves to be less complete than the UK's DEFRA emission factors and calculating by hand.

Furthermore, several respondents failed to complete the survey in a sufficient manner, rendering their response invalid and thus unusable in the final calculations.

The results, however, successfully demonstrate that Sar's hotspot of employee commuting emissions stems from personnel who own diesel powered vehicles. The vast majority of employees drive, with very few who bicycle, walk, or take public transportation on a regular basis. Only 54 respondents claimed to work from home at least on occasion and only a mere 5 employees said that they at least occasionally carpool.

To explore why this might be the case, the survey included questions regarding how personnel value certain factors regarding their transportation method choices including distance, time, cost, comfort, and flexibility.

Table 5.5
Sar personnel's values (%). Source: (Author's contribution).

	Very Important	Important	Neutral	Not Important	Not Important At All
Distance	7.70	49.23	27.69	10.00	5.38
Time	13.24	60.29	14.71	3.68	8.08
Cost	9.38	33.59	34.38	14.84	7.81
Comfort	7.09	41.73	37.8	10.24	3.14
Flexibility	14.18	61.94	15.67	5.22	2.99

From Table 5.5 above, Sar employees value time and flexibility above distance, time, cost, and comfort. This may aid Sar's decision making regarding future transportation schemes to lower the Category 7 footprint. Further, it may explain the high usage of cars over lower emission options such as public transportation or bicycling as cars are typically significantly faster and more flexible to the individual.

There may be several reasons as to the lack of responses and sufficient responses on the survey. The survey was voluntary therefore meaning that only personnel who felt they had the time and desired to complete the survey would answer. Moreover, privacy could be an issue as many employees may feel it an invasion of privacy to have their transportation methods examined in such detail. Beyond this, employees may worry that if Sar is asking about their transportation

methods, that sometime in the future, they may be informed that they can no longer use their preferred method of transportation, unlikely as such a scenario may be.

There may also be employees who feel opinionated on the climate change situation and therefore purposefully do not respond as they do not feel it necessary as they may believe that climate change is not a problem, especially here in Norway where climate change as impacted the people here very little compared to other parts of the world where homes have burned or drowned.

With these myriad reasons, it may be wise for Sar to make the survey mandatory in the following years.

Sar's 2022 Scope 3 categories 6 and 7 total about 273.75 metric tons of CO2e in comparison to Sar's 2021 Scope 1 and 2 emissions which totaled 7,598 (Scope 1) and 11,595 (Scope 2, market based) or 315 (Scope 2, location based)[27]. Most of the data for category 6 was unavailable however thereby producing a relatively small figure here. Keeping in mind that this data is incomplete and only 2 out of 15 Scope 3 categories, and these 2 categories are often quite small compared to other categories, this brief Scope 3 mapping depicts that Sar's Scope 3 emissions may likely be quite substantial in size.

[27] https://www.sargruppen.no/sustainability (Last accessed June 14, 2023).

5.1.3 Thematic analysis

To examine the primary interest of what are the barriers to business' successful adoption of Scope 3 reporting, a barriers thematic network was developed with the Scope 3 reporting principles as the Organizing Themes.

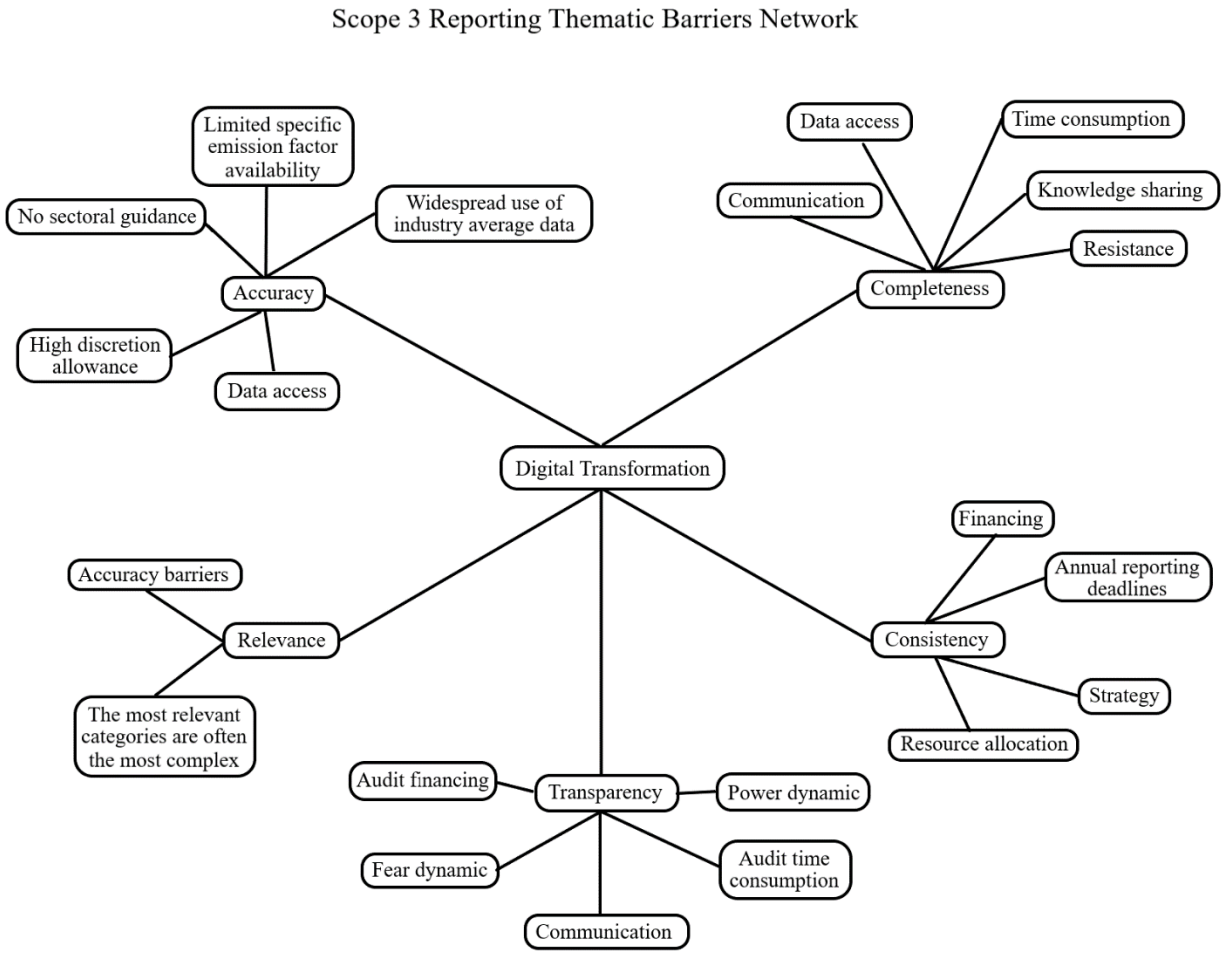

***Figure 5.1**. Scope 3 Reporting Thematic Barriers Network. Source: (Author's contribution).*

The Organizing Theme and Scope 3 reporting principle of 'Accuracy'. The primary barrier with Accuracy is data access. As there is limited data access and specific emission factor availability, businesses may use their high discretion allowance and lean towards a significant amount of industry average data as opposed to specific unique (i.e., accurate) data. This limited access and availability stems from a lag in digitization of the processes which emit GHGs. Further barring Accuracy is the lack of sectoral guidance. As there is currently a single general Scope 3 guide

meant for all businesses, it is too broad and leaves much to the imagination. Companies are left to their own devices to produce their own unique guidelines and procedures. However, companies are not necessarily Scope 3 experts, thus leaving the crucial activity to inherently biased non-experts which is a recipe for inaccuracy in the final report.

As Accuracy is compromised by its own barriers, this in turn compromises the Organizing Theme and Scope 3 reporting principle of ‘Relevance’. Without an accurate mapping, it is impossible to be sure of determining where GHG hotspots throughout the value chain are. Thus, it may be that subsequent irrelevant categories or areas of certain categories are focused on, despite their hidden irrelevance. Further, relevant categories are typically the most voluminous emitting categories. This then often entails a vast quantity of various emission sources which reveals that the most relevant categories are often the most complex and difficult to take on thereby compelling reporting companies to give priority to seemingly easier yet less relevant categories.

The Organizing Theme and Scope 3 reporting principle of ‘Transparency’ faces several barriers involving relationships and the auditing process. Scope 3 mapping must be verified (i.e., audited) by a third party to ensure accuracy and transparency. However, the auditing process takes both money and time, something not so easily afforded. Many businesses may lack those resources and choose to do without the auditing process, despite significant recommendations to do so, thus greatly reducing transparency.

Scope 3 reporting requires communication along the value chain. Communication always comes with a certain level of risk involved as communication is the key ingredient of relationships. Reporting companies have no choice but to reach out to value chain partners requesting Scope 3 relevant information and they have at least two ways of doing so: command and request. A request may be ignored as was seen throughout the observational study. Of the three partners reached out to: one agreed to meet, discuss, and ultimately send the information albeit the information was already prepared and easily sent within a few seconds at the click of a button; one responded with informing Sar that they could not and would not send Scope 3 information; and the third did not respond at all. From this experience it seems communication is a barrier for a few reasons.

Fear of irreversibly damaging profitable business relationships may stem from several possible scenarios. If the reporting company's Scope 3 information requests are ignored or not met, demanding the information may seem appropriate. However, such a demand could break a relationship apart if the value chain partner values the resources required for collecting the Scope 3 information more than the relationship with the reporting company. Further, value chain partners may be unwilling to disseminate Scope 3 information as it creates a glass wall around their operations thus exposing themselves to criticism, weakening what power they may have.

The Organizing Theme and Scope 3 reporting principle of 'Consistency' deals with several barriers. Consistency entails maintaining certain procedures and outcomes relatively evenly over time. However, several factors make this difficult in practice. Funds can be allocated differently each year and Scope 3 mapping is not inexpensive. Moreover, when a company is reporting on Scope 3 for the first time, it is often the most expensive as the initial entry costs must be paid, software, personnel training, time consumption, and external aid for example. This stems into the broader barrier of resource allocation. Reporting companies' needs and various goals will inevitably vary and deviate over time. Scope 3 reporting will not always be the top #1 priority. In order for there to be a need for Scope 3 reporting, a reporting company must continue to persist as an entity which requires Scope 3 reporting. Thus, resources will need to be allocated differently every year thereby making consistency challenging to obtain.

Strategy is the rulebook for how resources may be allocated. RRI demands an effective strategy to be laid out prior to embarking on a Scope 3 mapping quest. Yet, it is difficult to select an appropriate strategy with such high uncertainties surrounding accuracy and appropriateness of varying strategy options particularly as there is no sectoral guidance. Furthermore, a lack of solid strategy may stem toward a challenge in meeting annual reporting deadlines.

Communication is another barrier for the Organizing Theme and Scope 3 reporting principle of 'Completeness'. This is due to a lack of openness and willingness to share knowledge in the innovation ecosystem. Further, resistance to change and Scope 3 information divulgence was prevalent during the observational study. Some partners and employees may have perceptions and opinions regarding Scope 3 reporting and who should be responsible, some going so far as to call it "unfair" that the reporting company would be required to report on GHG emissions that itself did not emit. This lack of communication and forthcomingness leads to limitations in data

access which as described above stands as an obvious barrier to Completeness as well as without a full dataset, no project is complete. Lastly, time consumption is a barrier to Completeness in that there is a reluctance to allocate too much of the precious resource, time, toward Scope 3 reporting thereby potentially leaving the Scope 3 report incomplete. Moreover, there may simply not be enough time in the day to achieve full completion in the allotted time due to reluctance of participation from value chain partners and data unavailability.

The Digital Transformation is the Global Theme connecting all of the Organizing Themes as it was the one clear theme that all of the Organizing Themes had in common. To have access to Scope 3 data, digitization with software for tracking and data storage is crucial. This would allow for more accurate emission factors to support a comprehensive database of emission factors by country and sector. With the assumption that a publishment requirement was put into effect, digitization is essential for Transparency as if all emissions are digitally tracked and published, the information would be readily available for all to access and audit. Consistency demands digitization as it allows for automation which, if done correctly, would result in fewer errors regarding consistency. Further, Consistency would achieve sustainability as fewer resources would be required to maintain the process. Lastly, digitization is needed for Completeness as it provides all of the information if done correctly. Without human barriers, digitization uses less resources to put toward Scope 3 mapping as it would become automated and accurate, and the flow of information would be readily digitally available for all.

5.2 Sustainable transformation model & Interviews

5.2.1 Sustainable Transformation Model assessment

Table 5.6 below depicts the comparison of Sar's sustainability transformation and Sar's Scope 3 reporting transformation based on the total steps at each stage (not started to fully implemented) that Sar assessed itself at for each of the 50 sustainability change steps.

Table 5.6
STM Framework: Sustainability vs. Scope 3 Transformations Comparison.
Source: (Author's contribution)

	Not started	In start-up phase	Started	Fully implemented
Sustainability	0	2	45	3
Scope 3	15	18	15	2

At a glance, the sustainability reporting transformation is well integrated in Sar with 45 steps assessed as ‘started’, 3 steps ‘fully implemented’, and only a mere 2 steps as ‘en route to start’. Scope 3 reporting, however, is much farther behind with a total of 33 steps that have not yet been started. This comes as no surprise as the concept of ‘sustainability’ is older and has been integrated for longer than Scope 3 has. The GHGP did not publish the Scope 3 standard until 2011 and the CSRD has finally passed and will require Scope 3 from 2025. Meanwhile, sustainability initiatives began to enter front center stage much earlier.

Sar is perhaps relatively early as the CSRD is currently simply in hearing with the Norwegian government and not official implemented yet. However, Sar is pursuing the Scope 3 reporting path as if it does fall under the CSRD as a risk management strategy, to lead by example with business partners and customers, and to stay relevant and competitive. Further, Sar assessing itself as ‘started’ on most of the sustainability transformation steps perhaps reflects the attitude that the work of sustainability is never ‘finished’, rather it is continuously refined and adjusted.

To dive deeper into Sar’s Scope 3 reporting transformation situation, the bar chart below depicts each of the ten broader change steps (CS) and what percentage of that change step is at regarding each of the four stages: (1) Not started, (2) In start-up phase, (3) Started, and (4) Fully implemented.

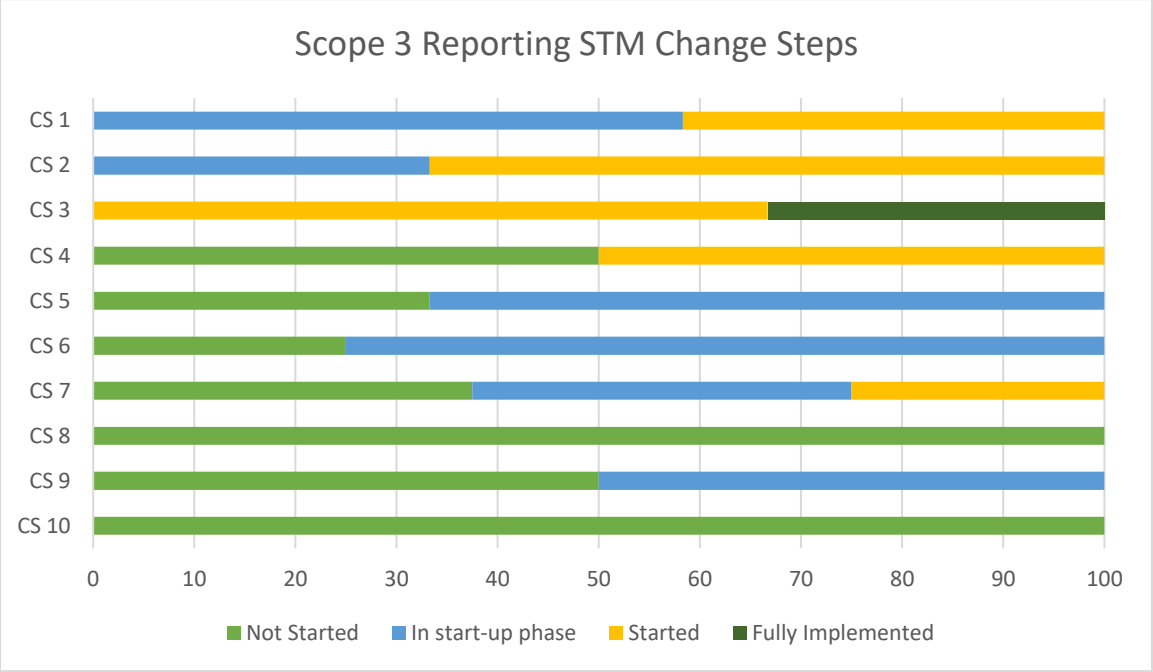

***Figure 5.2**. Scope 3 reporting STM change steps. Source: (Author's contribution).*

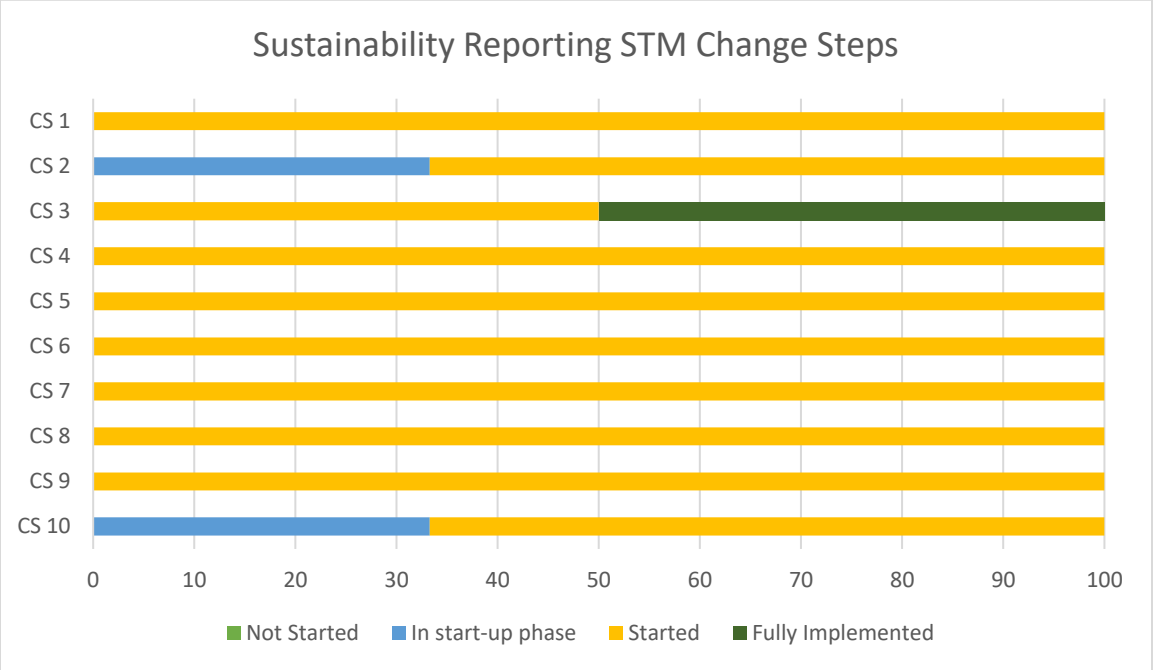

***Figure 5.3.** Sustainability reporting STM change steps. Source: (Author's contribution).*

The first key takeaway from comparing the two bar charts above is that Sar's sustainability reporting transformation is farther along than the Scope 3 reporting transformation. What becomes clearer is that Sar's Scope 3 reporting transformation is Sar is following the intended path of the sustainability change steps and is farther along in the earlier change steps and further behind in the later change steps.

The second key takeaway is that the only steps which Sar considered themselves to have 'fully implemented' in both the Scope 3 reporting and the sustainability reporting transformations was sustainable transformation Step 18: *Align with national or regional sustainability guidelines, principles, and regulations* and Step 19: *Align with sectoral sustainability guidelines, principles, and regulations*. Further, the sustainability reporting transformation also had Step 16: *Consider global sustainability anchors, mainly the SDGs and the Paris Agreement targets* as at the 'fully implemented' stage. This indicates that Sar prioritizes external landscape regulations and guidelines above all other steps.

Sar's priority now is to focus on Change Step 5: Mobilizing energy for change and then Change Step 6: Empower others to act, Change Step 7: Develop and promote change related knowledge and ability. It is therefore of interest whether Sar faces any particular barriers towards initiation and implementing these steps, and how any such challenges may be addressed and overcome to advance.

However, a major limitation of the STM is that it offers no explanation as to how the current results of the STM came to be nor does it offer a projection into the future of how the situation will change although it does offer the opportunity for reflection by the firm's top management who take part in the STM assessment. More that it offers the broad goal of 'sustainability' or 'Scope 3 reporting' and steps of how to get there. But it offers no explanation of how the current situation came to be or how it will certainly change.

Mixed methods were utilized to gain deeper insight beyond what the sustainable change management framework offers. In the next section, interviews regarding the STM, Sar's Scope 3 reporting transformation, and Sar's sustainability reporting transformation will be discussed and analyzed.

5.2.2 Grounded theory analysis

The Grounded Theory open, axial, and selective coding of interviews produced the following umbrella and selective code:

‘With the complexity of Scope 3 and intertwining of the digital and sustainability transformations, businesses seek and require external direction, collaboration, and guidance. As these are the earliest stages with the CSRD only recently announced, businesses are still early enough to implement RRI from the beginning of this R&I process of Scope 3 adoption.’

This selective code consists of three separate parts: (1) Digital transformation is necessary, (2) Businesses seek external direction, collaboration, and guidance regarding Scope 3 reporting, and (3) As the Scope 3 reporting niche is still in the early stages of adoption by the SDG 12.6 regime, there is still time for businesses to utilize RRI for a more sustainable and ethical niche adoption process.

No fewer than 17 distinct barriers surfaced throughout the interview process. The barriers are listed and discussed in no particular order, however barriers with inherent links are placed together:

(1) *Technical adoption* appears as a barrier as certain technical factors are needed to adopt Scope 3 reporting such as defined procedures and key personnel who undertake Scope 3 reporting responsibilities. However, many of these factors have not yet been identified, scheduled, or implemented.

(2) *Organizational restructuring* appears as a barrier as Scope 3 reporting requires personnel to take on these tasks which thereby require organizational restructuring. Organizational restructuring is a barrier in that change is rarely easy yet is an opportunity for real positive change.

(3) *Uncertainty* appears as a barrier as Scope 3 reporting is new, niche, and few experts are available for consultation. Scope 3 reporting is rather gray and foggy as a wide boundary is left to the reporting company’s discretion yet there is high pressure for accuracy else criticism of greenwashing and irresponsibility looms on the nearby horizon.

(4) *Financing* appears as an obvious barrier as change, transformation, and development costs money that businesses are apt to allocate as efficiently as possible. Scope 3 reporting does not

obviously nor directly bring in revenue thus making financial allocation a difficult decision to make if a possible decision at all for the reporting company.

(5) *Strategy development* appears as a barrier perhaps relating to technical adoption, organizational restructuring, uncertainty, and financing as strategy development consists of the identification of how to technically adopt Scope 3 reporting, how to restructure organizationally, resolve the uncertainties, and allocation financing.

(6) *Firefighting focus* appears as a barrier as Scope 3 reporting is a large and complex task, thus it is easy for the undertaker to hyperfocus on small fires such as data organization for a single category thereby neglecting the smoking building of the entre Scope 3 reporting progress development that should be being focused on.

(7) *Young personnel needed* appears as a barrier as young prospective employees may not be aware that Scope 3 reporting exists nor may they be interested in working with a company which may have abundant emissions.

(8) *Young personnel retention* appears as a barrier as young personnel tend to work their first job and quickly move for a different industry, a higher salary, or a variety of other reasons which could cause them to desire to move companies.

(9) *Lack of expertise* appears as a barrier as in addition to the fact that Scope 3 reporting is relatively new thus few people are highly knowledgeable on the subject, there is also no formal education on Scope 3 reporting for those wishing to pursue becoming an expert. The GHGP offers an 8 to 20 hour online course which results in a certificate for $325 as of June 11, 2023[28], however, one may argue that such a short course is inadequate for producing ‘experts’ and this links back to the financing barrier as well.

(10) *Complexity of data* appears as a barrier in two parts. The first being that Scope 3 is a vast complex entanglement of invisible lines. It is not easy to see the red thread which connects one category to the next nor is it easy to distinguish the differences between several of the categories, such as the many methods, modes, and function of transportation for example. The second part is the complexity of the reporting company’s data which may be disorganized or worse, useless, in terms of Scope 3 reporting.

[28] https://ghgprotocol.org/corporate-value-chain-scope-3-standard-online-course-0 (Last accessed on June 11, 2023).

(11) *Lack of data* appears as an obvious barrier as Scope 3 reporting is new thus the required data is likely to be uncollected in the first place as many companies were likely uninterested in GHG emissions prior to the landscape policy push.

(12) *Digitization transformation* appears as a primary barrier which surfaced the most frequently throughout the interview process. A major challenge to overcome is that many of the processes which result in GHG emissions are not tracked in a way helpful to GHG emission calculation. Making these processes trackable requires digitization. For example, categories 1 and 2 would require that every single product and service purchased by the reporting company be tracked and their lifecycle emissions tracked as well. From the mined or grown material through production, processing, refinement, sale, use, disposal, and all transportation steps in between. To fully calculate the Scope 3 emissions, this requires deep knowledge of extremely fine details for every single step: what fuel was used, how much electricity was consumed, how much electricity was lost from the grid, how much does the material weigh, how many kilometers did the product travel, how exactly was the item used, how exactly was the specific item disposed of, and the list goes on. Imagine this, but for every single item produced ever across an entire company which sees thousands upon thousands of products for use and sale across the world. Some may say it's impossible as a waste management company may not be able to know where every waste item originated from. Hence, digitization is needed from the birth of a product at the mine or the farm, each product with a unique item number, all the way to disposal with every step digitally recorded and tracked. This is the dream of Scope 3 accuracy. However, realistically, reporting companies are allowed the discretion of utilizing industry averages and population sampling. Yet, aiming for accuracy requires digitization processes beyond the current practice which requires R&I, financing, and expertise on its own apart from Scope 3.

(13) *Lack of openness in the ecosystem* appears as a barrier as such a complex project requires cross actor communication. However, many value chain partners are hesitant to share information as they may not have the information or may not wish to burn resources to retrieve the information. Further, as companies compete, knowledge sharing comes with a price some companies are unwilling to risk payment of. Further, sustainability employees are often the only sustainability employee in an entire company and few companies have dedicated sustainability employees who specifically focus on sustainability reporting such as Scope 3 reporting. This

makes the communication network small resulting in Scope 3 accountants having few to no options for someone to turn to when they need advice or help.

(14) *Complexity of actor web relations* appears as a barrier related to knowledge sharing and lack of openness in the ecosystem. Relationship dynamics come to the forefront regarding Scope 3 reporting. For example, a value chain partner may not wish to release GHG emissions information as they may not want that information to reach the public. However, the reporting company must have this information. This may then result in a complicated relationship where power and fear bubble to the surface.

(15) *Communication of goals externally and internally* appears as a barrier related to the complexity of actor web relations barrier. Communicating Scope 3 reporting goals truthfully and effectively while maintaining healthy, sustainable, and prosperous relationships with employees, partners, and customers is a trembling tightrope to balance on. If goals are not communicated effectively, relationships could be strained, some may receive an inaccurate message, others may draw incorrect conclusions, all of which could make Scope 3 reporting information more difficult to obtain or worse, it could make the reporting company suffer overall.

(16) *Lack of scope 3 sector guidance* appears as a barrier related to communication, relationships, complexity of data, and strategy development. Sector guidance on Scope 3 refers to industry sector which may further vary by country or region far larger countries which may vary in operations and practices from east to west for example. Without sufficient or proper guidance, reporting companies are left to their own devices to establish best practices. This then leads to uncertainty and to similar companies conducting Scope 3 accounting in quite different ways despite being in the same sector in the same geographical area. Overall, this leads to inaccuracy and may lead to miscommunication and further uncertainty.

(17) *Lack of incentives* appears as a barrier as companies need motivation to decide to take on such a complex, resource exhaustive, and relationship-risky task. However, the only formal incentive is the CSRD which only pertains to EU companies with only the possibility of Norwegian companies currently. There is no subsidy, grant, or any other formal incentive. Furthermore, the disincentives outweigh the incentives: the reporting company’s reputation is at risk if the emissions are too high or if inaccurate and Scope 3 reporting is resource expensive with high uncertainty. It comes as no surprise that many are seeking external incentives.

As seen in Figure 5.4 below, the intertangling of these barriers runs deep with digitization, uncertainty, lack of scope 3 sector guidance, lack of openness in the ecosystem, lack of expertise, and lack of incentives as the most inherent to the Scope 3 Reporting challenge, digitization as the central core.

These barriers are summarized in Table 5.7, which provides briefer one-line titles per barrier. This can be useful to analyze other cases, which would further add to this cataloguing of potential barriers. The barriers are further visualized as a web in Figure 5.4 to show the relationship across barriers, indicating that several of these must be tackled in a cohesive and synergistic manner.

Table 5.7
Scope 3 reporting barriers. Source: (Author's contribution).

Barrier Number	Barrier Title
1	Technical adoption
2	Organizational restructuring
3	Uncertainty
4	Financing
5	Strategy development
6	Firefighting focus
7	Young personnel needed
8	Young personnel retention
9	Lack of expertise
10	Complexity of data
11	Lack of data
12	Digitization transformation
13	Lack of openness in the ecosystem
14	Complexity of actor web relations
15	Communication of goals externally and internally
16	Lack of scope 3 sector guidance
17	Lack of incentives

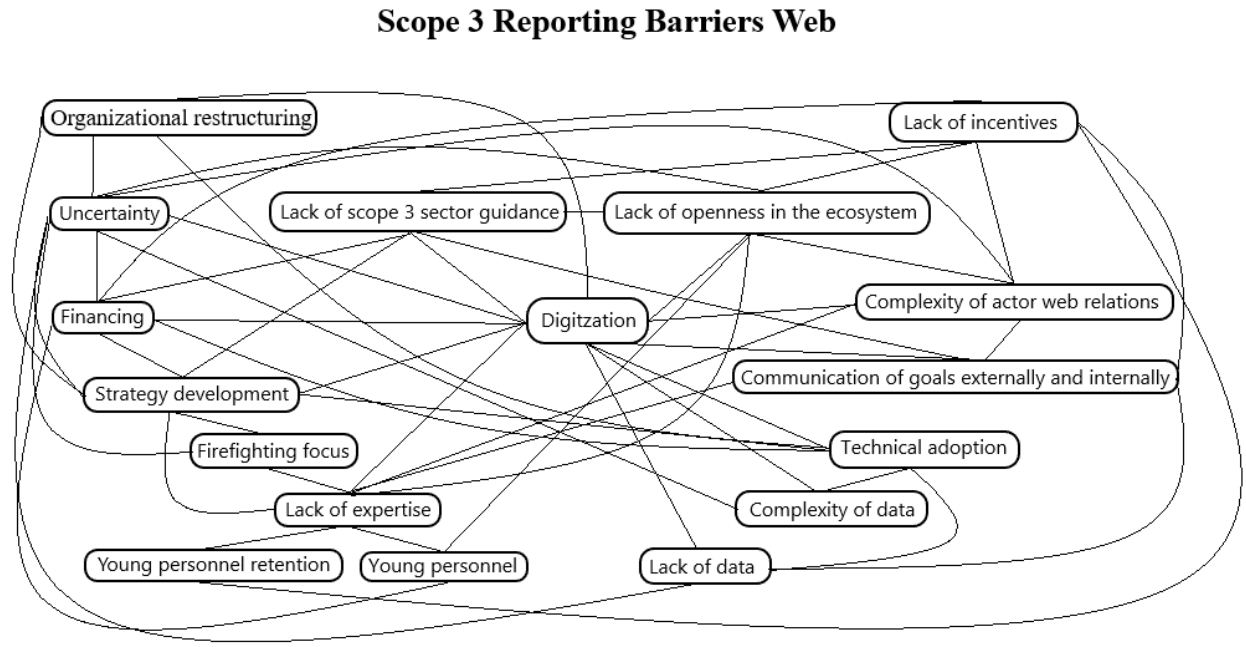

Figure 5.4. *Scope 3 Reporting Barriers Web. Source: (Author's contribution).*

While RRI was not specifically mentioned during the interviews, RRI impressions were sighted in 17 of the axial codes. Below, tables 5.8 and 5.9 categorize the axial codes into different the four RRI dimensions (Stilgoe et al., 2013) and the six EU RRI policy agendas.

Table 5.8
RRI Impressions with dimensional framework. Source: (Author's contribution).

Axial Codes	Dimensional Framework			
	Anticipation	Reflexivity	Inclusion	Responsiveness
Aware of 'accurate data' barrier; aims to lessen industry average data use	•	•		
Aware that current progress is marked with ESG data points, not roadmap STM-like steps	•	•		
Aim of marking sustainability progress with specific questions instead of broad generic goals	•	•		•
Aim of reprting Scope 3 as accurately, completely, and relevantly as possible	•			
Aim to improving Scope 3 reporting annually, consistently	•			
Aware that it is unlikely to have a complete and accurate Scope 3 map by 2025	•			
Aware of the 'lack of openness in the ecosystem' barrier	•	•		
Aware that collaborating/participating with other businesses on Scope 3 is crucial	•		•	
Aim of sharing and openness regarding data and sustainability	•		•	
Aware that many people know only pieces of sustainability	•	•		
Aware that no one has a full understanding of sustainability	•	•		
Next step for Scope 3 strategy is to build a knowledge base	•			•
Aim of "people, planet, profit"	•	•	•	•
Wary of possibility of greenwashed façade	•	•		
Aware of need of Scope 3 expertise knowledge	•			
This thesis study is the first step taken for scope 3 reporting		•		
Sustainability roadmap is in development	•			•

Table 5.9
RRI Impressions with EU policy agendas. Source: (Author's contribution).

Axial Codes	EU Policy Agendas					
	Ethics	Gender equality	Governance	Open access	Public engagement	Science education
Aware of 'accurate data' barrier; aims to lessen industry average data use	•		•			
Aware that current progress is marked with ESG data points, not roadmap STM-like steps	•		•			
Aim of marking sustainability progress with specific questions instead of broad generic goals			•			
Aim of reprting Scope 3 as accurately, completely, and relevantly as possible	•					
Aim to improving Scope 3 reporting annually, consistently	•					
Aware that it is unlikely to have a complete and accurate Scope 3 map by 2025	•					
Aware of the 'lack of openness in the ecosystem' barrier						
Aware that collaborating/participating with other businesses on Scope 3 is crucial				•		
Aim of sharing and openness regarding data and sustainability	•			•	•	
Aware that many people know only pieces of sustainability						
Aware that no one has a full understanding of sustainability	•					
Next step for Scope 3 strategy is to build a knowledge base	•					•
Aim of "people, planet, profit"	•	•	•	•	•	•
Wary of possibility of greenwashed façade	•					
Aware of need of Scope 3 expertise knowledge						•
This thesis study is the first step taken for scope 3 reporting						•
Sustainability roadmap is in development			•	•		

The tables above depict the clear picture that Sar is properly beginning RRI albeit despite being unaware of RRI as a concept.

This is seen in that Anticipation is the dominant of the four dimensions of Stilgoe et al.'s (2013) RRI dimensional framework. Horizon scanning is the primary indicative technique applied to conduct Anticipation. Horizon scanning and anticipating what is up ahead is a solid mark of

beginning RRI as one should look both ways before crossing the street i.e., it is prudent of the reporting company to maintain foresight in their planning and strategizing phase prior to heading off into the reporting journey.

Reflexivity impressions closely follow behind Anticipation impressions as this gives depth and reflection to the subsequent choices in strategy and governance. The majority of the RRI impressions reflect that Sar is ‘aware’ of the situation and ‘aims’ to better the situation. This is highly indicative of a sustainable pavement choice for the Scope 3 reporting pathway.

As for the EU policy agendas, Ethics is the strongest agenda depicted by Sar. This indicates a strong start for RRI embedment into the Scope 3 reporting process. Reflection and the aim of perfection within reason are the primary emergent themes from the RRI impressions. All five of the Scope 3 reporting principles of accuracy, transparency, consistency, completeness, and relevancy are built stronger with the Ethics policy agenda as ethics offers a sound foundation for target definition. While Anticipation has caused Sar to draw their arrow and Reflexivity adjusted the bow angle, Ethics perhaps refined the target itself.

Meanwhile, Governance is the act of shooting the arrow. The EU policy agenda of Governance falls quite behind Ethics, yet this comes to no surprise as Sar has only just begun walking the Scope 3 reporting pathway. These first Governance steps are imperative to be taken after thorough thought has been input into innovation strategy.

While Sar is beginning their Scope 3 reporting with RRI journey with a good start, across the table, Sar’s two major weak points are Gender Equality and Public Engagement when it comes to their Scope 3 reporting strategy. These two factors had the fewest impressions. However, this was not a full-fledged RRI evaluation, merely an impression snapshot. The interviewees were not specifically asked about those topics; they were asked broad questions about Sar’s Scope 3 reporting strategy and the RRI impressions stemmed from the emergent themes of those broad questions. The evidence clearly points towards a strong start for RRI with perhaps care and attention needing allocation towards Gender Equality and Public Engagement.

6. Discussion

Prior to departing into the discussion, the research questions of this thesis are reiterated here as the discussion's primary goal is to discuss the multiplicative answers to these questions.

1. How can businesses transition towards the successful adoption of Scope 3 into the SDG 12.6 sustainability reporting regime?
2. How do current business sustainability reporting practices interplay with Scope 3 reporting for businesses keen to embrace it, as shown through a case study?

The discussion is meant to combine the most relevant aspects of the literature review and the empirical findings of the study to answer the research questions through the frame of the theories employed in this thesis. This chapter is organized into four primary sections, one for each of the theories employed in this thesis and how they all tie together into one final section for policy and further research recommendations as a conclusory remark. First the key findings will be briefly summarized, then in each section, the key findings related to that theoretical context will be discussed, and then extrapolate a discussion of the main key findings which contribute the most to providing insight as to the research questions. Each section will lastly consider how the empirical findings are important and what their limitations are; that is, what the empirical findings can do and what they cannot do.

The four key findings

The first finding is that each of the five reporting principles have several barriers related to embarking on the Scope 3 reporting journey. Of both the barrier network and web produced, digital transformation is the core barrier as this is the one barrier which all five reporting principles have in common and are impacted by to the highest degree.

The second finding is that the sustainability reporting transformation is significantly further along than the Scope 3 reporting transformation. This comes as no surprise as Scope 3 entered the stage significantly later than sustainability reporting. Companies which have begun the Scope 3 journey may be ready to begin constructing and declaring a Scope 3 roadmap.

However, these roadmaps may greatly benefit with an RRI framework embedded into them per

the third key finding. This is particularly well as companies may already reflect a strong RRI approach to Scope 3 reporting with the dimensions of Anticipation and Reflexivity and the EU policy agenda of Ethics as the areas which indicate said strong approach. However, as it may not be obvious to do so and Scope 3 reporting tends to be kept an inside private process, the EU policy agendas of Gender Equality and Public Engagement are at risk of being neglected in Scope 3 reporting strategies despite being essential namely for the reporting principles of Relevancy, Completeness, and Transparency.

The fourth primary key finding was the selective code which serves as an umbrella to the findings of the interviews which notes that Scope 3 reporting marries the sustainability and digital transformations together, business seek and require external direction, collaboration, and guidance due to the complexity of Scope 3 reporting, and that businesses are early enough to embed RRI into the Scope 3 reporting adoption process.

6.1 Multi-Level Perspective

Landscape

The landscape push has catalysed businesses into Scope 3 reporting action. However, as discussed in the literature review section 2.2 and as the first key finding supports, the Scope 3 reporting niche may be underdeveloped and struggle to be successfully adopted into the SDG 12.6 regime. It was found in both the literature review and the empirical results that Scope 3 is notoriously complex and difficult to achieve true Accuracy and Completeness. It has been argued that it is currently impossible for businesses to achieve accuracy and completeness (Patchell, 2018, p.954). To discuss, the primary key findings of the empirical analyses will be examined.

It has been argued that firms will not act on Scope 3 reporting without a clear signal from policymakers and that there are limits to climate governance experimentation which could be improved upon by embedding a "coherent international regulatory setting which generates a clear stimulus for corporate action" (Hickmann, 2017, p.94).

The fourth key finding of the empirical analyses of this thesis notes that firms are seeking external direction, collaboration, and guidance. While the focus of this thesis is how can businesses develop/improve, it is impossible to ignore the regulatory side. Merely requiring

Scope 3 reporting and leaving the rest to non-governmental organizations (NGOs) and individual firms is simply not enough. Firms do not have the means to produce an accurate and complete Scope 3 mapping on an annual basis without government intervention. This is in part due to a major lack of guidance.

While the Scope 3 Standard is quite comprehensive, it is certainly meant to serve as a broad outline and better stands to serve governments in developing their own unique guidelines fit for their individual country's situation. Further, these guidelines must be sector specific as one can imagine that Scope 3 accounting for an energy distributing firm is vastly different from a financial services firm.

It is unrealistic to expect every single business to produce their own unique procedures and guidelines, moreover it would be wholly inefficient and would result in wide discrepancies in that similar businesses may conduct Scope 3 reporting with quite different approaches rendering valid cross-firm comparison impossible. Moreover, it is unrealistic to expect every single firm, or even most firms for that matter, to produce their own unique individual Scope 3 guidelines while maintaining all five reporting principles of Accuracy, Completeness, Consistency, Relevance, and Transparency.

Producing specialized guidelines further entails the individual firms' innovation of digitization. Per the first key finding, digitization is crucial to the Scope 3 reporting transformation as all five reporting principles heavily rely upon digital transformation as discussed in section 5.1.3. However, digitization requires specialized expertise which will likely require firms to hire third party assistance therefore cause the price of Scope 3 reporting innovation to skyrocket. Regardless of federal requirements, if the cost of conducting an accurate and complete Scope 3 report is higher than the potential violation fines incurred by not conducting a Scope 3 mapping at all, then a firm is unlikely to elect an activity where the cost outweighs the benefit. Further, to have perfect accuracy, all GHG emitting activities must be tracked digitally not only for accuracy but transparency as well. Once the system is in place, consistency will be easier to maintain. With accurate reports, locating and focusing on relevant emission hotspots will be easier as well. With all other principles fully activated, completeness can be ensured.

However, such a digitization process cannot occur in one single entity. All entities across the value chain must participate and collaborate on such a process thereby meaning that all entities

would need to collectively consult a single digitization specializing firm which would be unlikely to occur.

Furthermore, as with the current GHGP Scope 3 Standard, firms are able to use industry average data when unable to obtain specific accurate data thereby rendering the incentive to pursue an expensive digitization pathway obsolete. If firms do make the hefty digitization investment, it is, again, unlikely to divulge and spread their investment to competitors.

With that said, policymakers could help make headway toward this issue by allocating funding for country-sector-specific Scope 3 guidelines and for Scope 3 related digitization and rewarding firms for complying with research and pilot projects.

As per Muench et al.'s 2022 report for the European Commission, the key requirements for the twin transition are listed in Table 6.1 below.

Table 6.1

Key Requirements for the Twin Transition. Source (Muench et al., 2022, pp.75-76)

Social	Ensure just transitions
	Increase societal commitment to the need to change
	Ensure privacy and ethical use of technology
Technological	Implement innovation infrastructure
	Build a coherent and reliable technology ecosystem
	Ensure data availability and security
Environmental	Avoid rebound effects
	Reduce the environmental footprint of green-digital technologies
Economic	Create enabling markets
	Ensure diversity of market players
	Equip labor with relevant skills
Political	Implement adequate standards
	Ensure policy coherence
	Channel investments into green-digital solutions

While firms may hold as firm a grasp as possible onto the five reporting principles, it goes without saying that per the Table 6.1 above, the twin transition cannot occur without significant influence and pushing from the regulatory landscape. Firms may develop/improve by focusing on the social, technological, and environmental aspects of the key requirements for the twin transition to allow for a wider window of opportunity for Scope 3 adoption into the SDG 12.6 regime.

Finally, as county and sector specific guidelines would build an easily scalable staircase up the Scope 3 reporting mountain, country specific emission factors would guarantee improved accuracy. Currently, many countries do not have any unique emission factors at all and therefore reporting firms have no choice but to select trusted emission factors from other countries which may have a significant negative impact on accuracy as laws, standards, and norms vary significantly by country and culture. For example, the UK's DEFRA emission factors were used in the emissions calculations in the empirical analysis of this thesis. However, the emissions were largely Norwegian in origin. Norwegian environmental laws are different from UK environmental laws. Thus, accuracy would be significantly improved with country-specific emission factors which could be promoted with allocated federal funding.

Regime

The interplay of current sustainability reporting practices and Scope 3 reporting is give and take. As per the second key finding of the empirical analyses, the sustainability reporting transformation is farther along than the Scope 3 reporting transformation. For the SDG 12.6 sustainability reporting regime to successfully adopt Scope 3 reporting, the regime must be open and accepting.

Acceptance markers can be seen in several points. As the SDG 12.6 requirements accepts Scope 3 reporting as a type of sustainability reporting, Scope 3 already qualifies for adoption into the regime. Further, as SDG 12.6 accepts Scope 3, firms are already familiar with Scope 3 to some extent and are already producing Scope 3 mapping or at least what it entails.

As some firms have been able to acquire sustainability professionals, these professionals are likely to have a keen interest in Scope 3 reporting as it is so crucial to addressing climate change thereby potentially making the Scope 3 reporting adoption smoother.

However, non-acceptance markers can be seen in several points as well. The requirement of most sustainability reporting in SDG 12.6 does not consist of practices which directly aid Scope 3 reporting. Identified in the interviews conducted, general sustainability reporting is unrelated to Scope 3 reporting. They are related in the sense that they both address climate change. However,

measuring ESG values and gender diversity in a firm require completely perpendicular practices than Scope 3 accounting and reporting does.

Furthermore, while SDG 12.6 accepts Scope 3 reporting, it is not required therefore full adoption is incomplete and has left Scope 3 reporting farther behind than if it became a requirement.

Niche

The Scope 3 reporting niche may be underdeveloped still and unable to join the SDG 12.6 regime as is. As the first key finding notes the multiplicative barriers regarding Scope 3 reporting and as discussed above in the 'Landscape' section of 6.1, with the sink-or-swim style of encouragement, firms are apt to do what they can regarding Scope 3 mapping and simply use industry average data as they may not have the means or the desire to use an abundance of resources to produce a fully accurate and complete report. It may be up to the regulatory landscape to produce effective and sufficient guidance and emission factors, yet it is up to the niche itself to play the greatest part in avoiding mal-adoption into the regime.

Firms may choose to conduct Scope 3 mapping due to federal requirements or as they may deem it effective risk management, however the many barriers encourage the use of industry average data as opposed to specific data. While allowing industry average data may enable firms to conduct a seemingly full Scope 3 mapping on paper and may appear as a success on the surface, in reality, this does not produce accurate nor complete reports, yet it allows for this practice. Currently, there is an understanding to allow this as the beginning stages of adoption will be wobbly and uncertain due to the numerous barriers regarding Scope 3 reporting as highlighted in the empirical analyses first key finding. However, new updated versions could be published in stages phasing out the allowance for discretionary usage of industry average data to coincide with the decrease in regulatory allowance of this practice as well and with the federal release of country and sector specific guidance and emission factors as there will no longer be any excuse nor reason to need to use industry average data.

The identified barriers could be supported by the twin sustainability and digital transformations. As the digital transformation was the core barrier of the barrier network produced from the observational study and the barrier web emerged from the interviews, it goes without saying that

progression of the digital transformation would aid Scope 3 reporting adoption into the SDG 12.6 regime. Further, as Scope 3 reporting is an inherent biproduct of the sustainability transformation, progression of the sustainability transformation could see and increased support to optimize the pitfalls of Scope 3 reporting funding, guidance, and resource allocation to the cause.

The key findings contribute to the discussion of Scope 3 adoption success by enabling the formation of new insights into the situation at hand. Figure 6.1 below is a potential guide to ensuring successful Scope 3 adoption into the SDG 12.6 regime through the efforts of all three landscape, regime, and niche levels of the MLP transformation pathway.

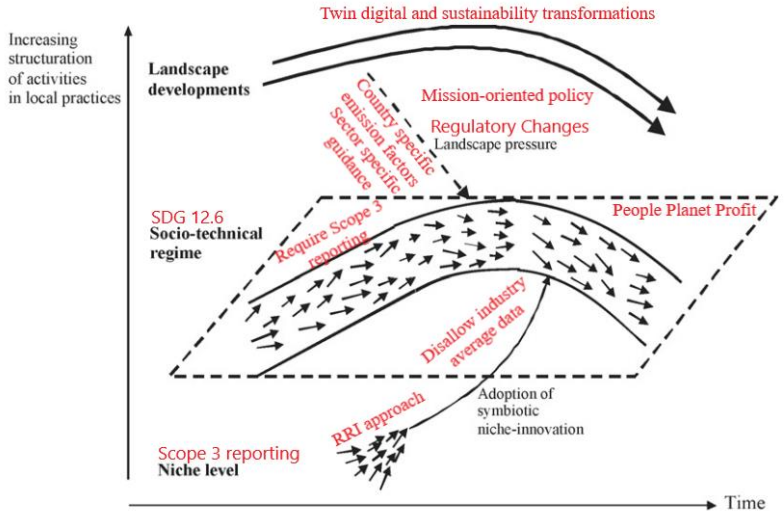

***Figure 7.1**. Successful Scope 3 transformation pathway. Source: (Author's adaption of Figure 5 from Geels & Schot (2007, p.407).).*

The twin transition sits at the landscape level above all else as this inevitable transition plays a part in widening the Scope 3 adoption window of opportunity, it will happen regardless of the Scope 3 and the SDG 12.6 situations.

Regulatory changes were identified to be the mission-oriented policies. However, these policies must include country and sector specific guidance and emission factors to ensure the five reporting principles.

The SDG 12.6 regime must require Scope 3 reporting else firms are likely to ignore the window due to the difficulty of Scope 3 mapping and high resource consumption.

Lastly, firms must embrace an RRI approach to Scope 3 reporting which will be discussed at length in section 6.3. Further, firms must avoid utilizing industry average data as much as possible as the GHGP's allowance of industry average data may enable more Scope 3 reports, however these reports' Accuracy, Completeness, Relevance, and Transparency are all greatly compromised.

However, the findings of the epistemological analyses are limited in that there is still much more to explore regarding this topic and thee findings cannot provide a complete picture nor a complete solution to the problem at hand. It can only provide an inkling of insight for decision making. Implementing sector-specific guidance, taking an RRI approach, learning of what barriers firms face, among the other findings, are all important findings with rich insight. However, this does not answer how governments should go about creating their country and sector specific guidelines and emission factors so that results across countries are still comparable. Nor does this describe how SDG 12.6 may begin requiring Scope 3 reporting or how firms should navigate away from industry average data despite so much specific data remaining unobtainable.

6.2 Post-Normal Science

The aim of this thesis is to answer the primary research question of how businesses can improve/develop to aid Scope 3 niche adoption into the SDG 12.6 regime. The EPC was consulted as these are the very people who are nearest to the problem studied, those who must do the improving/developing. To reiterate, the EPC are those who are not specifically experts nor professional researchers, however as they are so near to the problem, they hold invaluable insight as to the problem at hand.

While none of the key findings of this study could have been found without consulting the EPC, the fourth key finding is perhaps the most relevant to the PNS frame. From the EPC perspective, firms have been left to sink or swim as far as the CSRD is concerned. Scrambling to figure out what to do and how to do it for their own unique situation has led to a poor fostering of the innovation ecosystem.

Reporting firms may pursue the five reporting principles as fully as possible, however their ability to achieve these objectives are wholly reliant upon their value chain partners' cooperation. While the CSRD requires firms of a certain size and income to conduct Scope 3 mapping, the value chain partners are not required to comply nor provide the necessary information despite that an accurate mapping is impossible without this.

As discussed in section 2.4, the CSRD is the pinnacle of climate change mitigation mission-oriented policy goals. These policies are meant to drive and invigorate mission-oriented innovation ecosystems, in this case, specifically the sustainable transformation ecosystem. This coincides with the key finding of businesses seeking external direction and guidance. However, the CSRD simply requires Scope 3 reporting and does not pair with sector nor country specific guidance thereby leaving firms to more or less 'sink or swim'. As discussed above, if firms put great time and resources into the development of Scope 3 reporting processes, it is unlikely that they will share this hard-earned information as their value chain partners will require different processes; it is only their direct competition who would benefit from their newfound knowledge. This hardly fosters the sustainable transformation ecosystem as this is not representative of coopetition nor cooperation. The CSRD offers no incentive for knowledge sharing, yet this could be remedied through political incentives.

An analogy of this is that the government has required (the CSRD) farmers (firms of a certain size) to harvest apples (do Scope 3 reporting) and has given them apple tree seeds (the GHGP) that someone else (WRI and WBCSD) gave them. However, the government never taught the farmers how to grow apple trees (sector-specific guidance). Understandably, the farmers are disgruntled, stressed, and unlikely to later share their hard-earned apple tree cultivation techniques with the other farmers in the area.

The traditional PNS frame is that of uncertain facts, disputed values, high stakes, and urgent decisions (Funtowicz & Ravetz, 1993). Figure 6.2 below depicts key findings through this PNS frame.

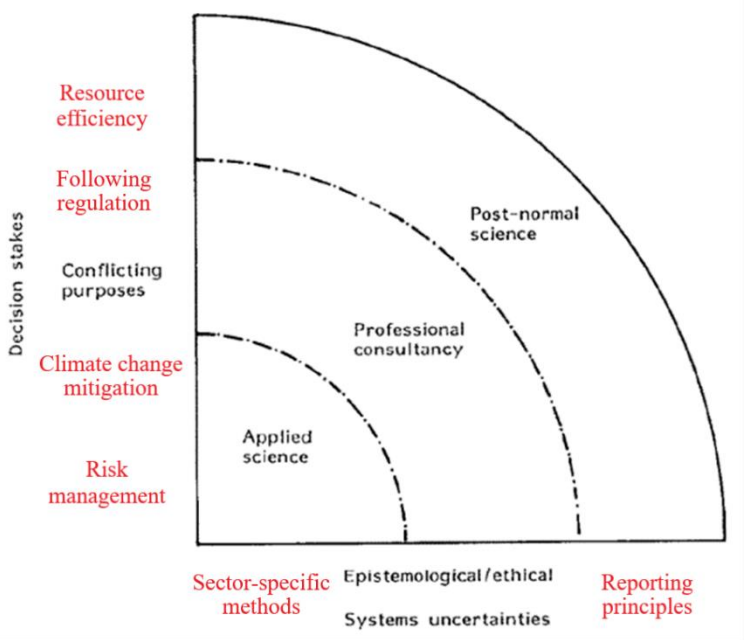

***Figure 6.2**. Scope 3 reporting through PNS lens. Source: (Author's contribution).*

The list of conflicting purposes and the two uncertainties are in no particular order. From the epistemological analyses, the above figure was able to be formed. Firms may have at least four distinct purposes for conducting Scope 3 reporting and therefore may have mixed uncertainties and ethical stances.

Firms may conduct Scope 3 reporting simply to increase resource efficiency by identifying GHG hotspots and reducing emissions at these points by improving upon operations. Others may simply be following regulation and have no other reason. Some may map their Scope 3 emissions to improve upon their risk management strategy as they may foresee upcoming regulations or other standards in which it is beneficial to reduce GHG emissions as early as reasonably possible.

As the myriad barriers were identified in the first key finding, it became clear that the sector-specific methods are perhaps the most protruding and painful uncertainty. As already discussed above, methods for conducting Scope 3 mapping may greatly vary between sectors as the operations and emissions location along the value chain can be quite different from firm to firm, such as, for example, between a paper mill and a concrete producer.

Meanwhile the standard of the five GHGP reporting principles are perhaps the most conflicting ethical stance. As discussed above, the reporting principle of Accuracy has significant opportunity to improve with the digital transformation. However, to what end? Some may resist

and argue that privacy is more ethically important than the reporting principles of Transparency and thus resist this transformation thereby resisting Accuracy. The firms whose only goal is to simply follow regulations regarding Scope 3, these are perhaps the firms most at risk of downgrading the ethical value of the reporting principles as they may only do the bare minimum required and nothing more. Differing firms will certainly have differing opinions on the ethical stance of the reporting principles as their motivations and purposes will be different. Further, opposing stances in the same value chain may cause major constraints in the final report outcome.

These key findings were able to help us paint the picture discussed and bring these issues to the forefront which is a crucial discussion if climate change is to be properly addressed. However, these findings leave us with questions that cannot be answered by this study. How can firms navigate these differences? How can firms collaborate and cooperate despite possible opposing purposes and ethical stances? To what extent might poor navigation affect the reporting principles and Scope 3 report quality?

6.3 Responsible Research & Innovation

The combination of the third and fourth key findings is the most inherent to RRI as it regards that firms are already off to a strong start regarding employing an RRI approach to their Scope 3 reporting adoption into the SDG 12.6 regime.

With this in mind, the analyses point toward that firms are still early enough to embed RRI properly into their Scope 3 reporting adoption process which will aid in combatting the mal-adopted version as discussed in section 6.1. Moreover, firms show several early signs of RRI without necessarily being aware of it (Stahl et al., 2017, pp.11,13).

The empirical analyses additionally noted that firms may be positive and open to adopting an RRI approach, however firms may also be prone to the preconception that they are a service or product provider and not necessarily an ‘innovator’ and therefore preconceive RRI as irrelevant to them signaling that they may not be educated as to what RRI is or its myriad benefits in various situations. Scope 3 reporting is not only new but requires new processes which must be created from scratch and are unable to be adopted through simply altering a preexisting function

or resource. Therefore, Scope 3 reporting demands innovation by the reporting firm. Firms in the earliest stages of Scope 3 reporting, especially those unaware or uneducated on RRI aspects, who elect to adopt an RRI approach may benefit from taking a learning approach. For example, the Research Council of Norway has adopted a learning approach to RRI (Egeland et al., 2019).

6.3.1 A learning approach

As this thesis focuses on how businesses can improve or develop to aid the Scope 3 reporting niche to successfully be adopted into the SDG 12.6 business sustainability reporting regime, the theme of innovation repeatedly surfaced as a business which would conduct Scope 3 reporting would thereby be a member of a mission-oriented innovation ecosystem, the sustainable transformation innovation ecosystem specifically.

A major constraint of RRI is the lack of uptake incentives for research organizations and businesses (van de Poel, 2021, p.339). An RRI compliance standard could be implemented before products are able to formally enter the market; and with this in mind, there has been increased attention to ramping up the development of methods and tools to measure, assess, and monitor RRI performance (van de Poel, 2021, p.340).

Perhaps the two primary tensions of RRI assessment are reliability vs. validity and window-dressing vs. crowding-out (van de Poel, 2021, p.354). Aiming to increase reliability by choosing attributes which are objectively more measurable, may decrease construct validity as this may ignore attributes which are normative and value-laden and thus less easily measured (van de Poel, 2021, p.354). Further, attempting to avoid window-dressing (i.e., the phenomenon of pretending to, but not actually meeting ethical standards) may increase the odds of crowding-out (i.e., the phenomenon of when intrinsic motivation to achieve good is replaced by external incentives thus decreasing or ‘crowding out’ the original intrinsic motivation) (van de Poel, 2021, pp.352-355).

To navigate these RRI assessment pitfalls, van de Poel (2021) argues that selecting one of three rationale approaches towards RRI can curb these shortcomings. The three rationales identified are (1) learning, (2) accountability, and (3) incentivizing and are all detailed in Table 6.2 below (van de Poel, 2021, p.357).

Table 6.2
Rationales for RRI assessment. Source: (van de Poel, 2021, p.357)

Rationale	*Main aim of RRI assessment*	*Assumed motivation for RRI*	*Self-assessment*	*Objectively measurable indicators*	*Context*
Learning	Improve RRI performance through learning	Intrinsic	Possible and even desirable	Not necessary	Need for context-specificity
Accountability	Show compliance and reliability to outside world	Can be both	Undesirable	Preferable if not required	Need for (some) comparability between contexts
Incentivizing	Improve RRI performance through external incentives	Extrinsic	Possible but usually undesirable	Preferable	Need for (some) comparability between contexts

However, van de Poel (2021) describes that the three rationales are not suited to simultaneous use as one method (van de Poel, 2021, p.355). The learning rationale will be defined followed by a description of why the learning rationale cannot be combined with the other two approaches.

The learning rationale is geared toward improvement of RRI performance through garnering new insights and learning new skills and can be divided into first-order learning and second-order learning (van de Poel, 2021, p.355). First-order learning grasps how to better achieve goals, while second-order learning is how to identify the goals and question existing value and belief systems.

Learning may improve increased awareness and sensitivity to RRI issues and to the abilities to work with varying stakeholders and connect R&I to the values, expectations, and needs of society (van de Poel, 2021, p.355; Argyris & Schön, 1978). For RRI to support second-order learning, it must allow for evolving goals and perspectives as opposed to checking predefined narrow boxes (van de Poel, 2021, p.355).

The learning rationale is inherently difficult to combine with accountability as learning requires an openness for failures and deviations whereas accountability specifically is closed to evolution in the sense that it demands objectively measurable indicators and independent assessment whereas learning demands self-assessment and normative indicators (van de Poel, 2021, p.356).

Further, learning stems from intrinsic motivation whereas the incentivizing rationale stems from external motivation thus potentially promoting the emergence of the crowding-out phenomenon of the external motivation crowding out and diminishing the intrinsic motivation and thus undermining learning (van de Poel, 2021, p.356).

These key findings and the finding of how to adjust for them are essential to this study as they focus on how businesses may develop/improve, inherent to the research questions. However, there are still aspects left desired as to further development of these findings. The analyses and discussion describe that firms are still early enough in Scope 3 reporting to adopt an RRI approach as firms may have a positive reception to it and may already be reflecting RRI aspects albeit unknowingly, and that a learning approach may be most advantageous due to this earliness and lack of awareness of RRI. However, these findings do not give a detailed picture of how individual firms may embed RRI to fit their unique situation.

7. Conclusion

GHG emissions accounting is a vital step toward taking responsibility for rapid climate change. To examine the problem of Scope 3 reporting adoption into the SDG 12.6 regime, a case study of Sar AS's ability to take on Scope 3 reporting was explored. The overarching problem was viewed through the MLP to understand the interactions of the various parts of the problem. The MLP noted that Scope 3 reporting is an underdeveloped niche which is attempting to jump through a window of opportunity created by a regulatory landscape push to symbiotically join the SDG 12.6 regime. PNS was used as the climate change and Scope 3 reporting situation is highly uncertain, with high stakes, and conflicting ethics. Further, the EPC was consulted as to gain deeper understanding of the perspective of those closest to the problem at hand, those who will actually be doing the Scope 3 reporting. Lastly, RRI was used to view Sar's innovation strategy.

7.1 Answering the research questions

1. How can businesses transition towards the successful adoption of Scope 3 into the SDG 12.6 sustainability reporting regime?

While there may not be one singular definitive answer to such a question, the findings of this thesis give us a few key takeaways as to what a complete answer might be at least partly constructed of.

To aid Scope 3 reporting's successful adoption into the SDG 12.6 sustainability reporting regime, firms may elect to take on a variety of tasks.

Firms must consciously choose to be active participatory members of their sustainable transformation ecosystem. This entails learning of and aligning themselves with the EU's mission-oriented goals and policies, and the UN's SDGs, particularly SDG 12.6. Further, to be a part of such an innovation ecosystem, firms must actively share their newfound knowledge of their Scope 3 barriers and overcoming of said barriers as everyone loses and no one wins if firms bar and keep Scope 3 reporting success prisoner so to speak.

To be a contributing member of the sustainable transformation ecosystem which strives for the EU missions to address rapid climate change, firms would be advised to adopt a learning focused RRI approach to taking on Scope 3 reporting as many firms are still at the earliest stages of Scope 3 reporting adoption and have not used RRI prior thereby entailing that a learning approach is most appropriate.

Despite the daunting height of Scope 3 complexity, it would be best for firms to adopt Scope 3 reporting as early as possible and not to wait for a particular regulatory deadline as tempting as it may be. This is effective risk management as it prepares firms for the likely inevitable regulatory requirements in the near future with so many countries having pledged to be net-zero by 2050 or sooner.

Firms would do well to spend the first year taking stock and looking into what Scope 3 data is already available and obtainable. Then, procedures would need to be put into place to prepare for full data collection the following year. This may entail digitization of certain processes, pressure for cooperation from value chain partners, software development, and data organization.

Lastly, firms must demand official country and sector specific guidance and country specific emission factors from the governmental level as varying broad guidance and multiple sources of emission factors, none of which may be tailored to the reporting firm's country or sector, will lead to inaccurate, incomparable, and potentially greenwashed reports thus accomplishing very little towards climate change missions.

2. How do current business sustainability reporting practices interplay with Scope 3 reporting for businesses keen to embrace it, as shown through a case study?

The findings of this thesis provide a picture of sustainability reporting practices and Scope 3

reporting practices surprisingly hardly interplaying at all as the requirements for Scope 3 and the requirements for general sustainability reporting are quite different. As firms are more likely to be conducting general sustainability reporting, such as reporting their ethical standards or ESG reporting for example, in addition to the unlikelihood of these firms having adopted Scope 3 reporting, it is unlikely that these firms will be prepared for Scope 3 reporting in good time before regulatory deadlines.

If firms focus merely on general sustainability reporting, and wait to pursue Scope 3 reporting until an imposed regulatory deadline, firms may adopt a mal-version of Scope 3 reporting if they. As discussed above, this may threaten the GHGP's five reporting principles and thus the outcome of the pursuit of the EU mission-oriented goals, policies, and innovation ecosystems.

7.2 Significance of key conclusions

These key conclusions are imperative to note as the primary mission to address rapid climate change demands the successful adoption of Scope 3 reporting into the SDG 12.6 regime. To ensure this feat, firms and government must both strive for this success. This thesis highlights major barriers toward this feat and potential solutions to said barriers and demonstrates a clear need for such solutions.

Addressing climate change is possible despite the odds, provided firms, value chain partners, relevant actors such as stakeholders, researchers, and policymakers all collaborate, cooperate, and facilitate Scope 3 reporting success as a strong part of climate change mitigation strategy.

7.3 Policy and further research recommendations

A key limitation of this study was that it consisted of a singular case study and thus provided but a narrow snapshot of what the research questions seek for a full and complete answer. Of the thousands of firms in various countries across the world, only one was consulted, thus the findings of this thesis are hardly universal or even representative of the firms in Norway. Yet within the scope of this, the focus afforded considerable room for play to conduct in-depth empirical analysis, and situate the findings within a fleshed-out context in a manner that can

yield generalizable insights. Hence there are broader implications of this in-depth case study, given the mixed methods approach implemented for analysis, in a manner that was quite demanding even for a single case.

Notably, while the EPC was consulted, no field experts, policy makers, members of the public, nor fellow researchers of the topic were consulted, which does entail that the findings of this thesis provide a narrow view and thus give a relatively narrow answer to the research questions. This is an important limit in scope to bear in mind within the time and resources of this Master project.

Regardless, the key findings discussed in this thesis do provide a valid and insightful picture as to the situation at hand and therefore produce a few recommendations, which follow for both policy and research respectively.

Policy recommendations

As the policy landscape is vast, the recommendations here are at least applicable to the waste management sector.

As the landscape regulatory push continues to put pressure on the SDG 12.6 regime to adopt Scope 3 reporting, the current regulations leave firms in a sink-or-swim situation where they are left with no choice but to find their own way which could cause greenwashing and poor discrepancy choices all of which threaten the GHGP's five reporting principles.

Policymakers should look toward solutions for developing government created country-specific emission factors and country and sector specific reporting guidance. Some countries, such as the UK, have already developed country-specific emission factors.

Further, a reporting framework should be committed to. SDG 12.6 has a list of topics which qualify as 'sustainability reporting'; however, this is all of the guidance the SDG 12.6 has apart from recommending the SASB, TCFD, and GRI for reporting guidance. In addition to the GHGP and CDP, these NGOs all offer guidance or recommendations for sustainability reporting, but none include minute specific detailed guidance for the myriad specific situations firms may find themselves in regarding Scope 3 reporting. With so many options available, this may lead to inconsistent reports across firms. Moreover, none of these guides are specifically required at the political level. Policymakers may consider selecting a specific sustainability reporting guidance

which details Scope 3 reporting specifically for governments to base their country and sector-specific guidelines on. As the GHGP includes the most thorough detailing of Scope 3 reporting, the GHGP is recommended albeit, once again, the GHGP is broad in its current state, not specific.

Further, as soon as sector-specific guidance is published, the usage of industry average data should be discouraged and disincentivized at the regulatory level as industry average data leads to great disparities and inaccuracies in and potential greenwashing of final reports thereby giving an imprecise and incomplete Scope 3 map.

Research recommendations

With this thesis' limitations, it is recommended for further research to include a widening and farther reach into varying cases across sectors and countries. Additionally, consultation should expand to other actor groups such as experts, policymakers, stakeholders, public laymen, and other researchers of a relevant field.

As firms conducting Scope 3 reporting are members of the sustainability transformation ecosystem, further study into firms' ability and desire to adopt an RRI approach to Scope 3 reporting or general sustainability reporting is recommended. As firms may not always see themselves as innovators nor the Scope 3 reporting process as an innovative process, Figure 6.3 below depicts the Scope 3 Reporting RRI Tools Network which may increase firms' understanding of RRI's relationship to Scope 3 reporting. Figure 6.3 is meant to mirror the barriers network discussed in section 5.1.3.

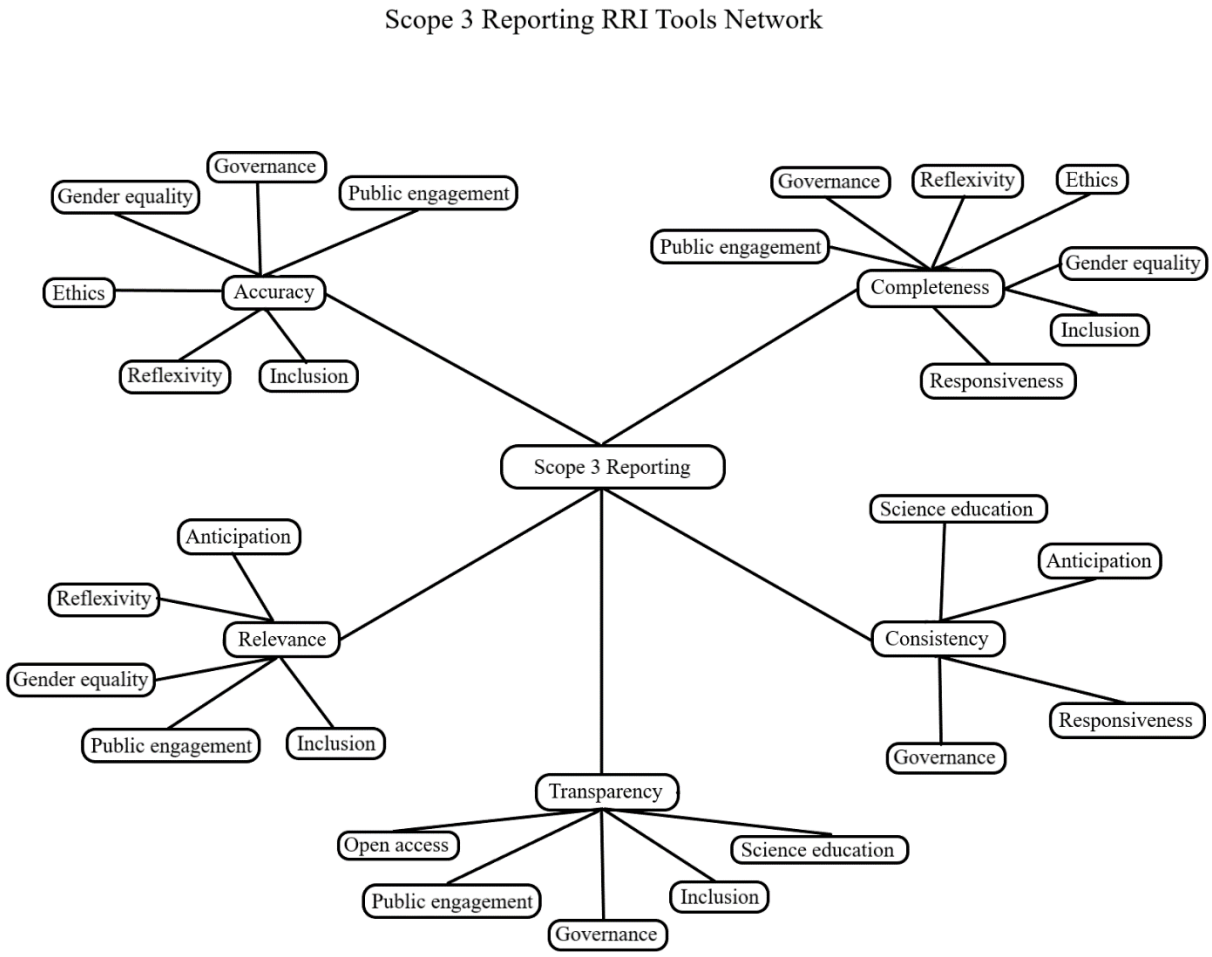

Figure 6.3*. Scope 3 Reporting RRI Tools Network. Source (Author's contribution).*

The Scope 3 Reporting RRI Tools Network notes the most relevant RRI dimensions respective of each Scope 3 reporting principle. Such a network may help firms understand how an RRI approach may be adopted for successful Scope 3 reporting, however this has not been tested or formally studied. Therefore, it is recommended that this or a similar such depiction be studied in how such a depiction may or may not provide connections as to firms' understanding of Scope 3 reporting as an innovative process.

Firms taking an active role in Scope 3 reporting is crucial for climate change mitigation. Despite the high complexity and current lack of tools, firms must choose to be pioneers and offer a guiding hand for firms who are unable to do the same. Even further, firms must demand the tools to do so from policymakers to provide the best possible outcome.

References

Argyris, C., & Schön, D. A. (1978). Organizational learning: a theory of action perspective (pp. VII, 344). Addison-Wesley.

Attride-Stirling, J. (2001). Thematic networks: an analytic tool for qualitative research. Qualitative Research : QR, 1(3), 385–405. https://doi.org/10.1177/146879410100100307

Baehr, J. S. (n.d.). *A priori and a posteriori*. Internet Encyclopedia of Philosophy. https://iep.utm.edu/apriori/

Borrás, S., & Edquist, C. (2013). The choice of innovation policy instruments. Technological Forecasting & Social Change, 80(8), 1513–1522. https://doi.org/10.1016/j.techfore.2013.03.002

Bouncken, R. B., Fredrich, V., Ritala, P., & Kraus, S. (2018). Coopetition in New Product Development Alliances: Advantages and Tensions for Incremental and Radical Innovation. British Journal of Management, 29(3), 391–410. https://doi.org/10.1111/1467-8551.12213

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Campbell, D. T. (1957). Factors relevant to the validity of experiments in social settings. Psychological Bulletin, 54(4), 297–312. https://doi.org/10.1037/h0040950

Carbon Disclosure Project (2023a). *Climate transition plan report 2022.* Carbon Disclosure Project. Retrieved on June 11, 2023. https://www.cdp.net/en/articles/climate/new-cdp-data-shows-companies-are-recognizing-the-need-for-climate-transition-plans-but-are-not-moving-fast-enough-amidst-incoming-mandatory-disclosure

Carbon Disclosure Project. (2023b). *Stepping up: Strengthening Europe's corporate climate transition.* Retrieved June 11, 2023. https://www.cdp.net/en/research/cdp-europe-reports/stepping-up

Corbin, & Strauss, A. (1990). Grounded Theory Research: Procedures, Canons, and Evaluative Criteria. Qualitative Sociology, 13(1), 3–21. https://doi.org/10.1007/BF00988593

Diniz, E., Yamaguchi, J. A., Rachael dos Santos, T., Pereira de Carvalho, A., Alégo, A. S., & Carvalho, M. (2021). Greening inventories: Blockchain to improve the GHG Protocol Program in scope 2. Journal of Cleaner Production, 291, 125900. https://doi.org/10.1016/j.jclepro.2021.125900

Douven, I. (2021). *Abduction. The Stanford Encyclopedia of Philosophy* (Summer 2021 Edition), Edward N. Zalta (ed.), https://plato.stanford.edu/entries/abduction/

Downie, & Stubbs, W. (2013). Evaluation of Australian companies' scope 3 greenhouse gas emissions assessments. Journal of Cleaner Production, 56, 156–163. https://doi.org/10.1016/j.jclepro.2011.09.010

Egeland, C., E.-M. Forsberg, and T. Maximova-Mentzoni. 2019. "RRI Implementation as Learning." Journal of Responsible Innovation 6 (3): 375–380. doi:10.1080/23299460.2019. 1603570

European Commission, Directorate-General for Research and Innovation, (2015). *Indicators for promoting and monitoring responsible research and innovation: report from the Expert Group on policy indicators for responsible research and innovation*, Publications Office. https://data.europa.eu/doi/10.2777/9742

European Commission, Directorate-General for Research and Innovation, Mazzucato, M. (2018). *Mission-oriented research & innovation in the European Union: a problem-solving approach to fuel innovation-led growth*, Publications Office. https://data.europa.eu/doi/10.2777/360325

European Commission, Directorate-General for Research and Innovation, (2021). *EU missions: 100 climate-neutral and smart cities*, Publications Office of the European Union. https://data.europa.eu/doi/10.2777/197915

European Commission, Directorate-General for Research and Innovation, Dro, C., Kapfinger, K., Rakic, R. (2022a). *European missions: delivering on Europe's strategic priorities*, Publications Office of the European Union. https://data.europa.eu/doi/10.2777/69252

European Commission, Directorate-General for Research and Innovation, (2022b). *EU missions – 100 climate-neutral and smart cities*, Publications Office of the European Union. https://data.europa.eu/doi/10.2777/191876

Franchetti, M., & Apul, D. (2013). Carbon footprint analysis: concepts, methods, implementation, and case studies. CRC Press.

Funtowicz, S. O., & Ravetz, J. R. (1993). Science for the post-normal age. Futures : the Journal of Policy, Planning and Futures Studies, 25(7), 739–755. https://doi.org/10.1016/0016-3287(93)90022-L

Geels. (2004). From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. Research Policy, 33(6), 897–920. https://doi.org/10.1016/j.respol.2004.01.015

Geels. (2011). The multi-level perspective on sustainability transitions: Responses to seven criticisms. Environmental Innovation and Societal Transitions, 1(1), 24–40. https://doi.org/10.1016/j.eist.2011.02.002

Geels. (2019). Socio-technical transitions to sustainability: a review of criticisms and elaborations of the Multi-Level Perspective. Current Opinion in Environmental Sustainability, 39, 187–201. https://doi.org/10.1016/j.cosust.2019.06.009

Geels. (2020). Micro-foundations of the multi-level perspective on socio-technical transitions: Developing a multi-dimensional model of agency through crossovers between social constructivism, evolutionary economics and neo-institutional theory. Technological Forecasting & Social Change, 152, 119894. https://doi.org/10.1016/j.techfore.2019.119894

Geels, & Schot, J. (2007). Typology of sociotechnical transition pathways. Research Policy, 36(3), 399–417. https://doi.org/10.1016/j.respol.2007.01.003

Griffin, P. (2017). *CDP Carbon majors report 2017*. Carbon Disclosure Project. https://www.cdp.net/en/reports/archive

Grin, J., Rotmans, J., & Schot, J. W. (2010). Transitions to sustainable development: new directions in the study of long term transformative change. Routledge.

Green, J. (2010). Private Standards in the Climate Regime: The Greenhouse Gas Protocol. Business and Politics., 12(3), 3–39. https://doi.org/info:doi/

Haag, & Kaupenjohann, M. (2001). Parameters, prediction, post-normal science and the precautionary principle—a roadmap for modelling for decision-making. Ecological Modelling, 144(1), 45–60. https://doi.org/10.1016/S0304-3800(01)00361-1

Hertwich, & Wood. (2018). The growing importance of scope 3 greenhouse gas emissions from industry. https://doi.org/https://doi.org/10.1088/1748-9326/aae19a

Huang, Y. A., Lenzen, M., Weber, C. L., Murray, J., & Matthews, H. S. (2009a). The role of input-output analysis for the screening of corporate carbon footprints. Economic Systems Research, 21(3), 217–242. https://doi.org/10.1080/09535310903541348

Huang, Y. A., Weber, C. L., & Matthews, H. S. (2009b). Categorization of Scope 3 Emissions for Streamlined Enterprise Carbon Footprinting. Environmental Science and Technology : ES&T, 43(22), 8509–8515. https://doi.org/info:doi/

Jiménez-Buedo, M., & Russo, F. (2021). Experimental practices and objectivity in the social sciences: re-embedding construct validity in the internal–external validity distinction. Synthese (Dordrecht), 199(3-4), 9549–9579. https://doi.org/10.1007/s11229-021-03215-3

Jütting, M. (2020). Exploring Mission-Oriented Innovation Ecosystems for Sustainability: Towards a Literature-Based Typology. Sustainability (Basel, Switzerland), 12(16), 6677. https://doi.org/10.3390/su12166677

Kasperzak, R., Kureljusic, M., Reisch, L., & Thies, S. (2023). Accounting for Carbon Emissions—Current State of Sustainability Reporting Practice under the GHG Protocol. Sustainability (Basel, Switzerland), 15(994), 994. https://doi.org/10.3390/su15020994

Klimas, P., & Czakon, W. (2022). Species in the wild: a typology of innovation ecosystems. Review of Managerial Science, 16(1), 249–282. https://doi.org/10.1007/s11846-020-00439-4

Köhler, Geels, F. W., Kern, F., Markard, J., Onsongo, E., Wieczorek, A., Alkemade, F., Avelino, F., Bergek, A., Boons, F., Fünfschilling, L., Hess, D., Holtz, G., Hyysalo, S., Jenkins, K., Kivimaa, P., Martiskainen, M., McMeekin, A., Mühlemeier, M. S., & Wells, P. (2019). An

agenda for sustainability transitions research: State of the art and future directions. Environmental Innovation and Societal Transitions, 31, 1–32. https://doi.org/10.1016/j.eist.2019.01.004

Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. Research Policy, 41(6), 955–967. https://doi.org/10.1016/j.respol.2012.02.013

Martinuzzi, A., Blok, V., Brem, A., Stahl, B., & Schönherr, N. (2018). Responsible Research and Innovation in Industry—Challenges, Insights and Perspectives. Sustainability (Basel, Switzerland), 10(3), 702. https://doi.org/10.3390/su10030702

Matthews, H. S., Hendrickson, C. T., & Weber, C. L. (2008). The Importance of Carbon Footprint Estimation Boundaries. Environmental Science & Technology, 42(16), 5839–5842. https://doi.org/10.1021/es703112w

Mazzonetto, M., & Simone, A. (2018). Introduction to "Science, society and citizens: Suggestions (and hopes) on how to foster RRI in Horizon Europe". Journal of Science Communication. 17. 10.22323/2.17030301.

Mazzucato, M. (2018). Mission-oriented innovation policies: challenges and opportunities. Industrial and Corporate Change, 27(5), 803–815. https://doi.org/10.1093/icc/dty034

Ministry of Climate and Environment of Norway. (2021, December 08). Veikart for grønn konkurransekraft. Regjeringen. https://www.regjeringen.no/no/tema/klima-og-miljo/innsiktsartikler-klima-miljo/veikart-for-gronn-konkurransekraft/id2604070/

Ministry of Climate and Environment, & Ministry of Foreign Affairs of Norway. (2022, November 03). *Norway's new climate target: Emissions to be cut by at least 55%*. Regjeringen. https://www.regjeringen.no/en/aktuelt/norways-new-climate-target-emissions-to-be-cut-by-at-least-55-/id2944876/

Morgan, H. (2022). Conducting a Qualitative Document Analysis. The Qualitative Report, 27(1), 64-77. https://doi.org/10.46743/2160-3715/2022.5044

Muench, S., Stoermer, E., Jensen, K., Asikainen, T., Salvi, M. and Scapolo, F., Towards a green and digital future, EUR 31075 EN, Publications Office of the European Union, Luxembourg, 2022, ISBN 978-92-76-52451-9, doi:10.2760/977331, JRC129319

Mytton, D. (2020). Assessing the suitability of the Greenhouse Gas Protocol for calculation of emissions from public cloud computing workloads. Journal of Cloud Computing: Advances, Systems and Applications, 9(1), 1–11. https://doi.org/10.1186/s13677-020-00185-8

Nogueira, L. A., Bjørkan, M., & Dale, B. (2021). Conducting Research in a Post-normal Paradigm: Practical Guidance for Applying Co-production of Knowledge. Frontiers in Environmental Science, 9. https://doi.org/10.3389/fenvs.2021.699397

Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods. 16(1).* https://doi.org/10.1177/1609406917733847

Osazuwa-Peters, M., Hurlbert, M., McNutt, K., Rayner, J., & Gamtessa, S. (2021). Risk and socio-technical electricity pathways: A systematic review of 20 years of literature. Energy Research & Social Science, 71, 101841. https://doi.org/10.1016/j.erss.2020.101841

Patchell, J. (2018). Can the implications of the GHG Protocol's scope 3 standard be realized? Journal of Cleaner Production, 185, 941–958. https://doi.org/10.1016/j.jclepro.2018.03.003

Pellikka, J., & Ali-Vehmas, T. (2016). Managing Innovation Ecosystems to Create and Capture Value in ICT Industries. Technology Innovation Management Review, 6(10), 17–24. https://doi.org/10.22215/timreview1024

Peters, & Besley, T. (2019). Citizen science and post-normal science in a post-truth era: Democratising knowledge; socialising responsibility. Educational Philosophy and Theory, 51(13), 1293–1303. https://doi.org/10.1080/00131857.2019.1577036

Poel, I. van de. (2021). RRI measurement and assessment. In Assessment of Responsible Innovation (1st ed., Vol. 1, pp. 339–360). Routledge. https://doi.org/10.4324/9780429298998-25

Ravetz, J. R. (2006). Post-Normal Science and the complexity of transitions towards sustainability. Ecological Complexity, 3(4), 275–284. https://doi.org/10.1016/j.ecocom.2007.02.001

Reichertz, J. (2009). Abduction: The Logic of Discovery of Grounded Theory. Forum, qualitative social research, 11(1).

Ritala, P., & Almpanopoulou, A. (2017). In defense of 'eco' in innovation ecosystem. Technovation, 60-61, 39–42. https://doi.org/10.1016/j.technovation.2017.01.004

Robinson, D. K. R., Simone, A., & Mazzonetto, M. (2021). RRI legacies: co-creation for responsible, equitable and fair innovation in Horizon Europe. Journal of Responsible Innovation, 8(2), 209–216. https://doi.org/10.1080/23299460.2020.1842633

RRI Tools. (n.d.). *About RRI.* RRI Tools. Retrieved June 11, 2023. https://rri-tools.eu/about-rri

Sagayam, S., Ising, E., & Leiper-Jennings, S. (2023). European Union's Corporate Sustainability Reporting Directive: What Non-EU Companies with Operations in the European Union Need to Know. Insights; the Corporate & Securities Law Advisor, 37(2), 12–18.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). Experimental and quasi-experimental designs for generalized causal inference (pp. XXI, 623). Houghton Mifflin.

Song, J. (2016). Innovation ecosystem: impact of interactive patterns, member location and member heterogeneity on cooperative innovation performance. Innovation (North Sydney), 18(1), 13–29. https://doi.org/10.1080/14479338.2016.1165624

Stahl, B. C., Obach, M., Yaghmaei, E., Ikonen, V., Chatfield, K., & Brem, A. (2017). The responsible research and innovation (RRI) maturity model: Linking theory and practice. Sustainability (Basel, Switzerland), 9(6), 1036. https://doi.org/10.3390/su9061036

Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. Research Policy, 42(9), 1568–1580. https://doi.org/10.1016/j.respol.2013.05.008

Thapa, R., Iakovleva, T., & Foss, L. (2019). Responsible research and innovation: a systematic review of the literature and its applications to regional studies. European Planning Studies, 27(12), 2470–2490. https://doi.org/10.1080/09654313.2019.1625871

Turnheim, B., & Nykvist, B. (2019). Opening up the feasibility of sustainability transitions pathways (STPs): Representations, potentials, and conditions. Research Policy, 48(3), 775–788. https://doi.org/10.1016/j.respol.2018.12.002

Turnpenny, Jones, M., & Lorenzoni, I. (2011). Where Now for Post-Normal Science?: A Critical Review of its Development, Definitions, and Uses. Science, Technology, & Human Values, 36(3), 287–306. https://doi.org/10.1177/0162243910385789

Turnpenny, J., Lorenzoni, I., & Jones, M. (2009). Noisy and definitely not normal: responding to wicked issues in the environment, energy and health. Environmental Science & Policy, 12(3), 347–358. https://doi.org/10.1016/j.envsci.2009.01.004

United Nations. (25 September, 2015). *Transforming our world: the 2030 Agenda for Sustainable Development.* https://sdgs.un.org/2030agenda

United Nations (2018). *Progress towards the Sustainable Development Goals.* United Nations. Retrieved June 11, 2023. https://digitallibrary.un.org/record/1627573?ln=en

United Nations (2019). *Guidance on core indicators for entity reporting on contribution towards implementation of the Sustainable Development Goals*. United Nations. https://unctad.org/publication/guidance-core-indicators-entity-reporting-contribution-towards-implementation

United Nations (2022). *The Sustainable Development Goals Report 2022*. United Nations. https://unstats.un.org/sdgs/report/2022/

United Nations (2023). *SDG Indicator Metadata 12.6.* United Nations. https://unstats.un.org/sdgs/metadata/

Von Schomberg, R., González Esteban, E., & Sanahuja-Sanahuja, R. (2022). Ethical challenges and limits of RRI for improv-ing the governance of research and innovation processes. Recerca : Revista de Pensament i Anàlisi. https://doi.org/10.6035/recerca.6750

Wigley, B., Cary, N. (2017). *The future is decentralised: blockchains, distributed ledgers, and the future of sustainable development*. United Nations Development Programme. https://www.undp.org/publications/future-decentralised

Williams, I., Kemp, S., Coello, J., Turner, D. A., & Wright, L., A. (2012) A beginner's guide to carbon footprinting, Carbon Management, 3:1, 55-67, https://doi.org/10.4155/cmt.11.80

World Business Council for Sustainable Development & World Resources Institute. (2004). *Corporate Standard.* Greenhouse Gas Protocol. https://ghgprotocol.org/corporate-standard

World Business Council for Sustainable Development & World Resources Institute. (2011). *Corporate value chain (Scope 3) accounting and reporting standard.* Greenhouse Gas Protocol. https://ghgprotocol.org/corporate-value-chain-scope-3-standard

World Business Council for Sustainable Development & World Resources Institute. (2013). *Technical guidance for calculating scope 3 emissions*. Greenhouse Gas Protocol. https://ghgprotocol.org/scope-3-technical-calculation-guidance

World Resources Institute. (2021). *Global Protocol for Community-Scale Greenhouse Gas Inventories. An Accounting and Reporting Standard for Cities*. Greenhouse Gas Protocol. https://ghgprotocol.org/ghg-protocol-cities

Annex

Interview guide

1. How has Sar's current sustainability reporting practices helped or hindered Sar's scope 3 reporting? Has it enabled a speedy transition towards the inclusion of scope 3 or has it delayed the inclusion of scope 3?
2. Why is scope 3 reporting so far behind Sar's general sustainability practices?
3. Please describe Sar's transition strategy to include scope 3 reporting by 2025 reporting on the 2024 fiscal year.
4. Does Sar intend to continue to pursue the STM framework or an alternative? Why/why not?
5. What are Sar's next major steps towards adopting scope 3 reporting?
6. How can Sar improve to be able to successfully adopt scope 3 reporting on an annual basis?
7. What are Sar's biggest barriers regarding scope 3 reporting?

Observation guide

1. Who participated?
2. What was the setting?
3. What was I, the observer, doing? How was I involved?
4. What was the time, place, and length of what was observed?
5. Describe the observation in good detail.
6. What are the reflections on the observations (experiences, hypothesis, guidance)?
7. How was the observation related to scope 3 (if not obvious)?
8. How did the observation impact scope 3 (if not obvious)?
9. What are (if any) the RRI notes?