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Improving Supplier Engagement as a Means to Reduce Greenhouse Gas Emissions of a Global Company

Abstract

The primary objective of this research is to provide a resource for corporations on how they can reduce their overall environmental impact and risk related to climate change by extending their Corporate Social Responsibility (CSR) strategy to include partnerships with suppliers, for instance third-party logistics contractors. A secondary objective is to create a management strategy for how companies can better align the environmental impact of third party contractors with those of the corporation as a whole. A detailed literature review was conducted to identify current CSR strategies for green supply chain management, including commonly used reporting platforms, accounting strategies, trends and drivers for Scope 3 emissions. Furthermore, a guidance for industry professionals is provided in the format of a case study using FMC Corporation (FMC). The case study included interviews with industry experts, a survey sent to individuals from prominent corporations based in the United States of America (US) with global footprints, benchmarking across the chemical sector and an evaluation of supplier engagement. The conclusion of the case study demonstrates the initial steps corporations should take to develop partnerships with organizations and their suppliers thereby identifying risks and opportunities to align their environmental goals and reduce their overall impacts.

Keywords

green supply chain management, supplier engagement, Scope 3 emissions reporting

Disciplines

Environmental Sciences | Physical Sciences and Mathematics

IMPROVING SUPPLIER ENGAGEMENT AS A MEANS TO REDUCE
GREENHOUSE GAS EMISSIONS OF A GLOBAL COMPANY

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Fall 2017

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Linda Froelich

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ABSTRACT

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Kristen Elizabeth King

Yvette Bordeaux, PhD

The primary objective of this research is to provide a resource for corporations on how they can reduce their overall environmental impact and risk related to climate change by extending their Corporate Social Responsibility (CSR) strategy to include partnerships with suppliers, for instance third-party logistics contractors. A secondary objective is to create a management strategy for how companies can better align the environmental impact of third party contractors with those of the corporation as a whole. A detailed literature review was conducted to identify current CSR strategies for green supply chain management, including commonly used reporting platforms, accounting strategies, trends and drivers for Scope 3 emissions. Furthermore, a guidance for industry professionals is provided in the format of a case study using FMC Corporation (FMC). The case study included interviews with industry experts, a survey sent to individuals from prominent corporations based in the United States of America (US) with global footprints, benchmarking across the chemical sector and an evaluation of supplier engagement. The conclusion of the case study demonstrates the initial steps corporations should take to develop partnerships with organizations and their suppliers thereby identifying risks and opportunities to align their environmental goals and reduce their overall impacts.

Keywords: green supply chain management, supplier engagement, Scope 3 emissions reporting

ABBREVIATIONS

CDM	Clean Development Mechanisms
CDP	Carbon Disclosure Project
CCWG	Clean Cargo Working Group
CER	Certified Emissions Reductions
CH ₄	Methane
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalent
COP	Conference of Parties
CSCMP	Council of Supply Chain Management Professionals
CSR	Corporate Social Responsibility
EDF	Environmental Defense Fund
EIA	Energy Information Administration
EIOLCA	Economic Input-Output Life Cycle Assessment
EPA	Environmental Protection Agency
ERMS	Emissions Reduction Market System
ESG	Environmental Social Governance
ETS	Emission Trading Schemes
EU	European Union
FMC	FMC Corporation
FSB	Financial Stability Board
FSC	Forest Stewardship Council
G20	Group of 20
GHG	Greenhouse Gas
GICCC	Global Investor Coalition on Climate Change
GLEC	Global Logistics Emissions Council
GRI	Global Reporting Initiative
ICCT	International Council on Clean Transportation
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change

ABBREVIATIONS

ISO	International Organization for Standardization
LCPTi	Low Carbon Technology Partnerships Initiative
MARPOL	International Convention for the Prevention of Pollution from Ships
N ₂ O	Nitrous Oxide
NO _x	Nitrogen Oxides
NRE	New Economic Regulation
O ₃	Ozone
OECD	Organization for Economic Co-operation Development
PM	Particulate Matter
PwC	PricewaterhouseCoopers
SASB	Sustainable Accounting Standards Board
SBTi	Science-Based Targets Initiative
SEC	Securities and Exchange Commission
Sedex	Supplier Ethical Data Exchange
SFC	Smart Freight Centre
SO _x	Sulfur Oxides
TCFD	Task Force on Climate-related Financial Disclosures
TRIR	Total Recordable Incident Rate
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNGC	United Nations Global Compact
US	United States of America
WBCSD	World Business Council for Sustainable Development
WHO	World Health Organization
WRI	World Resource Institute
WWF	World Wide Fund for Nature

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Chapter 1. INTRODUCTION

As companies become increasingly cognizant of their environmental impacts, corporate sustainability practices have expanded to include the development and incorporation of supply chain management strategies as a link between economics and environmental effects. This increased focus on supply chain has resulted in higher visibility and accountability for environmental performance by organizational, societal and regulatory stakeholders (Acquaye, Genovese, Barrett, & SC, 2014). For the purposes of this study, supply chain is defined by the Council of Supply Chain Management Professionals (CSCMP) (2013) as “the material and informational interchanges in the logistical process stretching from acquisition of raw materials to delivery of finished products to the end user. All vendors, service providers and customers are links in the supply chain.” This research endeavors to answer the question of how to best reduce the Greenhouse Gas (GHG) emissions of a global company including those generated by supply chain activities.

To understand the complexity of the question as well as to establish current practices in the field a literature review was conducted, which included a review of benchmarking reporting tools, methodologies and current reporting trends. It should be stated that to reduce an organization’s environmental impact, the impacts must first be measured, and then to allow for transparency and accountability to stakeholders should be publicly disclosed. As the literature review will show, in recent years, there has been an uptake in reporting Scope 3 emissions. These are the emissions generated from sources owned or controlled by other entities throughout the value chain; both upstream supply chain and downstream components. Including these emissions provides a more comprehensive report and allows more accurate analysis of the overall direct and indirect emissions generated along the value chain (Greenhouse Gas (GHG) Protocol, 2011). Through the accountability of public disclosure there is increased pressure on organizations to be proactive towards incorporating industry best practices ultimately reducing GHG emissions. In an ideal world, an organization would own and operate its whole value chain, thereby allowing for control of all emissions related to

the organization. This is impractical for several reasons including risks and costs such an operation would invoke for an organization. Given this it is compulsory for organizations to engage with their suppliers, customers and consumers to understand the overall impacts due to the activities of their value chain.

This paper analyzes drivers for Scope 3 emission disclosures including: increased emissions from the transportation industry leading to government regulation, risk management, carbon markets, and competitive advantage; tools and methodological trends for measuring carbon emissions; and communication platforms including best practices for publicly reporting. On average, indirect supply chain emissions are four times higher than direct operational emissions (CDP, 2017b). The Greenhouse Gas (GHG) Protocol (2011) defines “Scope 1 emissions are those direct from company equipment and operations, Scope 2 emissions, indirect emissions due to purchased electricity and Scope 3 or indirect emissions from activities elsewhere in an organization’s supply chain.” Therefore, for an organization to reduce their overall emissions, it is imperative that Scope 3 emissions are accounted for and targets to reduce them are included in the company’s environmental strategy. Scope 3 emissions for many organizations include carbon emissions from the transportation industry. Those due to the transport of goods including: raw materials to manufacturing facilities, then to distribution and end-users.

The inclusion of a case study using a US based corporation having a global logistic footprint, aims to meet the secondary objective of this research. It provides reference for organizations as they begin to establish a management strategy for Scope 3 emissions reductions. The case study identifies the first step of emissions reductions as supplier engagement. By first engaging with suppliers, partnerships can be developed and utilized to align environmental goals and ultimately lead to overall carbon emissions reductions. By participating in globally recognized partnerships and reporting platforms an added layer of openness and transparency is given to the organization as they take their first steps towards holistically monitoring and reducing their carbon emissions.

Chapter 2. **METHODOLOGY**

2.1. Literature Review

To develop historical reference and investigate current practices for Scope 3 reporting a literature review was conducted. This review utilized the database compiled by the University of Pennsylvania online library (<http://www.library.upenn.edu/>) including Scopus, Web of Science and Science Direct, the unit of analysis being green supply chain management. The context was further narrowed for papers published within the last five years, 2012 to 2017, using the following three key phrases: “Scope 3”, “supply chain emissions” and “CSR strategy + supply chain”. Overall, 36 papers were included in this review. For the most part, papers published prior to 2012 were excluded from the review, although in select cases and to provide more extensive context and historical information, some studies published prior to 2012 were also included or reviewed during the writing process. Typically, these earlier publications were identified as references in the more recent publications, those within the last five years. The studies included were those that most aligned with the goals and objectives of the thesis, as allowed by time and scope of the research.

2.2. Case Study

The following sections describe the process of (1) conducting benchmarking the chemical industry; (2) conducting initial interviews and (3) providing an email survey to prominent organizations based in the United States of America with a global logistics footprint.

2.2.1. Benchmarking the Chemical Sector

To establish common practices across the chemical sector and identify best practices a benchmark of the chemical sector was undertaken. This included reviewing the annual Corporate Social Responsibility (CSR) reports, Sustainability Reports, Annual Reports and websites for industry leaders, peer companies to FMC Corporation and logistics companies as identified through conversations with the industry experts,

analysts and members of the sustainability and procurement teams at FMC Corporation. Eight industry leaders, seven peer companies, and eight logistic companies, 23 companies in total were compared during this benchmark due to time and study constraints.

2.2.2. Interviews with Industry Analysts and Experts

To better comprehend current business practices and challenges facing organizations for initiating or expanding their CSR strategies, including monitoring and reducing their environmental impacts, interviews were conducted with industry experts and analysts. The interviews were accomplished through phone calls and in person interviews. The interviewees were selected via recommendations from personal communications with members of the procurement team at FMC Corporation (FMC) and based on job title and description within their organization. The interview questions were open-ended and sent in advance via email, they are included for reference in the Appendix. The in-person interviews were conducted at FMC headquarters in Philadelphia, Pennsylvania, United States of America.

2.2.3. Email Survey

Furthermore, to provide a resource and example for organizations a case study was performed as a constituent of the role of Sustainability Analyst Intern at FMC. This included performing additional research to benchmark other organizations within the chemical sector to more comprehensively understand FMC's position. Additionally, to broaden the scope beyond the chemical sector an email survey was sent to 20 individuals from prominent corporations (e.g., capital goods and consumer products manufacturers, financial institutes, and logistics contractors) based in the US with a global logistics footprint. The email survey posed three open ended questions on current reporting practices and the internal barriers to reporting. The responses were synthesized and provided back to all responders as agreed upon for their contribution to the study. In two cases, the email survey was followed by additional conversation over the phone. This case study was conducted to determine best practices for engaging suppliers and measuring and reporting Scope 3 emissions. Furthermore, the case study serves as a resource for FMC and similar corporations for incorporating best

practices into their CSR strategies as determined by significance of risks and impacts associated with their value chain.

Chapter 3. **LITERATURE REVIEW**

The term greenhouse gases (GHG) refers to chemical compounds in the Earth's atmosphere that trap or absorb infrared radiation. "When sunlight strikes the Earth's surface some of it radiates back producing this infrared radiation, or heat" (U.S. Energy Information Administration (EIA), 2016). As GHG trap this radiation within the atmosphere it results in an overall elevation in temperature or global warming. The changes within the atmosphere alter weather patterns and culminate in what is generally referred to as climate change. GHG can be naturally occurring or generated by human activities. Several major GHG emitted by anthropogenic sources include: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and industrial gases (U.S. Energy Information Administration (EIA), 2016). In 2016, an estimated 45 percent of US energy-related CO₂ emissions came from the burning of petroleum fuels. While the industrial sector is the largest consumer of energy, "the transportation sector is responsible for generating more CO₂ emissions, primarily due to its near dependence on petroleum fuels" (U.S. Energy Information Administration (EIA), 2016).

The Greenhouse Gas (GHG) Protocol (2011) defines "Scope 1 emissions as those direct from company equipment and operations, Scope 2 emissions, indirect emissions due to purchased electricity and Scope 3 or indirect emissions from activities elsewhere in an organization's supply chain." The Figure 3.1 below, produced by the Greenhouse Gas (GHG) Protocol (2011) in the *Corporate Value Chain (Scope 3) Accounting and Reporting Standard*, provides a visual representation of Scope 1, 2 and 3 emissions generated as part of an organizations activities, including those associated with logistics and transportation of goods and people.

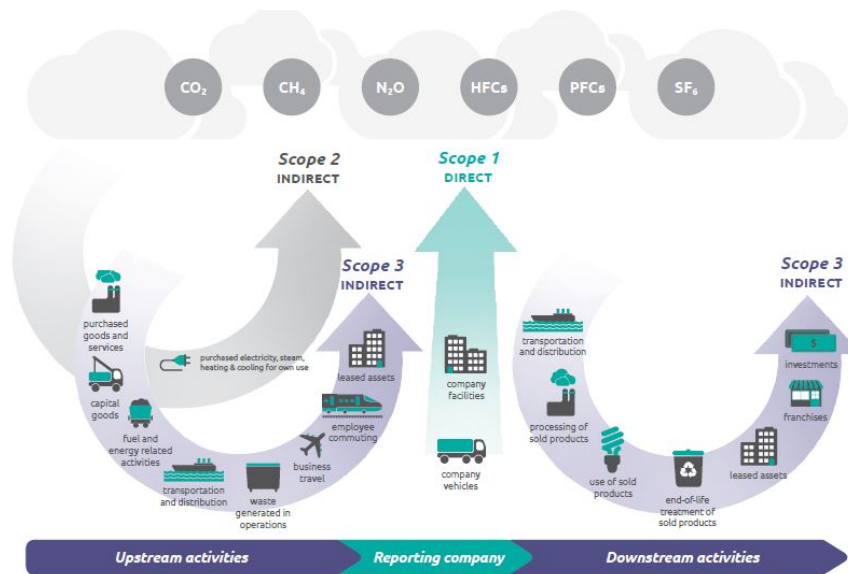


Figure 3.1 Overview of Scopes and Emissions across the Value Chain, sourced from the Greenhouse Gas (GHG) Protocol, 2011.

As organizations continue to develop and strengthen their Scope 1 and 2 emission inventories, Scope 3 emissions are still a new area of interest and methodologies for accounting are being developed. One study conducted by Matthews, Hendrickson and Weber (2008), found that on average the upstream Scope 3 emissions represent approximately 74 percent of a company’s total carbon footprint. This is significant, as it demonstrates that the majority of companies’ emissions are likely going unmeasured and unreported. Additionally, Downie & Stubbs (2012) report the lack of Scope 3 disclosure is due to limited guidance on determining which activities result in relevant emissions. Furthermore, the report suggests the high investment cost of time and labor for organizations in the US in identifying Scope 3 activities, calculating associated emissions and publicly reporting requires regulatory compliance and/or risk mitigation to incentive increased reporting. Without this pressure, why would an organization report emissions?

3.1. Air Quality and Greenhouse Gas Emissions from the Transportation Industry

The information presented in this section will provide examples and background on GHG production within the ground and shipping sectors of freight transportation. Each sector is unique with regards to the chemical make-up of the GHG

emissions produced, and they each also present unique challenges with regards to measuring and reporting emissions. Furthermore, this chapter will discuss some of the policies and regulations that have been created to attempt to curb emissions production. With the introduction of government regulation there is a trickle-down effect as companies and organizations alter current practices or adopt innovative ones to meet new regulations. In some instances, regulations may be put in place without clear guidelines or standards for meeting those regulations driving corporations, in recent years, to develop their own strategies to reduce emissions, and in certain cases even their own standards for measuring and reporting. Furthermore, the role that shareholder and client motivators play in incentivizing organizations to measure and report their emissions will also be discussed and examples of these motivators will be provided. This is not an exhaustive list but does provide an overall context for the creation of corporate strategy that accounts for governmental regulation, and the interplay among companies, stakeholders and clients.

3.1.1. Road Transport

Economic development depends on the ease of access to people and goods. Although transportation may occur in many forms, due to its flexibility, road transport is most often the predominant mode chosen, especially in areas of early development. The benefits of truck transport include: “door-to-door” service, lower expenses for short hauls and small shipments, and the reduced timeframe for freight to be loaded and unloaded. Unfortunately, the benefits of road transport are quickly overshadowed by the impact posed to the environment and human health (Dora C., & Phillips M., 2000). As early as the 1950s air pollution and cars were linked by a researcher based in California who determined the pollutants from traffic were to blame for the smoggy skies over Los Angeles. “Air contaminants of varying toxicity come from road transport, originating from the tailpipe of vehicles with internal combustion engines, from other vehicle components (such as brake and clutch lining and pads, tires and fuel tanks), and from road-surface wear and treatment materials” (World Health Organization (WHO) Europe, 2005). Road traffic is a contributor for many pollutants such as nitrogen oxides (NO_x), carbon monoxide (CO) and particulate matter (PM). Additionally, atmospheric reactions from secondary pollutant gases (e.g., NO_x, and

sulfur oxides [SO_x]) lead to the formation of tropospheric ozone, a well-known and recognized air pollutant. In the US the largest emitted of CO₂ emissions is the transportation sector (U.S. Energy Information Administration (EIA), 2016).

- **Policies on Road Transport**

In 1970 the US Congress passed “the first major Clean Air Act requiring a 90 percent reduction in emissions for new automobiles by 1975” (U.S. Environmental Protection Agency (EPA), 2017). Today the majority of countries have fuel economy standards for passenger vehicles and light-duty vehicles; according to the International Council on Clean Transportation (ICCT) (2016) “as of 2011 only Japan and the United States had set efficiency and GHG emission standards for heavy-duty vehicles”. Most heavy-duty vehicles are powered by diesel combustion engines, which without tailpipe and pollutant controls can emit high levels of pollution responsible for global warming and local air contamination. In the US combination tractor-trailers make up less than 2 percent of the on-road fleet but around 20 percent of the on-road transportation oil use and emissions. One study conducted by Delgado & Lutsey (2015) found, “current combination tractor-trailers’ average fuel economy has remained at approximately six miles per gallon for nearly two decades.” In Europe these statistics look similar, with heavy-duty vehicles making up around 4 percent of the on-road fleet and approximately 30 percent of the CO₂ emissions (Delgado & Lutsey, 2015). In 2011 the US government set new efficiency standards for heavy-duty vehicles manufactured in 2017, with proposed second phase for those manufactured in 2019 and beyond. These new policies and standards align with increased investment in low-carbon energy and emerging advanced technology to increase efficiencies. Integrated transmission technologies, load reduction technologies (e.g., mass reductions, aerodynamic and tire efficiency improvements) and integrated power trains or hybrid electric systems with regenerative braking could improve fuel efficiency ultimately reducing emissions.

In recent years Europe, the US, Japan and other developed countries have instituted vehicle emission standards for heavy-duty vehicles, thus requiring the use of technologies to reduce these emissions to almost zero. As truck sales in China and India are continually increasing at a higher rate than developed nations, it is imperative that these countries also adopt similar strategies to increase the adoption of new

technologies and limit the emissions. China's transportation sector carbon emissions have "more than doubled from 2000 to 2010 and are projected to increase by another 54 percent by 2020 from 2010 levels" (International Council on Clean Transportation (ICCT), 2016). The Chinese government has recently adopted more stringent emission reduction policies to combat their own emissions and to help prevent health related damage. In the 11th Five-Year Plan new mechanisms which interact with political incentives were introduced. According to Jin, Andersson, & Zhang (2016) "these policies proved effective and the national goal of reducing total SO₂ emissions by 10 percent was achieved. However regional air pollution problems dominated by particulate matter (PM) and ground level ozone (O₃) have emerged and worsened." China enacted the first fleet average fuel consumption for light-duty vehicles, which is expected to go into effect in 2017 and is in the process of developing standards for heavy-duty vehicles. Increased stringent policies on newly manufactured vehicles will help target the pollutants associated with on-road transport but China has additional human health and environmental impacts associated with increased freight transport from the shipping industry. As the world's leading manufacturer of capital goods which are shipped around the world the impacts of this industry must also be considered.

3.1.2. The Shipping Industry

Freight shipping is a less visible mode of transport for many people, but it is one that should not be overlooked when discussing GHG emissions and efforts to decrease them. It is true that shipping is a relatively clean transport mode based on emissions per tonne-kilometer (i.e., emissions generated by transporting one tonne of cargo over one kilometer); however, there is diversity among vessel types, with fuel efficiency generally increasing as vessel size increases. Air emissions from shipping are considerable, with estimates ranging from three to four percent of total global emissions. In term of chemical composition of these emissions, they can be broken down as follows, according to Merk (2014):

- CO₂ emissions are approximately a fifth of those of road transport,
- NO_x and PM emissions are almost equal,
- SO_x emissions are substantially higher.

This is again related to the fuel source used in cargo shipping, as ship fuel has higher sulfur content. The International Maritime Organization (IMO), the global body that regulates the shipping industry, has outlined plans to reduce the sulfur content down to 0.5 percent by 2020. For comparison, “long-haul trucks in the United States only are allowed to use fuel with a sulfur content of 0.015 percent,” (Pruzan-Jorgensen, 2010).

While the majority of shipping emissions do take place at sea, the most conspicuous shipping emissions occur in port areas and the surrounding cities. For example, shipping emissions in ports were calculated at “18 million tonnes of CO₂, 0.4 million tonnes of NO_x, 0.2 million tonnes of SO_x and 0.03 million tonnes of PM₁₀,” in 2011 (Merk, 2014). In the same report by Olaf Merk, Shipping Emissions in Ports (2014), around 85 percent of emissions come from container ships and tankers. These emissions result in considerable external costs with an estimated US \$14 billion per year spent in the 50 largest ports in the Organization for Economic Co-operation and Development (OECD) as a result of NO_x, SO_x and PM emissions. According to the same study conducted by Merk (2014) “approximately 230 million people are directly exposed to the emissions in the world’s top ports.” In these areas shipping emissions have been known to increase respiratory diseases, and are associated with increased incidence of premature births and deaths. Without altering current practices these emissions are estimated to grow by a factor of four by 2050, with Asia and Africa experiencing the sharpest increase in emissions (Merk, 2014).

- **Policies on Shipping Transport**

The increasing public awareness linking human health and environmental impacts to the transportation industry led to legal action being taken to protect the communities near highways and ports. These actions represent the role that government can play in implementing and enforcing regulations. In 1973 the International Convention for the Prevention of Pollution from Ships (MARPOL) was adopted. “The Convention includes regulations aimed at preventing and minimizing pollution from ships – both accidental pollution and that from routine operations” (International Maritime Organization (IMO), 2017). In Europe, Council Directive 80/779/EEC on air quality to set limit, and guide, for SO₂ and PM was enacted

(European Commission, 2016b). Public and governmental awareness has also led to global air quality and pollution prevention regulations. However, there is inherent difficulty in implementing and enforcing regulations on a global scale. As these impacts on human health and the environment from transport related emissions continue to worsen organizations are being called upon to identify areas for emission reductions within their organizations and throughout their value chain. Regulations support increased measuring and reporting of corporate emissions related to transport as an approach to identify risks and opportunities for investors and other stakeholders.

3.2. Why Would an Organization Report Emissions?

The above section provides context to understand the importance for organizations to measure their carbon footprint throughout their value chain. The next section will identify three drivers for an organization to identify and measure their emissions and those of their suppliers.

3.2.1. Risk Management for Future Required Disclosures

As previously introduced GHG emissions generated by anthropogenic sources, such as road and shipping transport, directly impact the atmosphere, resulting in climate change. Increasingly the societal perception of corporations' ability to manage and reduce their contributions to GHG emissions and resulting climate change is prompting stakeholders to act to quantify these perceived and actual risks. The large-scale and lasting nature of risks posed by climate change creates unique challenges, chiefly in the context of financial decision making. "The growing demand for decision-useful, climate-related information has resulted in the development of several climate-related disclosure standards" (Task Force on Climate-Related Financial Disclosures (TCFD), 2017a). Up to this point the existing standards and frameworks associated with climate-related information prioritized the disclosure of environmental and social information (e.g., energy use, associated carbon emissions, human rights and other sustainability metrics), while neglecting the economic component.

According to the Task Force on Climate-Related Financial Disclosures (TCFD) (2017a) "users of such climate-related disclosures commonly cite the lack of information on the financial implications around the climate-related aspects of an

organization's business as a key gap." In 2010, the US Securities and Exchange Commission (SEC) tried to address this gap by requiring the financial annual reports of publicly traded companies to also include the business risks (i.e., physical and regulatory risks) as a result of climate change (Jira & Toffel, 2013). In general, "failure to accurately determine risks can lead to a mispricing of assets and misallocation of capital which can lead to financial instability," this is in part due to market vulnerability to abrupt corrections as outlined in a speech to the Bank of England, *Breaking the Tragedy of the Horizon – Climate Change and Financial Stability*, made by Mark Carney (2015). Consequently, the G20 (Group of 20) Finance Ministers and Central Bank Governors requested the Financial Stability Board (FSB) to "convene public- and private-sector participants to review how the financial sector can take account of climate-related issues" ("Communiqué from the G20 Finance Ministers and Central Bank Governors Meeting in Washington, D.C. April 16-17, 2015," April 2015). Thus, the Task Force on Climate-related Financial Disclosures (TCFD) was established to design a set of recommendations for corporations. The following section outlines the goals of TCFD and provides reference for the actions that corporations should take to mitigate their climate-related risks.

- **Task Force on Climate-Related Financial Disclosures (TCFD)**

The TCFD was founded with the aim to "develop voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to investors, lenders, insurers and other stakeholders" (Task Force on Climate-Related Financial Disclosures (TCFD), 2017b). It is led by Michael Bloomberg and comprised of 32 international members, including: members of the energy and transportation sectors, large financial institutions (i.e., banks, insurance companies, asset owners and managers), and consumer product manufacturers among others.

In June 2017, the Task Force on Climate-Related Financial Disclosures (TCFD) (2017a) released, *Recommendations of the Task-Force on Climate-related Financial Disclosures: Final Report* providing guidance for businesses to disclose climate-related financial information including risks and opportunities. This differs from other guidance as the TCFD prioritizes financial impacts over the direct impacts of the organization on the environment. The TCFD divided risks related to climate

change into two main categories, “risks related to the *transition* to a lower-carbon economy and risks related to the *physical* impacts of climate change” (Task Force on Climate-Related Financial Disclosures (TCFD), 2017a). Transitioning to a lower-carbon economy is not as easily witnessed as the physical impacts of climate change. It entails policy, technology and market shifts in order to mitigate or adapt to climate-related risks. An example of transitional risk associated with regulation is provided in the next section related to Emission Trading Schemes (ETS); corporations now have mandatory regulatory requirements to measure their carbon emissions for the trading system to function properly. The Task Force on Climate-Related Financial Disclosures (TCFD) (2017a) defines physical risks as those “resulting from climate change as either event driven, acute, or longer-term, chronic, shifts in climate patterns.” Efforts to mitigate these risks also generate opportunities through increased cost savings, access to new markets, better resource efficiency and strengthening resilience throughout the value chain. The primary objective of the TCFD is to provide recommendations for organizations to better disclose the financial impacts of risks as a result of climate change and the associated opportunities. To facilitate investors, lenders and insurers to make informed financial decisions they must first understand how climate-related risks and opportunities are likely to impact an organization’s future financial position as outlined in Figure 3.2 below (Task Force on Climate-Related Financial Disclosures (TCFD), 2017a).



Figure 3.4 Climate-Related Risks, Opportunities, and Financial Impact, sourced from Final Report: Recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD), 2017a.

Climate-related financial risks may influence demand for certain products and services. In this case it is imperative corporations consider the potential impact on returns and identify opportunities for augmenting or generating new returns to mitigate loss. Particularly given the potential growth of carbon pricing as a mechanism to regulate emissions, it is important for affected industries to consider the possible impacts of such pricing on business strategy and growth. The TCFD developed “recommendations around four thematic areas representing the core elements of how organizations operate: governance, strategy, risk management, and metrics and targets,” see Table 1 in the Appendix. for the recommendations per thematic area (Task Force on Climate-Related Financial Disclosures (TCFD), 2017a). These recommendations are supported by specific disclosures as defined by the TCFD. Organizations should provide information to decision makers and others (e.g., investors) through financial filings and ESG or CSR report, to provide a holistic understanding of their risks and opportunities. In addition to the guidance for all industries, the TCFD also provides supplemental guidance for financial and non-financial organizations on information which should be disclosed.

Limitations warranting further research and analysis or the development of methodologies and standards includes: relationship to other reporting initiatives,

scenario analysis, data availability and quality of financial impact and examples. As part of the TCFD's public consultation as well as in discussions with preparers, "some asset owners and asset managers expressed concern about reporting on GHG emissions related to their own or their clients' investments given the current data challenges and limited existing accounting guidance on how to measure and report GHG emissions associated with investments" (Task Force on Climate-Related Financial Disclosures (TCFD), 2017a). Current carbon footprint metrics are limited and as such should not necessarily be interpreted as risk metrics. However, the TCFD (2017a) views "the reporting of weighted average carbon intensity as a first step and expects disclosure of this information to prompt important advancements in the development of decision-useful, climate-related risk metrics."

The success of the TCFD's recommendations depends on widespread adoption by corporations. Through adoption climate-related financial risks and opportunities will become a significant component of corporations' strategic planning and risk management processes. Concurrently, corporations' and investors' understanding of the potential financial implications associated with climate-related risks will be strengthened. The better comprehension of financial implications results in information that is more decision-useful and results in accurately priced climate-related risks and opportunities, thus allowing for an overall efficient allocation of capital. However, widespread adoption will require strong leadership by the G20 and by FSB to incorporate more stringent requirements for mandatory disclosures of this information and non-financial information to promote transparency.

- **European Union (EU) Commission on Mandatory Non-Financial Disclosures**

In 2014 a new European Union (EU) Directive (Directive 2014/95/EU) was passed to set a minimum standard for reporting data across many domains, including: environmental, social and employee matters, human rights, anti-corruption and bribery matters, and diversity issues. This ambitious legislation requires corporations with 500 or more employees per member state (in some member states the minimum is 250 employees) to submit non-financial disclosures, affecting "around 6,000 large corporations listed on EU markets or operating in the banking and insurance sectors

which disclose relevant environmental and social information in their management reports” (European Commission, 2016a). The aim of this directive is to increase corporate transparency and performance, as well as promote organizations to take a more sustainable business approach. The first reports are projected to be published in 2018, providing data and information for financial year 2017. According to the (European Commission, 2016a) Member States were required to finalize the transposition of this Directive into national legislation by the 6th of December 2016. While the Directive does not directly apply to US based companies, certain European subsidiaries and sites are likely to be impacted. If corporations do not comply the consequences in the form of fines could be significant. It is very reasonable that in the coming years this degree of reporting and disclosure could become the global regulatory norm. This would, therefore, be a major driver for companies to invest in standardizing their reports and emission calculation methodologies, perhaps ahead of being required to do so.

3.2.2. Carbon Markets

As corporate social responsibility reporting has become mandatory in many countries and as the general public continues to increase its environmental awareness companies have prioritized monitoring and reporting their direct emissions (Scope 1) and indirect emissions from electricity purchased (Scope 2) as a way to understand their environmental and social impacts. Increasingly companies are recognizing the need to account for carbon emissions along their value chain and product portfolios to more holistically manage their climate-related risks and opportunities. The Greenhouse Gas (GHG) Protocol developed, as a supplement to the *GHG Protocol Corporate Account and Reporting Standard*, a standard for corporate value chain (Scope 3) accounting (Greenhouse Gas (GHG) Protocol, 2011). The GHG Protocol has been partnering with the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) for almost 20 years. The information provided by the GHG Protocol helps governments, industry associations, non-governmental organizations (NGOs), businesses and other organizations around the world to develop GHG monitoring and reporting platforms (Greenhouse Gas (GHG) Protocol, 2004). As part of the standard, the GHG Protocol provides steps for identifying risks and

opportunities along the value chain. The development of a Scope 3 inventory provides better understanding of the total emissions profile of an organization, and it more readily allows for evaluation of risks and opportunities along their value chain. One example of risk per the GHG Protocol is regulatory risk. “Regulatory risk is the risk that a change in laws and regulations will materially impact a security, business, sector or market,” (Investopedia, 2017). To be a successful organization today, companies must mitigate these risks by planning for potential future carbon regulations. This must also include understanding the impact of their value chain activities on their carbon footprint and their public reputation.

- **International Policies**

The Kyoto Protocol is an international treaty which broadened the 1992 United Nations Framework Convention on Climate Change (UNFCCC) by committing State Parties to reduce GHG emissions. It provided for a new ‘cap-and-trade’ framework in transnational trade and provided a way to gradually initiate a new GHG emission trading market (United Nations Framework Convention on Climate Change (UNFCCC), 2015). One study conducted by Du, Zhu, Liang, & Ma (2006) set out to present a formal decision-making model which considers sustainability throughout the supply chain life cycle. For their study, an emission-dependent value chain consisting of one single emission-dependent manufacturer allocated by the environmental authority was studied. The study analyzed decision-making within the concerned emission-dependent value chain, and effectively broke ground into this previously unstudied area. Prior to this, there was limited discussion about how management practices might influence the green supply chain, and those discussions had limited objectivity. Moreover, the study conducted by Chaabane, Ramudhin, & Paquet (2012) introduced a cap-and-trade system which found there was room to increase profit in certain conditions depending on the influence the manufacturer held over the supplier.

- **Emission Trading Schemes (ETS)**

Emission Trading Schemes (ETS) have been widely regarded as central policy pillars of climate change mitigation. According to Chaabane et al. (2012) to achieve the optimal output of an ETS, “the manufacturer’s profits and the system-wide profits

increase as the cap increases, while the emission price, the purchased emission permits and the permit supplier's profits decrease." In this capacity, it is mandatory for ETS to be strengthened and aligned at the global scale with the purpose of driving a meaningful environmental strategy. Organizations must rethink their strategic business approach to ensure the sustainability of their value chain including operations, accounting for product life cycle, and sustainable development that recognizes the interdependencies among the environmental, social and economic performance of an organization. Various key performance indicators have been used to assess the sustainability of value chains. These often combine the economic and environmental performance to establish trade-offs between the two performances.

The majority of developed and some developing countries (e.g., China) employ various mechanisms to reduce GHG emissions including incentives and mandatory targets to reduce their carbon footprint. Carbon prices, taxes and resulting markets are increasingly acknowledged as the most cost-effective devices. "The basic idea incorporates a price tag on carbon emissions and creating new investment opportunities to generate a fund for green tech development" (Chaabane et al., 2012). An example of an existing carbon market includes the European Union Emission Trading Scheme (EU ETS), operating in 31 countries and covering approximately 45 percent of the EU's GHG emissions, making it the largest multi-national emissions 'cap and trade' system in the world. The EU ETS has been successful in that it achieved immediate and significant emissions reductions at minimal cost, but the over-allocation of emission permits caused the price of carbon allowances to drop, risking the whole system. Other emission trading markets include the New Zealand ETS, Chicago Emissions Reduction Market System (ERMS) in the US and the Montreal Climate Exchange in Canada. These markets pressure organizations to make measuring and assessing carbon emissions important. The results of these studies indicate the best method for mitigating regulatory risk is by investing time and resources in planning and developing strategies for reporting carbon emissions.

- **Example of Emissions Trading Scheme (ETS) In China**

Carbon markets require a great deal of responsibility and faith in a well-structured political entity. As the second largest economy in terms of GDP in the

world, China has a responsibility to take action in reducing the consequences of climate change. China, as a signatory of the Kyoto Protocol, has been a recipient of international funds, and also serves as a supplier of inexpensive reduction certificates, Certified Emissions Reductions (CERs) under the Clean Development Mechanism (CDM) (Ma, 2013). Over the past three decades China has experienced incredible economic growth coupled with a transition to a market-based economy. This rapid development has environmental and social implications. China has responded by developing energy efficiency and carbon intensity targets; the Chinese ETS is central to the achievement of these goals.

According to Ma (2013) the Chinese ETS is unique for a few reasons: “it is a bottom-up structure with pilot projects carried out at the provincial and city level, but with the aspects of strong top-down command and control.” China is currently the largest carbon emitter in the world, however, unlike most other countries, China is a one-party state. This helps China to establish the largest ETS in the world, as it does not have to go through democratic efforts and gain partisan support, it can truly have top-down control. The results of the pilot projects and China’s ability to bring them together into a national ETS will determine if this type of organizational scheme is successful. If so, it is likely that China will set itself up as the global leader in climate change mitigation. world.

3.2.3. Competitive Advantage

The process of measuring and calculating emissions is complicated; it is also only the first part in organizational transparency. The collected data must also be reported, once reported public information can be used to identify investment and climate change related risks and opportunities. Understanding and reporting emissions from supply chain activities enables organizations to mitigate supplier vulnerability, a point of weakness and/or possible threat to the supply chain network, due to climate change and GHG regulation (Council of Supply Chain Management Professionals (CSCMP), 2013). Since 2009, the US EPA has required large corporations, those emitting 25,000 metric tons or more per year to publish their emission data (U.S. Environmental Protection Agency (EPA), 2013a). The trend in organizations utilizing energy and associated emissions data as key performance indicators has led to the

proliferation of recent studies evaluating the tier and completeness level at which upstream emissions should be measured. One study, Jira & Toffel (2013) reports that out of the suppliers who are requested by CDP to disclose climate change information, only a little over half respond.

In the US, a few organizations and governmental agencies are addressing this data gap. In 2009, Walmart launched an initiative in collaboration with the Sustainability Consortium to evaluate the sustainability of its supply chain. Walmart is the largest retailer in the world; “each week over 260 million customers and members visit over 11,000 stores across 28 countries” (Walmart Stores, 2017a). Walmart is the first retailer with a verified science-based target for emissions reductions. An emission reduction target is considered science-based if it is in line with the level of decarbonization required to keep global temperature increase within 2°C of pre-industrial levels. Walmart’s aim is to eliminate one gigaton of carbon dioxide equivalent (CO₂e) emissions from its upstream and downstream Scope 3 sources by 2030.

Due to increasing changes in consumer preferences and market conditions there is an increasing number of companies measuring their GHG emissions generated by operational activities. This information is then used to assess their exposure to risks and identify new opportunities. Simultaneously there is an uptake by governments to incorporate climate-related information into their key performance indicators and annual reporting. The US federal government now requires federal agencies to set reduction goals and targets, and track the progress with their supply chains. The main motivator for the government to request emissions information from organizations is to encourage them to reduce their emissions and, by publicly disclosing this information to facilitate investors’ access and decisions.

Companies actively seek to maintain and advance their competitiveness in changing markets, through addressing risks and costs, while pursuing innovative business opportunities. Kauffmann, Tebar Less, & Teichmann (2012) identified the opportunities for cost savings as a major driver for organizations to invest time and resources for preparing carbon inventories. “Measuring and reporting energy use and the resulting carbon emissions is frequently a starting place for organizations’ efforts

to identify sources of savings and emissions reductions as studies have identified the most significant share of GHG emitted is CO₂ from energy consumption” (Kauffmann et al., 2012). In addition to cost savings which can be extended to the consumer, there are also the reputational risks for organizations by not being transparent. Competitive risks and societal perception from loss of advantages opposite competitors, is mitigated by developing a more exhaustive carbon inventory including the organizations value chain. Public awareness is becoming increasingly focused on organizations’ supply chain. Customers deem it progressively more important to establish a “secure and reliable, and therefore climate-resilient, supply chain” (Kauffmann et al., 2012). Customer preference includes business-to-business sales as well as business-to-consumer. The Carbon Disclosure Project (CDP) has been successful by including a supplier questionnaire in addition to its original investor questionnaire, in response to demand from financial stakeholders to better understand the risks across their value chain. This allows large consumer facing organizations to request detailed information about how their suppliers are managing their climate-related risks and opportunities. By not publicly reporting these information customers are left wondering what organizations are hiding.

3.3. What Information Should Organizations be Reporting?

Developing a CSR strategy can be challenging for organizations. Possibly even more challenging is what information about an organization’s strategy should be made public through reporting. The drive for a company or corporation to develop a social responsibility platform may come from several sources, which can generally be divided into stakeholder pressures, governmental mandates, or within the company itself. In each instance, there are likely different motivations, but will ultimately lead to similar demands of company resources to measure emissions and other data and report their findings as a socially responsible company. Difficulties in adopting these strategies are often either in the collecting of information or in the reporting of their findings. In reviewing current corporate strategies, it was disheartening to find that several studies suggest there is little to no correlation between adopted management practices and reducing emissions. The Global Reporting Initiative (GRI), “no longer scores submitted reports as the scores do not reflect the quality of data but the

frequency with which the organization reported using GRI guidelines,” according to Belkhir, Bernard, & Abdelgadir (2017). It can be assumed from this study that currently the challenge of completing a report alone may be too great or too overwhelming for certain companies.

3.3.1. Current Progress & Pitfalls in CSR Reporting

The study by Liesen, Hoepner, Patten, & Figge (2015) using empirical data from 431 European companies from 2005 to 2009, found “on average only 15 percent of companies that disclose GHG emissions report them as complete.” This would suggest a very real problem when attempting to compare reported data, as incomplete reporting would lead to further inaccuracies as that data is used as the input for further calculations and projections. This study had the added benefit of demonstrating the role of stakeholders in promoting data reporting. It showed that indeed stakeholder pressure is a positive influence in data reporting, however stakeholder pressure does not lead to increased reporting of complete data. Stakeholder pressure, then, is a determinant of the existence but not the completeness of emissions disclosure. Furthermore, Fung & O'Rourke (2000) suggest that when stakeholders drive GHG emissions reporting, they are motivated “presumably (to) reward better performers and increase pressure on firms not meeting their expectations.” This is compared to when a company discloses their own emissions through voluntary reporting. Gray & Bebbington (2000) found that “voluntary reporting reflects those aspects of performance that organizations are willing to release. Voluntary reporting allows organizations to disclose information as a tool rather than as a mechanism of accountability.” Seventeen years after these studies were published little evidence has been found to suggest the increase in GHG emission disclosure programs have resulted in substantial improvements in corporate GHG emission reductions. Belkhir et al. (2017) suggests several key improvements (e.g., standardize public reporting and present data in conjunction with industry-specific goals) which could strengthen a companies’ reporting, “thus making it truly coherent, transparent and indicative of a company’s sustainability performance both in relative and absolute terms.” Although these studies demonstrate the current weaknesses in reporting as well as the limited utility of reported data, they do not recommend that reporting stop. Instead, they

recommend strengthening reporting frameworks to provide transparency and guidance for engaging corporations throughout their value chain.

The Council of Supply Chain Management Professionals (CSCMP) (2013) defines the value chain as “a series of activities, which combined, define a business process.” The value chain for a product includes a number of stakeholders, such as material suppliers, third-party logistics providers, waste management suppliers, travel suppliers, lessees and lessors, franchisees, retailers, employees and customers. The complexity, geographical differences, lack of standardized data and overall limitations in visibility and transparency within the value chain components and stakeholders has restricted the development of benchmarking in product value chains. Acquaye et al. (2014) prepared a framework to address some of these challenges by ensuring the supply chain GHG emissions and resource use are evaluated at each tier. This evaluation is the first step for organizations to manage their environmental performance as it allows them to identify high GHG emission hotspots. Current strategies should then include at the very least an analysis of their value chain components and stakeholders. Whether the pressure to disclose comes from external stakeholders or from within the company, it should be with the intent to disclose as complete reporting as possible. Strategies which promote transparency are likely the best managerial strategies to motivate participants at each level to improve their reporting. With these things in mind, perhaps companies and overseeing organizations will be able to focus again on the quality rather than quantity of emissions reporting.

3.3.2. Global Reporting Guidance

Sustainability or CSR reporting is based on social, environmental and governance information. It has traditionally been voluntary but increasingly governments and stock exchanges around the world are imposing mandatory requirements. The main advantage of mandatory reporting is the development of standardization and comparable measures that enable benchmarking and best practices. In a report published by Idil Kaya (2016) the countries with a CSR reporting rate of 90 percent or higher have mandatory regulatory reporting requirements for social and environmental reports, including: The United Kingdom, Denmark, France, South Africa, India, Indonesia, and Malaysia. Global Reporting Initiative (GRI) published

sustainability reporting guidelines in an attempt to standardize reports. As early as 1996 the International Organization for Standardization (ISO) standard series 14000 for environmental management was developed. In 2000 the United Nations (UN) launched the Global Compact (GC) Ten Principles in areas of human rights, labor, environment and others. By 2010 the ISO standard series 26000 was approved as guidance for how corporations can operate in a socially responsible manner (Kaya, 2016). The most recent regulation on non-financial reporting comes for the EU Commission Directive 2014/95/EU, which was passed in 2014 setting a minimum standard for reporting environmental, social and employee matters, human rights, and anti-corruption among other issues. Member states were expected to transpose this directive into national legislation by December 2016. This ambitious legislation impacts over 6,000 companies operating in the European Union. Even companies not directly impacted by this Directive should be cognizant of its effects as often legislation starts in Europe and expands into other countries and regulations.

- **French Legislation Transposition of Directive 2014/95/EU**

In 2001, the New Economic Regulation (NRE) Act introduced the obligation for “all listed French companies to include information within their annual reports on a series of social and environmental impacts and their activity” (Kaya, 2016). In 2009 and 2010 two laws, the Grenelle I Act and the Grenelle II Act, confirmed: CSR reporting made mandatory for all companies in France with over 500 employees. These provisions were then consolidated into the French Code of Commerce to meet the requirements of transposing Directive 2014/95/EU into national legislation. The guidance for complying with the NRE act includes 42 topics spanning 3 categories: labor (i.e., employment, labor relations, health and safety), environmental (i.e., pollution, waste management and energy consumption) and societal (i.e., social impacts, relations with stakeholders and human rights) (Kaya, 2016). The list of topics reflects the content of the international guidance on CSR reporting including: GRI, UNGC, ISO 26000 and others. Among the 42 topics, 29 are subject to the disclosure requirement regardless of the size of the organization. This implies all companies in France are required to report on some level their CSR strategy and actions taken. Findings from the study by (Kaya, 2016) *The Mandatory Social and Environmental*

Reporting: Evidence from France, reported that the new legislation has improved the quantity and quality of non-financial corporate communications. A survey conducted by KPMG (2015) ranked France sixth in sustainability reporting and first worldwide in terms of percentage of corporate reports with external assurance.

- **International Organization for Standardization (ISO) 14064**

The International Organization for Standardization (ISO) is a non-governmental organization located in Geneva, Switzerland, responsible for coordinating the activities of technical experts representing individual national standard institutes to develop consensus-based voluntary technical standards. The ISO 14000 standards series covers environmental management. ISO 14064 is “an international standard that addresses the quantification and reporting of GHG emissions and the verification of this information,” (Wintergreen & Delaney, 2015). The standard is divided into three parts, the first part addresses conducting a bottom up approach to data collection and emissions quantification for an organization to develop a carbon emission inventory. In most cases the key aspects for conducting an emissions inventory under ISO 14064 are derived from the GHG Protocol’s guidance, *GHG Protocol: A Corporate Accounting and Reporting Standard*. The ISO standard establishes minimums for compliance, while the GHG Protocol identifies details and references options for GHG inventory development best practices. Though different in a few minor areas the protocol and the ISO standard should be treated as complementary documents, ISO identifies what to do for compliance while the GHG Protocol, a voluntary accounting and reporting initiative, explains how an organization should develop an inventory with the goal to reduce their impacts.

The ISO 14064 standard identifies three key aspects for developing a GHG inventory for organizations, “setting inventory boundaries, quantifying GHGs and reporting GHG emissions” (Wintergreen & Delaney, 2015). Boundaries for an emissions inventory include both the organization and the operational boundaries. According to the ISO standard, Wintergreen & Delaney (2015), “there are two approaches to defining organizational boundaries, those recognized as belonging to the organization developing the inventory, by control or equity share.” Where an organization can implement financial or operational policy to account for GHG

emissions or where an organization has equity interest accounting for only a percentage of the total GHG emissions, are control and equity share approaches respectively. Additionally, there are three categories for emissions associated with operational boundaries previously introduced, that refer to “operational activities at a facility which are included in the emissions inventory,” commonly referred to as Scope 1 and Scope 2 emissions (Wintergreen & Delaney, 2015). The Greenhouse Gas (GHG) Protocol (2011) defines “Scope 1 emissions are those direct from company equipment and operations, Scope 2 emissions, indirect emissions due to purchased electricity and Scope 3 or indirect emissions from activities elsewhere in an organization’s supply chain.” Direct GHG emissions (Scope 1) must be included while indirect emissions (Scope 2 and 3) are optional.

- **Inclusion of Scope 3 Emissions**

Sustainability needs to move beyond organizational boundaries into the supply chain. Science shows increasingly negative impacts on the environment, human health and economies. It also reflects that the collective sum of action being undertaken today is not enough to mitigate the most extreme negative impacts. Suppliers recognize the climate-related risks to their business. In 2016 over 4,300 suppliers responded to the CDP supply chain questionnaire indicated only four percent have supply chain carbon emission reduction targets. This is a significant challenge as on “average an organization’s supply chain emissions are four times greater than those from direct operations,” (CDP, 2017b). There are opportunities to engage suppliers to measure and report their carbon emissions. Through engagement and partnerships, organizations and their suppliers can identify risks and opportunities and better manage them together to align their goals.

The *Global Climate Change Report 2015*, published by the CDP (2015) on behalf of 822 investors with over USD 95 trillion in assets, comments on calculating and reporting Scope 3 emissions, stating that it is “ambitious because Scope 3 activities are so diverse and involve a company’s supply chain and customers’ use of products.” Despite the reality that Scope 3 reporting is ambitious, it is not impossible. In 2015, CDP reported that globally 63 percent of disclosures included emissions data in two or more Scope 3 categories. Similarly, it was found that 66 percent of

companies based in the US were disclosing Scope 3 emissions for at least one category (Blanco, Caro, & Corbett, 2016). The study conducted by Blanco et al. (2016) used an Economic Input-Output Life Cycle Assessment (EIO-LCA) to estimate the percentage of Scope 3 emissions being reported by US companies. Blanco et al. (2016) concludes that, “if a respondent reported Scope 3 emissions then they only reported 22 percent of their total Scope 3 emissions.” This is partially due to the natural course that reporting takes, until recently organizations have prioritized measuring, monitoring and reporting on the emissions within their direct control (Scope 1 and 2). Working to reduce these emissions, organizations are hesitant to release new information, which in most cases will cause their overall emissions to increase. Beyond the perception of increased emissions, the low reporting rate is a by-product of the EIO-LCA method, capturing emissions from all upstream tiers in the supply chain while the GHG Protocol recommends organizations initially engage their tier 1 suppliers as it is often unlikely that organizations have the resources to incorporate information from tier 2 and up suppliers.

3.4. How Should Organizations Measure Scope 3 Emissions?

No one methodology or tool has been adapted by all sectors to define and calculate emissions. Unlike regulated air pollutants, PM or SO_x, GHG emissions are typically estimated, not directly measured and therefore the methodology and calculations used to estimate emissions can vary, sometimes minimally and at other times more drastically. For the purposes of this paper, it can be assumed that measuring emissions also involves a certain amount of estimation. The complexity of the value chains and the lack of standard practices create difficulties in both gathering and reporting this information, especially with regards more indirect, Scope 3 emissions. Furthermore, companies that operate on a global scale have the added difficulty of trying to keep policies consistent across both political and cultural boundaries. Three examples for tracking and measuring emissions will be presented below. The methodologies selected and presented are based on those typically used by global chemical corporations based in the US as identified through conversations with Maureen Malia, Sustainability Manager for BDP International (M.Malia, personal communication, June 20, 2017). This is not meant as a comprehensive list of available

methodologies, but serves as a reference for organizations when determining which methodologies are most applicable to their business.

3.4.1. North American Partnership Program

In 2004, fifteen companies and freight sector associations in the US partnered with the United States Environmental Protection Agency (US EPA) to create the SmartWay program. The program's aim was to generate a more effective way of measuring the environmental impact of transporting goods as freight. It was understood that a secondary aim would be to reduce that impact. The program has now grown to include more than 3,500 companies and organizations, and has recently led to the publishing of the *SmartWay Vision 2020: A New Era of Freight Sustainability* (U.S. Environmental Protection Agency (EPA), 2015). In this document, SmartWay outlines how it is developing and implementing carbon assessment and monitoring tools to cover all modes of freight transport. SmartWay provides assessment tools for both carriers, companies engaged in moving goods via truck, rail, logistics, multi-modal, and shippers, companies which engage with carriers to transport their products. "The carriers collect data on fuel used, miles driven, truck and engine model year and cargo payload" (U.S. Environmental Protection Agency (EPA), 2013b). This data is then included to calculate the freight environmental performance in grams-per-ton-mile or gram-per-mile. The carrier performance data is then imported into the shipper reporting tool, "multiplied by each carrier's share of the shipper's freight, generating a composite weighted average of their emissions performance. Once partners (carriers and shippers) complete and submit their reporting tools, SmartWay quality-checks the data, records it into a database, and calculates the companies' emission scores" (U.S. Environmental Protection Agency (EPA), 2013b). The carriers' performance is then ranked, low (best) to high (worst), and released publicly on the SmartWay website. In addition, SmartWay provides a way for organizations to earn recognition from the EPA, distinguishing them from competitors by publicly showcasing them on the same website.

There are a few limitations of the SmartWay program. At this time, SmartWay remains a completely voluntary program. And while voluntary, it remains labor intensive for both carriers and shippers, requiring reporting on both sides. It helps

organizations streamline how they monitor and report their freight emissions, but does not require that they reduce their emissions, and does not rank them on a year-by-year basis with regards to how they do over time. Furthermore, because it is a one country, one sector program the applicability or universality may be questioned. It is true that the SmartWay program is based on the US freight transportation industry, however, the assessment and monitoring tools as well as the methods utilized are not limited to one nationality or region. The SmartWay program serves as a template for other countries working to establish partnership-based programs to address freight emissions, and also demonstrates how governmental agencies and businesses can work together towards common goals.

3.4.2. Global Framework for Measuring and Reporting Logistics Emissions

When a company operates on a global scale, there are enormous transportation costs associated with getting goods to customers. A need was recognized by Smart Freight Centre (SFC), a non-profit organization based in Amsterdam, with the goal to improve freight efficiency and emissions tracking at lower cost. In 2013, the Global Logistics Emissions Council (GLEC) was created by SFC. Led by SFC, GLEC is comprised of leading multinationals, associations and industry initiatives engaged with moving freight. To address the gap of a universally adopted method for calculating logistics emissions, GLEC was tasked with developing a way to calculate logistics emissions across global multi-modal supply chains (Greene & Lewis, 2016). Ultimately, from this council's work the GLEC Framework for measuring logistics emissions was developed.

The GLEC Framework provides a process for calculating emissions from a multi-modal supply chain through four steps: planning, collecting data, calculating emissions and using the results. The organization must first define the transport chain including the start/stop for each segment, weight of the freight being shipped and distance travelled. The framework uses a consumption factor, a fuel efficiency metric specific to freight movement, which represents the average fuel use to move one tonne of freight for one kilometer. The GLEC Framework identifies specific consumption factors for each mode of transport. The GHG emission is calculated by multiplying the

shipment information (tonne-kilometer) by the consumption factor (fuel use per tonne-kilometer) (Greene & Lewis, 2016). The results from the GLEC Framework have many applications, such as identifying hotspots within the transport chain, determining overall organizations emissions and using the consumption factors to understand GHG efficiency of different modes, carriers and transport services.

The benefits of using the GLEC Framework vary depending on whether you are a carrier, a logistics service provider or a cargo owner (i.e., shipper). By participating in the GLEC Framework as a shipper or logistic service provider an organization will be able to “make or influence decisions on supply chain optimization, manage the performance of their carriers, demonstrate leadership across business sector and demonstrate to end-users or customers the commitment of the organization to delivering products in a sustainable manner” (Greene & Lewis, 2016). Unlike the SmartWay Partnership Program, the GLEC Framework does not have separate levels for partnering or reporting. By participating in the GLEC Framework corporations must be at an advanced level in their sustainability journey to dedicate extensive time and resources to developing emissions inventories and tracking the volumes and distances of freight shipped globally.

3.4.3. Technical Guidance for Inclusion of Scope 3 Emissions

The Carbon Disclosure Project (CDP) promotes the GHG Protocol’s methodology as a corporate accounting and reporting standard. The *Corporate Value Chain (Scope 3) Accounting and Reporting Standards* were developed to provide guidance for organizations to prepare and report an inventory of their indirect emissions resulting from value chain activities (Greenhouse Gas (GHG) Protocol, 2011). The guidance document is intended to be more than a technical accounting standard, serving also to facilitate effective management strategies for reducing Scope 3 emissions. It does this by helping organizations understand their value chain emissions, raising awareness of associated opportunities and risks.

The standards were developed following a three-year endeavor by the GHG Protocol, whereby work was conducted in a multi-stakeholder process. The standards were then tested by over 30 companies, including AkzoNobel, BASF, PepsiCo, DuPont and IKEA, prior to their publication. GHG accounting and reporting, like other

disclosures, is based on five key principles: relevance, completeness, consistency, transparency, and accuracy. Realistically there are likely to be tradeoffs among the principles when completing an inventory with this degree of complexity (Chaabane & Geramianfar, 2015). Which principles are able to be given precedence will be based on the material issues as identified by the organization, with the goal being to diminish the tradeoffs as the accuracy and completeness of reporting increases over time.

CDP reporting for Scope 3 consists of fifteen categories, covering such topics as goods and services, transportation and fuels costs, and waste. While each category may affect the organizations emissions to a greater or lesser extent overall, it is important to define the boundaries of each category separately. Creating clearer boundaries helps organizations understand which categories are material and therefore more crucial for reporting, and also provides standardization for comparison over time and ideally comparison among companies as well. For detailed information on the boundaries of each category see Table 2 in the Appendix. The GHG Protocol methodology provides guidance for reporting to each of the fifteen categories. It includes a description of the category, guidance on data collection, activity data required, emission factors required, summary of calculation methods, and calculation formulas, as well as examples (Greenhouse Gas (GHG) Protocol, 2013). In this way, the GHG Protocol methodology attempts to provide the relevant information in a way that also informs the user on how to more readily collect and report that data. However, the complex nature of measuring Scope 3 emissions becomes evident, as the majority of Scope 3 categories offer not one, but multiple calculation methods. Added to this may also be a ranking system, where, in general the more specific the method the higher quality the Scope 3 emissions data. As expected, the more specific methods are often much more labor intensive and time consuming. Organizations choosing to utilize the GHG Protocol should have some framework to match the needs of the decision maker with the quality of the calculation method, in order to ensure that emissions as well as time and resources are allocated appropriately according to the company's environmental sustainability strategy and targets.

The above methodologies provide guidance for developing emissions inventories, measuring their impact, and identifying risks and opportunities. The methodologies introduced here are by no means an exhaustive list of the many

methodologies available for measuring and reporting emissions. As any methodology may be used to compare the emission reduction targets and progress for a particular company, comparing even similarly sized companies or companies that handle similar products can become difficult and cumbersome. Furthermore, for companies or organizations that may be only starting to determine how to measure emissions and set targets, determining the best methodology for their activities can be overwhelming. By first identifying the activities the organization undertakes to move goods help determine which methodology and level of data quality is necessary to meet the needs of the decision-makers. The next step is to communicate the initiatives and progress an organization is making through reporting.

3.5. How Should Organizations Communicate Their Initiatives and Progress?

The previous sections outlined the drivers for governments and corporations to take action to reduce their overall impacts, including the importance for measuring emissions and the various methodologies available to estimate their emissions. This next section provides guidance on reporting an organization's actions and best practices for communicating their sustainability initiatives. It is not enough for a company to measure their direct and indirect emissions; they must also be able to communicate the actions they are taking to mitigate their risks. Their shareholders are demanding it. This is not an exhaustive list of the available reporting platforms nor established best practices, but serves as a reference for some of the largest global reporting platforms and generally agreed upon best practices from corporations.

3.5.1. Public Disclosures

Attempts to standardize reporting practices are being made through the development and implementation of larger reporting platforms. This type of reporting is often done through questionnaires or audits, or sometimes a combination of both. This reporting may be requested by suppliers or customers with the intent to allow for more direct comparison throughout the company or corporation, and potentially among companies as well. The following examples of reporting platforms were selected to provide an overview of the numerous options for disclosing environmental social governance (ESG) indicators. Depending on the needs of the organization one platform

may be sufficient to meet the organization's goals, while for others a combination of all three might be necessary. These platforms are representative, but by no means an exhaustive analysis, of what currently are available to suppliers, customers and investors.

- **Self-Reporting Questionnaire**

The Carbon Disclosure Project (CDP) (2017a) operates “a global disclosure system enabling companies, cities, states and regions to measure and manage their environmental impacts.” The CDP disclosure for climate change was finalized in 2011. It is divided into 15 categories, collecting data throughout a companies' value chain. Emissions are divided into three categories: Scope 1 emissions direct from company equipment and operations, Scope 2 indirect emissions due to purchased electricity and Scope 3 or indirect emissions from activities elsewhere in an organization's supply chain. Reporting to CDP is done through either an investor or supplier questionnaire. In 2016 CDP supply chain collected data from more than 4,300 suppliers around the world, with reported savings of US \$12.4 billion proving that action on climate change and water is not only the right thing to do, but the smart thing according to Patricia Espinosa, Executive Secretary for the UNFCCC (CDP, 2017a).

The primary advantage of CDP is its size; it has inherent comparability and credibility due to the large number of organizations who participate in it (Matisoff, Noonan, & O'Brien, 2013). As of 2017 over 5,600 companies responded to CDP climate change, water, forests and supply chain questionnaires. However, it is expensive to operate, thus requiring organizations to pay a fee as part of the submittal process. In addition, the questionnaire in its attempts to be more inclusive has the potential to allow confidential information to be inadvertently shared by the organization who is responding.

- **Investor Scorecards**

Beyond CDP there are a number of reporting methodologies including CSR and ESG scorecards, which are sent to organizations via a disclosure platform. While similar to CDP's supply chain module, these platforms are designed to address some of the issues around sustainable procurement. For example, proliferation of CSR standards (e.g., ISO 26000, United Nations Global Compact, GRI, etc) and eco-labels

(e.g., Energy Star, Forest Stewardship Council [FSC], Fairtrade, etc.), has led to increased confusion and more complicated reporting. At least in part due to this complexity, many companies continue to have a lack of supplier engagement which results in limited available reported data. EcoVadis is a disclosure platform which aims to improve reporting and engagement by providing web-based collaboration tools for buyers and suppliers. This allows procurement executives to access scorecards, monitor sustainability performance, and follow continuous improvement actions. EcoVadis obtains the majority of its data through online questionnaires, which are then pooled with other available published information from third-party auditors, other government or oversight agencies, and then creates a scorecard based on collected pooled data. The use of a system pooling information reduces the processing time and cost associated with monitoring environmental impacts, and also improves the reliability of what is reported as it has built in oversight and accountability. The disadvantages of EcoVadis are the reliance on self-reporting. For large companies with many suppliers, however, it is likely to play a beneficial role in allowing more streamlined comparison and monitoring over time.

EcoVadis is no longer simply a CSR reporting platform for social and ethical business practices but increasingly gives more weight to organizations environmental impacts. Organizations are scored on four themes (i.e., environment, labor, fair business practices and procurement) covering 21 CSR criteria. “The environment theme asks for companies to disclose information about their operational factors (e.g., energy consumption, waste management, water use, etc.) and product stewardship (e.g., product end-of-life, customer health and safety issues)” (EcoVadis, 2016). As part of the scorecard corporations are benchmarked against industry peers on the EcoVadis platform. This allows investors to quickly compare organizations on a number of important criteria.

3.5.2. Best Practices

Communication is vitally important to the success of an organization’s environmental performance. Shareholders are now viewing the triple bottom line of people, planet and profits as a benchmark for long-term profitability. Customers are demanding more sustainable business practices. Governments are increasingly passing

legislation to require organizations to report their climate-related risks and actions they are taken to mitigate those risks. Without internally communicating sustainability an organization will be unable to implement the changes necessary to become more sustainable. Without communicating externally an organization could lose sales to the increasing number of environmentally-conscious consumers. In a report published by GreenBiz (Wicinski & Griffith, 2013) analyzing modern communication tools it brings to light a few statistics: “the average person gets one information interruption every eight minutes, or approximately seven an hour and 50-60 per day and the average American is exposed to 247 commercial messages and 3,000 advertising messages each day.” There are many different avenues for communicating an organizations’ environmental performance depending on the targeted audience. Executive summaries to support the traditional print or online CSR or sustainability report are recommended to highlight the actions an organization is taking to measure and reduce their emissions. Furthermore, developing a brand to represent the organization’s approach to sustainability distinguishes the organization from its competition with recruitment, employee engagement and customer loyalty (Wicinski & Griffith, 2013). Organizations must take control of their own narrative through technology that exist today. Social media provides outlets for positive and negative stories about an organization’s environmental performance and by incorporating social media in their sustainability messaging corporations can better communicate the initiatives and progress they are achieving.

It is not enough for an organization to measure and take actions to reduce their emissions and overall environmental and human health impacts. They must report these initiatives publicly and control their story. With the increasing environmental-conscious public, investors and other stakeholders are demanding corporations be proactive towards addressing climate-related risks. An organization must first understand their risks and identify opportunities, then take action and control their narrative to increase their competitiveness.

3.5.3. Interpreting Corporate Communications

As organizations become more familiar with emissions tracking, measuring and reporting, the metrics which they are compared against become more advanced.

Recognizing economic development is dependent on the ability to move goods and services, a group of organizations established analysis tools to facilitate better identification of risks and opportunities. These tools utilize scenario analysis, “the process of estimating the expected value after a given period of time assuming specific changes in the values or key events take place,” to account for the needs of a growing global population, and the costs to the environment and human health if GHG emissions are not reduced (Investopedia, 2017).

- **Scenario Analysis**

The TCFD as previously introduced “aims to develop voluntary, consistent climate-related financial risk disclosures for use by companies in providing information to investors, lenders, insurers and other stakeholders” (Task Force on Climate-Related Financial Disclosures (TCFD), 2017a). TCFD promotes forward-looking information through scenario analysis. Scenario analysis is a tool used for improving the resiliency and flexibility of strategic plans. Investors want to understand how resilient an organization’s strategy is to climate-related risks. The Task Force on Climate-Related Financial Disclosures (TCFD) (2017a) recommends including a 2°C or lower scenario, “the 2°C Scenario provides a common reference point that is generally aligned with the objectives of the Paris Agreement.” There are numerous reasons scenario analysis should be considered a useful tool for corporations in assessing the implications of climate-related risks and opportunities on their business practices. For example, it can help organizations calculate the potential range of “plausible business, strategic and financial impacts from climate change and the associated management actions that should be considered in strategic and financial plans” (Task Force on Climate-Related Financial Disclosures (TCFD), 2017a). This may lead to more robust strategies under a wider range of uncertain future conditions. It is recommended that all organizations apply a basic level of scenario analysis and organizations more significantly affected by transition and physical risks should consider a more in-depth application of scenario analysis.

The investment community is increasingly recognizing the material risk climate change poses for many sectors, either in terms of how it impacts a given company or how that company understands and manages its risk. CDP has integrated science based

targets in its scoring system. With limited sector specific guidance on setting a science based target, achieving a leadership level score on CDP becomes increasingly difficult. The Global Investor Coalition on Climate Change (GICCC), a joint initiative of four regional climate change investor groups endorsed by over 400 investors representing more than USD 24 trillion in assets, issued a statement at COP 21 committing to take action by, “working with the companies in which we invest to ensure that they are minimizing and disclosing the risks and maximizing the opportunities presented by climate change and climate policy” (Investors Platform For Climate Action, 2015). The Sustainable Accounting Standards Board (SASB), a non-profit organization, is creating industry standards for the disclosure of material sustainability information in mandatory Securities and Exchange Commission (SEC) filing that investors can use to assess and make decisions about a company. Unfortunately, SASB is only focused on the US market currently, but its guidance documents can be useful for organizations which work in the global market. The EU Commission now mandates that financial institutions and large corporations disclose their climate risk. The 2015 UN Paris Agreement on Climate Change commits governments to “making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development” (United Nations Framework Convention on Climate Change (UNFCCC), 2015). The TCFD is working to develop consistent climate-related financial risk disclosures for companies to use in providing information to investors, lenders, insurers and other stakeholders.

According to Task Force on Climate-Related Financial Disclosures (TCFD) (2017a) the benefits for organizations to implement the recommendations include, “better access to capital by increasing investors’ and lenders’ confidence that the company’s climate-related risks are appropriately assessed and managed, increase in effectively meeting existing disclosure requirements to reporting material information in financial filings, and increased awareness and understanding of climate-related information in a framework that investors are increasingly asking for, which could ultimately reduce the number of climate-related information requests received.” Reporting of climate-related risks and opportunities is expected to evolve over time as there is an increase in the quantity of disclosures the quality and consistency will also increase.

- **Science Based Targets**

The Science Based Targets Initiative (SBTi) is an international initiative on science-based target setting for corporations initiated by CDP, United Nations Global Compact (UNGC), the World Resources Institute (WRI) and the World-Wide Fund for Nature (WWF). The initiative works to support and promote corporate best practice in setting SBTs. The Fifth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC) shows that despite efforts to mitigate climate change, GHG emission levels have increased by 31 percent between 1990 and 2010 (Intergovernmental Panel on Climate Change (IPCC), 2014a). In order to keep the global temperature increase within 2°C compared with pre-industrial temperatures global GHG emissions must be cut between 49 and 72 percent from 2010 levels by 2050 (Intergovernmental Panel on Climate Change (IPCC), 2014b). Some scientists indicate that 2°C is not enough, calling for a 1.5°C limit. This would require the phasing out of some energy sources and elimination of industry emissions at a faster rate. Nearly 200 countries participated in the twenty first UN Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP) 21 and signed onto the accompanying Paris Agreement to hold “the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C” (United Nations Framework Convention on Climate Change (UNFCCC), 2015). Business has a critical role in limiting and reducing emissions.

The SBTi advocates science-based target setting as a powerful tool for increasing companies’ competitive advantage in the transition to a lower carbon economy. The Science Based Targets Initiative (SBTi) (2017) defines GHG emission reduction targets as science-based, “if they are in line with the level of decarbonization required to keep global temperature increase within 2°C of pre-industrial levels.” Many organizations recognize the risk climate change poses to their business and the opportunity it creates for leadership and innovation, and have already committed to emission reduction targets, tracking and publicly reporting GHG emissions. However, most of these targets do not equate to the reductions necessary to meet the threat posed by climate change. For example, of the 70 world’s largest emitters, nearly a third do

not have targets, another third have targets covering internal operations that are not aligned with climate science. There is opportunity for corporations to fill in the emission gaps.

Earlier this year Walmart announced the launch of a sustainability platform, “inviting suppliers to join Walmart in committing to reduce greenhouse gas emissions resulting from their operations and supply chains,” (Wal-mart Stores, 2017b). Walmart’s aim is to eliminate one gigaton of carbon dioxide equivalent (CO₂e) emissions from its upstream and downstream Scope 3 sources by 2030. For reference, eliminating one gigaton of carbon emissions is approximately equivalent to removing over 200 million passenger vehicles off roads for a year. This ambitious target makes Walmart the first retailer with a verified science-based target for emissions reductions. An emission reduction target is considered science-based if it is in line with the level of decarbonization required to keep global temperature increase within 2°C of pre-industrial levels. According to Kathleen McLaughlin, Senior Vice President and Chief Sustainability Director for Walmart, “we are proud of the improvements we’ve made in reducing our own emissions, but we aim to do more. That’s why we’re working with our suppliers and others on Project Gigaton,” (Wal-mart Stores, 2017b). Ms. McLaughlin recognizes in order to make lasting change as a corporation one must engage and incentivize their suppliers. To help their suppliers make commitments to emission reductions and initiate projects, Walmart collaborated with NGOs and like-minded organizations to develop an emissions reduction toolkit. Initiatives like Project Gigaton are ultimately consumer driven, and corporations must rise to the challenge to stay competitive in today’s markets. As said by Fred Krupp, President of Environmental Defense Fund (EDF), “forward-looking companies like Walmart, and the suppliers that will join them, know that our economy and our planet can-and must-thrive together. Consumers deserve both, and these businesses are leading the way,” (Wal-mart Stores, 2017b).

The Low Carbon Technology Partnerships Initiative (LCPTi) created low-carbon technology deployment action plans for nine business sectors, including freight transport, agriculture and chemicals. PricewaterhouseCoopers (PwC), a global consulting service with more than 223,000 people with services including audit, assurance, tax and others, estimated that if its ambitions were realized, the LCPTi

could contribute to 65 percent of the emission reductions necessary to keep us within the 2°C scenario by 2030 (Science Based Targets Initiative (SBTi), 2017). The SBTi has developed a guidance document for organizations in setting science-based targets; it includes making the business case for SBTs, methods for defining SBTs, communicating and implementing the targets. In additional sections case studies from organizations and more in-depth technical information is provided for the methods as well as how to choose among the methods. The SBTi is limited when considering specific sector guidance and methodologies, which are still in concept or development phases for many sectors including transport and chemical industries.

The key components of a science-based target approach are the carbon budget, emissions scenario and allocation schemes. There is a finite amount of carbon that can be emitted into the atmosphere before warming will exceed specific temperature thresholds. This amount is called the carbon budget. All science-based target methods are based on keeping the total cumulative global emissions below the total available carbon budget for a 2°C threshold, the budget is 1010 GTCO₂ (Intergovernmental Panel on Climate Change (IPCC), 2014b). An emissions scenario represents a way of distributing the available carbon budget over time. Scenarios vary depending on assumptions taken regarding population, economic growth, technological advance and their cost-effectiveness. According to the Science Based Targets Initiative (SBTi) (2017) an allocation approach refers to “the way the carbon budget underlying a given emissions scenario is allocated among companies with the same level of disaggregation (e.g., in a region, in a sector or globally).”

The SBTi guidance provides criteria and recommendations for setting targets for Scope 1, 2 and 3 emissions. It is recommended to consider all three scopes at the same time, and there are different tactics for determining which operations to include. A company should select a single approach and maintain consistency across its corporate structure. When companies set targets, they initially focus on Scope 1 and 2 emissions because they are likely more able to influence these emissions. However, a company’s Scope 3 emissions are often much greater and ambitious Scope 3 targets can play an integral part in a company’s GHG reduction strategy, allowing it to demonstrate performance and leadership, manage supply chain risks and opportunities, and address the needs of stakeholders. To provide a resource to guide organizations a

table was generated to summarize the previous sections and support users in developing strategies based on their personal motivations for measuring and reporting carbon emissions, see Table 3.1 below.

Table 3.1 GHG Emissions Reporting Guidance Table. Literature review results summarized here by Kristen King, 2017.

Why Report Emissions?	What Information Should Be Reported?	How Should Organizations Measure Scope 3 Emissions?	Ways for Organizations to Communicate their Initiatives and Progress?
Risk Management	Climate-Related Risks and Opportunities	Task Force on Climate-Related Financial Disclosure (TCFD) 2°C Scenario Analysis	CSR or Sustainability Report and Annual Report as required by Security Exchange Commission filings or EU Commission. Since CDP is an investor requested questionnaire this should also be used to disclosure information.
	Mandatory Non-Financial Disclosures	Directive 2014/95/EU New Economic Regulation (NRE) Act in France	
Carbon Markets	Carbon Inventories	International Organization of Standardization (ISO) 14064 Greenhouse Gas (GHG) Protocol	Above, plus Supplier Scorecards (e.g., EcoVadis)
Competitive Advantage	Emission Reduction Goals and Progress	US Environmental Protection Agency (EPA) SmartWay® Partnership Program Global Logistics Emission Council (GLEC) Framework	Above, plus using scenario analysis to identify risks and opportunities and social media or other public communication outlets

Moving from the top to bottom of the table, risk management is driven by investors desire to have climate-related risks information, financial and non-financial in order to make informed decisions. For organizations in locations which have carbon markets, developing a carbon inventory is necessary. The ISO 14064 and GHG Protocol both provide methodologies for measuring and calculating an organization’s emissions. Lastly, to become a leader in sustainability and generate competitive

advantage organizations should be setting goals and targets and reporting on their progress to achieve results.

Chapter 4. **CASE STUDY**

FMC is a specialty chemical company head-quartered in Philadelphia, Pennsylvania, United States of America. FMC has served the global agricultural, industrial and consumer markets with innovative solutions, applications and quality products for more than a century. As of November 1, 2017, FMC acquired a significant portion of DuPont's Crop Protection business. FMC's 2016 pro forma revenue was approximately \$4 billion. FMC employs more than 7,000 people throughout the world and operates in its businesses in two segments: FMC Agricultural Solutions and FMC Lithium (FMC Corporation, 2017b). FMC is a business-to-business company, and as such its customers vary widely, including agricultural retailers and distributors, battery producers, as well as consumer product companies. FMC's Agricultural Solutions division provides innovative and cost-effective solutions to enhance crop. FMC's lithium products are used in energy storage, specialty polymers and pharmaceutical synthesis (FMC Corporation, 2017a).

Most organizations use standardized practices to evaluate suppliers regularly; however, for FMC this remains particularly challenging. FMC enlists third-party logistics contractors for both delivery of raw materials to FMC's manufacturing locations as well as for the goods and products produced by FMC to reach the customer. With their reliance on outside contractors, measuring and controlling emissions is dependent on the relationship and influence of the company. This case study aims to provide a resource for FMC and other organizations to develop CSR management strategies for engaging with contractors and suppliers to measure and reduce emissions throughout the value chain.

4.1. FMC's Sustainability Journey

As companies look to extend their sustainability initiatives, they have begun to look beyond their own manufacturing operations and electricity purchased into their supply chain. FMC published its first sustainability report in 2011 in accordance with GRI Application Level B. This report presented an overview of FMC's sustainability strategy, including accomplishments and challenges. Some of the highlights included

the formation of the Chairman's Sustainability Council, comprised of leaders from across FMC's businesses and functions, the establishment of dedicated sustainability resources within FMC and the creation of a roadmap for businesses to make coordinated progress in sustainability (FMC Corporation, 2012). Over the subsequent years FMC has advanced from defining sustainability to establishing targets. In the past two years FMC has made tremendous progress, setting 2020 and 2025 sustainability goals. The 2020 goals prioritize sustainable innovation, with the goal of dedicating 80 percent of the research and development (R&D) budget to develop sustainably advantaged products. Recognizing a need to address the social pillar of sustainability, FMC also included a 2020 goal for engaging in the communities where they live and work. The Community Engagement Index tracks manufacturing sites performing at least one activity in each of the four categories: community leadership, community partnership, operational transparency and safety, in order to achieve a 100. The 2025 environmental goals are focused on reducing the impact of FMC's manufacturing sites, through reductions in energy, GHG emissions and waste intensities by 15 percent and reductions in water intensity in high risk locations by 20 percent (FMC Corporation, 2017b). FMC reported to the CDP Climate Change module for the first time in 2016, and performs an annual materiality assessment to identify key issues which have the greatest impact to the business from economic, environmental and social standpoints. This is an extensive process with internal and external stakeholder input. These materiality assessments, in addition to CDP disclosures and supplier questionnaires have led FMC to intensify their sustainability initiatives beyond their own operations across their value chain.

Similar to many global organizations FMC purchases millions of dollars of goods and services from suppliers to use in manufacturing their products, and in turn FMC's products are sold and shipped to customers around the world. In 2015 a global supply chain diagram for FMC Health and Nutrition was generated for the corresponding sustainability report. This diagram featured information about the source of the raw materials, the manufacturing process, the FMC customer and the end consumer, but the transportation and storage section was lacking as seen in Figure 4.1 below (FMC Corporation, 2016a).

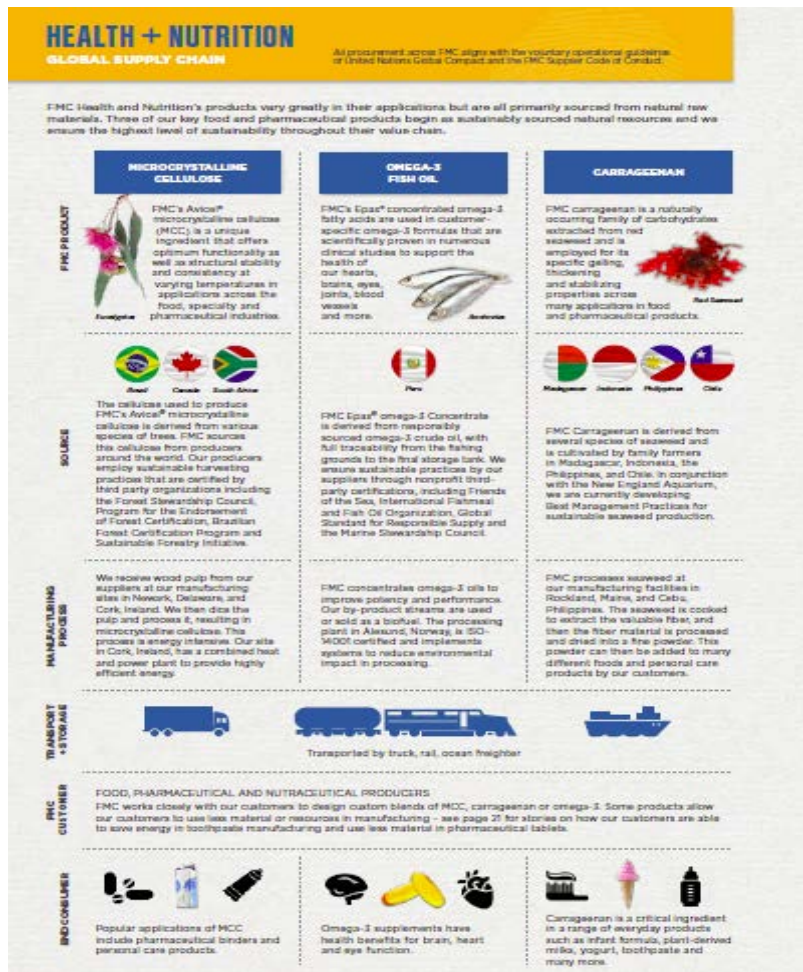


Figure 4.1 FMC Health and Nutrition Global Supply Chain, sourced from 2015 Sustainability Report: Our Formula for Progress (FMC Corporation, 2016).

As part of their commitment to responsible procurement the decision was made to further investigate measuring and monitoring their logistics footprint, with the goal to generate a more comprehensive account of their transportation processes and emissions occurring in this portion of the value chain.

4.2. Supplier Engagement

As determined in the previous sections the first step for an organization desiring to measure their Scope 3 emissions due to logistic activities is to engage with their suppliers. Developing a Scope 3 inventory specific to a particular entity encourages quantification and reporting of emissions from individual partners across the value chain. For many organizations, a primary goal of developing a Scope 3 inventory is to encourage suppliers to measure and report GHG emissions, so that

reduction targets can be set and ultimately reached. As discussed in earlier sections, some of the pressure to measure and report emissions does not come from internal company sources alone, but also from stakeholders that may be external to the company. The ability to demonstrate good standing in measuring and reporting, with increased environmental awareness, also makes a company more appealing to stakeholders and customers. Perhaps the easiest, most straight forward way to engage and report is through supplier questionnaires, surveys and audits.

4.2.1. New Vendor Questionnaire

For a new raw material supplier to begin working with FMC, they must first complete the pre-qualification process, which includes a self-assessment questionnaire. The pre-qualification process assesses a supplier's sustainability efforts, safety record, environmental and quality management systems and responsible sourcing and ensures that the supplier abides by the FMC Supplier Code of Conduct to be an ethical, reliable and safe supplier. The questionnaire, *Raw Materials Supplier Pre-Qualification Form*, asks questions such as, "Do you have a policy on sustainable manufacturing practices for the raw materials you supply and do you engage your suppliers on environmental standards," (FMC Corporation, 2016b). The assessment is conducted by the procurement team as part of the vendor selection process. By asking FMC's suppliers about their supplier engagement strategies, FMC is taking the first step to engaging with their tier 2 and 3 suppliers (i.e., the suppliers of FMC's suppliers). The responses to the self-assessment questionnaire are evaluated using the internal Ranking Assessment Tool. The tool adjusts for weighting the responses on criteria as appropriate for the supplier. For example, a third-party logistics supplier may receive a higher weight for the category "transportation security programs" than a supplier who is responsible for providing raw materials. Suppliers are then ranked in each area, 1 to 3 (with 3 being superior). Scores are then generated: poor, good or superior. Each level indicates whether a supplier is acceptable or not based on their responses to the questionnaire and provides measures for further engagement. Scores of "good" or "superior" indicate acceptable vendors, while a score of "poor" indicates a supplier should be rejected. In the event that it is not possible to reject the supplier (e.g., there being no alternative supplier in a particular area) FMC requires the supplier to develop

a risk mitigation strategy including frequent audits and reviews to increase the supplier's ranking. A successful supplier partnership is vital to ensuring a safe and responsible supply chain. In this instance, the questionnaire serves as the first step toward establishing an open and transparent partnership.

4.2.2. Participating in the Supplier Ethical Data Exchange (Sedex)

In addition to the prequalification screening, FMC coordinates through the external screening and risk management provider, Supplier Ethical Data Exchange (Sedex), assessing contractors on safety, environmental and sustainability criteria (Sedex Global, 2017). The partnership with Sedex was initiated in 2016 with the goal to thoroughly evaluate supplier social responsibility. For an organization with thousands of suppliers it is time and resource extensive to evaluate pre-existing suppliers thus the Sedex partnership gives more credibility to suppliers who were already in FMC's employ prior to initiating the "new vendor questionnaire". Through the partnership FMC suppliers are requested to complete a self-assessment evaluation on the Sedex online portal. The assessment is then evaluated using the Sedex Risk Assessment Tool. It is given a low, medium, or high-risk score for the overall risk as well as for each of the four pillars of Sedex (business integrity, labor, health and safety, and environment). The scores help determine the level of risk for a company if they buy from these suppliers. Additionally, suppliers are encouraged to have audits performed at their sites. The auditor uploads the audit findings and any non-compliance(s) to the Sedex platform. The auditor and supplier agree to a corrective action plan as needed and the supplier uploads the plan with evidence of actions taken to Sedex for review and approval. A follow-up audit may be necessary. This third-party assessment process adds additional layers of transparency to corporations. Furthermore, it facilitates engaging with suppliers to include environmental impact targets, develop CSR strategies to mitigate risks, and to take action on identified opportunities.

The limitations of the Sedex partnership are that it is not mandatory for suppliers to be engaged through Sedex. Additionally, the partnership relies on self-reported data which may or may not be a true reflection of the situation. As audits are not currently required accountability is dependent on the individual supplier. In such a

scale, there is also the limitation that by scoring “just good enough” you may miss even easy opportunities for improvement in middling companies and suppliers. Lastly, by using a third-party provider, like Sedex, the direct engagement between supplier and company is minimized or lacking which can further complicate a fragile relationship.

According to Ms. Nolan, Center of Excellence Process Lead at FMC Corporation, the partnership with Sedex is initiated in three phases (A.Nolan, personal communication, June 22, 2017). The first phase was initiated in 2016, by engaging with suppliers who were current members of Sedex. This engagement process required that FMC join Sedex and then submit requests to establish “relationships” with suppliers. FMC has successfully established “relationships” and engaged with 67 percent of the current members which were targeted. Phase Two includes identifying and targeting new suppliers and the suppliers who did not respond in Phase One for additional engagement to encourage further partnerships to align social and environmental goals (see Figure 4.2 below).

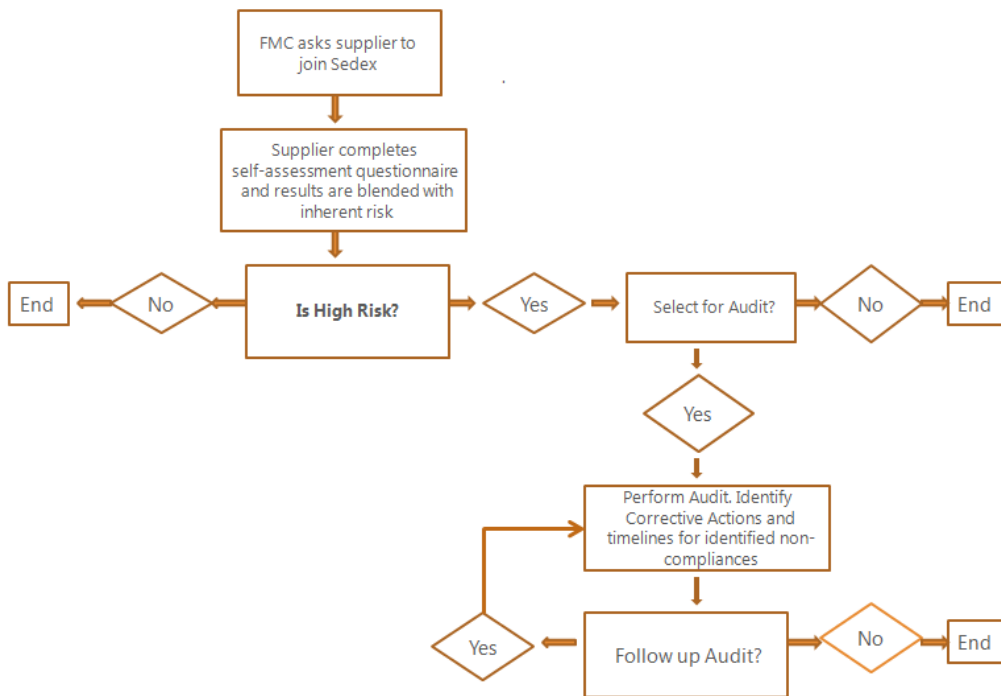


Figure 4.4 Flow Diagram of Phase Two FMC and Sedex Partnership, sourced from FMC Overview for GPG Meeting (A.Nolan, 2017).

Phase Three of the partnership is to identify FMC’s strategic suppliers and suppliers identified as high risk using the Ranking Assessment Tool. These suppliers are then engaged through Sedex, if the “relationship” has not already been initiated. Furthermore, FMC as a supplier has been engaged by their customers to complete the Sedex questionnaire and have had sites audited by third-party auditors.

Ideally, by working through a platform such as Sedex, you are able to determine where a company or supplier falls with respect to sustainability and safety practices. This is valuable not only prior to engaging with a particular company, but over time as company goals and targets change, to ensure that components of the company’s value chain align with their overall mission. Through such partnership, a network is built that includes good working models of successful practices, and this resource has the potential to provide practical strategies to help lower scoring companies improve.

4.3. Benchmarking Chemical Sector

The primary objective of benchmarking the chemical sector is to identify industry standards for reporting sustainability and logistics. These standards may then be applied to FMC to determine where it stands when compared to peer-companies and leaders in the field of sustainability. Organizations are continually seeking to optimize their logistics network to reduce costs and improve overall efficiency; FMC is no different. Because FMC operates on a global scale, understanding its logistics can be cumbersome, especially for manual processes such as coordinating shipments.

To better understand the practical requirements of reporting in the chemical sector, this phase of research included engaging with organizations, industry experts and analysts on current industry standards. These standards included estimating emissions, reporting practices and supplier engagement. Industry leaders and peer companies who have their own fleets are more consistently reporting emissions as they readily have access to this data. Additionally, leaders within the industry are reporting on their suppliers' emissions. For example, BASF, a specialty chemical company head-quartered in Germany reports Scope 1 and 2 emissions annually as well as Scope 3 emissions, which account for 84 percent of their overall total GHG emissions (BASF, 2016). How these organizations engage with their suppliers to compile the required data for reporting includes developing a baseline for emissions, often starting with one mode of transportation (e.g., trucking or ocean freight) and one region, refining the process for collecting data and performing calculations using an accepted methodology. For organizations with access to more resources, setting goals and targets to reduce these emissions from the baseline level is the next step.

Organizations that are “on-the-road” are those which report Scope 1 and 2 emissions, and may recognize the need to further investigate their supply chain but aren't their yet. This is FMC, which annually reports their Scope 1 and 2 emissions and is aware of the potential risks in the supply chain, particularly transportation, but up to now has not engaged with suppliers to develop a Scope 3 carbon inventory. FMC regularly works with third party logistics providers to transport raw materials to manufacturing facilities, then to distribution warehouses. One such supplier provided a quick estimation of FMC Agricultural Solutions emissions for North America trucking freight contracted through this company. Comparing this with all of FMC's annual

emissions due to its manufacturing operations the emissions from this supplier was 36 times higher than all of FMC's manufacturing operation emissions. This is on the same order of magnitude as BASF. The "non-performers" are those companies which at this time have not publicly reported their emissions, it does not mean that they are not tracking emissions but only that this study could find no publicly disclosed information. The graph below indicates the breakdown of the 23 companies reviewed, with majority "on-the-road".

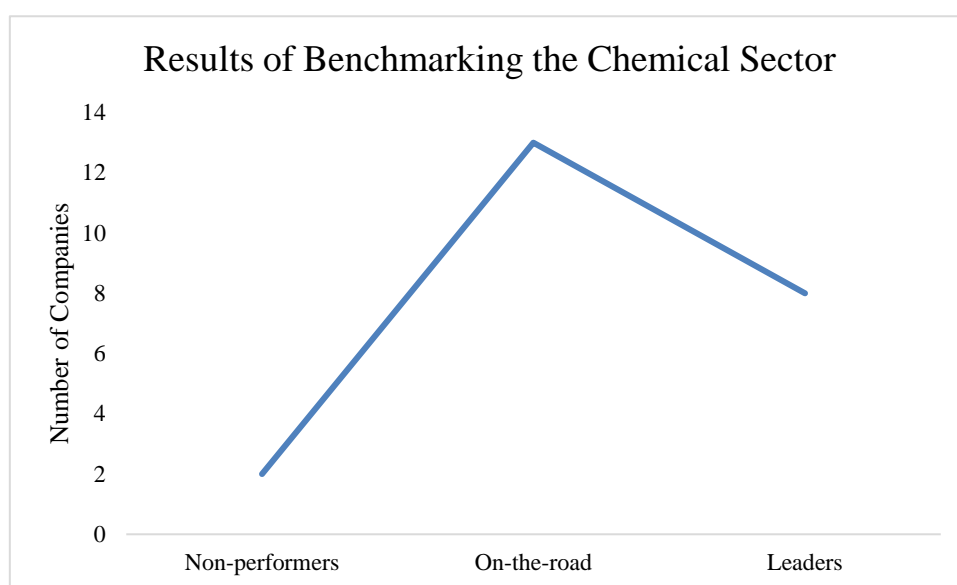


Figure 4.7 Results from Benchmarking the Chemical Sector. Generated by Kristen King, 2017.

As expressed previously, the majority of organizations also engage with their suppliers around safety targets. Indeed, safety targets and initiatives, such as driver or operator training programs, are often the first step to supplier engagement for the transportation industry. It should not be overlooked that the relationship built between companies and suppliers is of paramount importance to create successful engagement and effect change, whether it be with regards to safety targets or incorporation of sustainability practices.

In speaking with industry analysts as part of the interview process outlined in the methodology section, their findings show that there is currently no widely accepted industry standard framework for reporting supplier's emissions. At the minimum, organizations are reporting on transportation safety, including any work they are doing with their suppliers and logistic providers to ensure that they meet and maintain a high

level of safety standards. Being that there is no standard framework for calculating emissions, we must look to organizations currently working towards standardizing methodologies for calculating or estimating emissions. Some of the most common methodologies according to analysts are the Clean Cargo Working Group (CCWG), US EPA SmartWay® Partnership Program, GLEC Framework, and the Environmental Defense Fund (EDF) “Green Freight Handbook” (P. Fitzpatrick and D. Gonzalez from Gartner, Inc., personal communications, August 2, 2017). The CCWG is a large member organization, including the International Maritime Organization (IMO), focused on developing ‘clean’ standards for shipping freight. The CCWG was established to be proactive towards impending emission regulations by establishing an accepted methodology for all organizations to use for estimating their carbon footprint associated with shipping freight. This will allow for direct benchmarking of shipping providers and sharing of best practices to reduce emissions. The SmartWay and the EDF “Green Freight Handbook” work in a similar manner but with a focus on truck freight, while the GLEC Framework is implementing guidance documents for multi-modal freight transport (e.g., road, air, rail and ocean freight) by combining principles from SmartWay and CCWG and others. Currently, much of the reporting is being driven by the industry itself. A best estimate is that it may be up to 10 years before there is an accepted standard for reporting emissions within the transportation sector.

4.4. Industry Survey and Interviews

To better garner an appreciation for the difficulty involved with undertaking emissions measuring and reporting, and how this reporting is viewed internally at the corporate level, 20 individuals from prominent industries (e.g. capital goods and consumer product manufacturers, power generation, chemical, financial, consulting and logistics firms) based in the US with a global presence were provided a series of three open-ended questions via direct email from myself:

1. Is measuring and reporting carbon emissions important to your organization?
2. How does your company measure and report carbon emissions?
3. What internal barriers to measuring and reporting emissions have you experienced?

With a 20 percent response rate, 100 percent of the responses indicated that measuring and reporting carbon emissions is very important, as seen in Table 4.1 below (the original responses can be viewed in the Appendix Table 3). Having publicly stated goals for emission reductions and reporting on that progress is increasingly valuable to investors and customers. These organizations recognize it is a big undertaking with value-added. Larger organizations have a long history of investing time and resources to track emissions and report, while smaller organizations are catching up.

CHAPTER 4 CASE STUDY

Table 4.1 Email Survey Responses. Interpreted by Kristen King, 2017.

Question	Companies				
	A (Specialty Chemicals)	B (Consumer Products)	C (Capital Goods Manufacturer)	D (Energy Service Provider)	E (Freight Forwarder)
Is measuring and reporting carbon emissions important to your organization?	Yes	Yes	Yes	Yes	Yes
How does your company measure and report carbon emissions?	GHG Protocol	GHG Protocol	GHG Protocol	GHG Protocol	Clean Cargo Working Group
What internal barriers to measuring and reporting emissions have you experienced?	Internal organizational changes	Data collection	Size of operations and internal organizational changes	Data collection	Office spaces are rented which doesn't allow for making big changes and data collection

Frequently CDP was named as the platform for organizations to publicly disclose their goals and actions. In a few cases, the direct emissions for an organization may be small, due to being mostly office spaces, while the indirect emissions, from customers, are becoming increasingly more significant. Such organizations are beginning to measure and report shipping emissions for their customers (e.g., a third party logistic company reports emissions from freight shipping to their customers whose products are being transported; in this case the transportation fleet is not owned by the logistics provider and therefore falls into the category of Scope 3 for the company as well as the customer). This is becoming an increasingly common request. Third party logistics providers must have a comprehensive understanding of their supply chain in order to provide this level of detail to their customers. This is particularly complicated when the shipments are multi-modal and measuring requires understanding fuel consumption factors and transport type. With the majority of shipments occurring via multi-modal it is imperative that an accepted framework be established and used to facilitate public understanding of reported information.

Consensus showed that the GHG Protocol for measuring Scope 1 and 2 emissions was generally used to calculate an organization's carbon footprint, and that this calculation was typically reported on an annual basis. When considering Scope 3 emissions, most often organizations are reporting to the CDP Supply Chain questionnaire at the request of their customers, using varying methodologies available due to the complicated nature of multi-modal transport options. At this time, companies reporting Scope 3 emissions have limited engagement with their suppliers, which poses a significant barrier to measuring and reporting these emissions. Refraining from engagement with suppliers serves as a missed opportunity for organizations who want to understand their overall carbon footprint and identify areas for logistic optimizations and emission reductions. The exception to this seems to be with third party logistics companies and freight forwarders. These companies rely on their suppliers to provide information about emissions and performance in reducing emissions, which they in turn provide to their customers, who are really the driver at this time for such reporting.

One responder indicated the desire to set science-based targets with further description of how they are actively working to quantify their Scope 3 emissions.

Consistently, the greatest challenge faced by organizations is in collecting emissions data. This becomes increasingly difficult as large companies merge and new data is acquired that must now be incorporated into existing data and frameworks. Even with the guidance from the GHG Protocol, such large shifts are difficult to account for and even more challenging to explain. Furthermore, global organizations are challenged to provide accurate data for transport of materials throughout their value chain often working with different units of measurement (e.g. tonnes of material per mile or kilometer). Aside from the challenges of data collection, there is the question of significance and control. Organizations have direct control over their operations and electricity purchased. The approval of the decision-makers within an organization to make changes in these areas, to prioritize reducing these emissions makes sense. Depending on the type of industry these may be significant emissions which can be addressed more simply than Scope 3 (e.g., by utilizing more energy efficient technology the electricity needs can be reduced). Logistics is significant but has often been lower priority for organizations as they begin and strengthen their CSR strategies.

There is also the difficulty of public perception. As companies begin measuring and reporting Scope 3 emissions, their calculated overall emissions, as reported, are seen to increase. However, this is not completely accurate. The emissions are not increasing, but what is being reported as emissions is seen to increase, because previously unaccounted-for emissions are now included. It may be prudent to keep Scope 3 emissions separate from “overall” emissions to prevent under-reporting, and to encourage companies to report such data without fear of a penalty when their overall emissions are seen to increase.

4.5. Initiating a Partnership with US EPA SmartWay® Program

Organizations of all sizes have limited resources when it comes to monitoring and engaging across their supply chain. The SmartWay Transport Partnership Program helps address some of the limitations and demands placed on corporations for environmental accountability and carbon-risk assessments by providing shippers, companies which engage with carriers to transport their products, with tools and resources to better understand their freight supply chain footprint (U.S. Environmental

Protection Agency (EPA), 2013b). SmartWay helps improve operational and financial performance by reducing an organization's freight supply chain carbon footprint through carrier engagement and the use of proven fuel saving strategies. The program is free to join, and through it organizations gain access to benchmarking tools, emission calculators and reports which support completing CDP disclosures for Scope 3. Since 2004, SmartWay has helped its partners save 196.5 million barrels of oil-equivalent, and trucking companies have saved \$27.8 billion on fuel costs (EPA, 2016).

According to Ms. Turkington, Accounts Manager for EPA SmartWay and Supply Chain Programs, during a personal communication on August 1, 2017, the program provides shippers four different levels of partnership (Table 4.2 below provides a visual representation of the benefits garnered by participating in SmartWay as a shipper).

Table 4.2 Benefits of SmartWay Shipper at the Different Levels of Partnership, sourced from US EPA SmartWay for Shippers, 2016.

Benefit	SmartWay 1 Shipper Candidate	SmartWay 2 Shipper Partner/Custom Metric	SmartWay 3 Shipper Partner/ Activity Based	SmartWay 4 Shipper Partner/ Activity & Operational Strategy Based
Access Custom Engagement Plan	✓			
Relative Carbon Assessment		✓		
Carbon Footprint/ Use to Report & Benchmark			✓	✓
Compete for SmartWay Excellence Award			✓	✓
Quantify Carbon Savings from Operations				✓
Opportunity for Additional Recognition				✓

For an organization solely looking to engage with their suppliers, level one, Shipper Candidate, has access to resources and a customized engagement plan for working with their carriers to enroll in SmartWay. At level two, as a SmartWay Partner, the organization is able to provide data for how much they are spending on non-SmartWay carriers versus SmartWay carriers. Using spend is not the recommended way of determining significant suppliers, but SmartWay recognizes that for some organizations this may be the only information available, and thus, may serve as a valuable first step in understanding the impact of an organizations' supply chain carbon footprint. The next step as an organization strengthens its engagement, level three, requires submitting carbon tracking data. As a Partner at level three, the

organization provides annual activity data (e.g., cargo tonnes and miles of freight shipped) to measure energy and environmental efficiency of company-specific freight activities. At this level, a report is generated for the organization's indirect freight transportation emissions (Scope 3) which can be used directly in a CDP disclosure. The final level of partnership is level four, and it is at this level that an organization is recognized as a leader in reporting annual activity, as well as an innovator and strategist for determining best practices to reduce emissions. It takes five years of engagement, measuring and reporting, as well as documentation demonstrating how you are reducing emissions and showing continual improvement for a corporation to be considered a leader in the SmartWay program.

As an organization with a global network, tracking consistent data across all regions and sectors is challenging. If FMC were to partner with SmartWay based on the level of the data presently available they should initiate a relationship at level two. At this level of partnership, the Shipper Tool requires that the distinction between SmartWay carriers and non-SmartWay carriers be made and information about the mode of transport (e.g., truck, rail or barge) be provided. In this case, only truck mode is identified as it comprises the majority of North American freight transport for FMC Ag Solutions, which remains the majority of FMC's logistic activity in North America. The decision to prioritize North America over another region is due to the consistency of data available for North America transport. The next section of the tool "Activity Data" requires additional information be collected and reported as tonne-miles, total miles, or average payload. Currently, this information is not available and therefore this section is skipped. The "Percent SmartWay" section calculates the organizations Percent SmartWay Value, reflecting the fraction of miles, tonne-miles, or user-provided custom metric attributable to SmartWay carrier partners. Options for custom metric include percentage of total payments, the percentage of total weight or total packages for calculating the Percent SmartWay Value. While the level of data is not at a granularity to provide carbon emissions activity data, partnering with SmartWay is the beginning of the process to engage suppliers, with clearer objectives to measure and quantify supplier "activity data." The projection is that FMC will be able to better guide reporting from suppliers with the intent to use the resources available from SmartWay to calculate or estimate as well as report collected emissions data. In time,

with the procurement team members and improved supplier engagement, FMC aims to prioritize reducing emissions as it aligns with their goals of decreasing environmental and human health impacts associated with transport.

Chapter 5. **DISCUSSION**

In earlier sections, the difficulty of measuring and reporting Scope 3 emissions due to a lack of standardization in the methodologies used was discussed. In brief, reporting platforms, such as CDP or EcoVadis, may be able to more quickly reach a standard practice, at least on the local or national level. However, successful reporting for a global company will require international standardization. Such standardization is likely only to come at the demand of global companies themselves or the mandate of international governing bodies. Until then, how can companies improve their local reporting of Scope 3 emissions? This discussion will focus on the difficulties companies face in engaging their suppliers, and provide recommendations for improving engagement. Supplier pre-qualification assessments and platforms afford an organization an initial reference for engaging their suppliers. This assessment provides a ranking device that can identify suppliers as “poor,” “good,” or “superior.” It would seem straight forward that if a supplier is identified as “good” or “superior” then they would be accepted, and a “poor” supplier would be rejected. Such simplification, however, is limiting if a company desires to be a leader in sustainability. A leading company would desire that their suppliers fall into “superior” ranking, or at the very least are working towards it. For potential suppliers identified as “poor,” it would indeed be recommended that they be rejected and another supplier chosen. But if such a rejection is not possible, for example, there being no alternative supplier in a particular area, what should a company do then? In this case, the supplier should be required to develop a risk mitigation strategy. This strategy would include frequent audits and reviews by the partnering company as the supplier works towards improving their ranking. A similar process should also be recommended for “good” suppliers, holding them to set goals and targets for reaching a “superior” ranking. The benefit of using a ranking tool is that it also allows for compiling of data on companies of similar size and operation. Compiled data may provide insight into how similar companies may alter current practices or adopt new practices to improve their ranking. Of course, this ranking is its own reflection of sustainable practice and emissions and

therefore as a company operates with more “superior” and with fewer “poor” suppliers, the Scope 3 emissions would also be presumed to decrease. If an organization desires to be a leader in sustainability, generate competitive advantage in a market and provide quality products to their customers, under the guise of actively engaging across their value chain, it is imperative that they are transparent about the strategies they are undertaking. Caveats or exceptions cannot be allowed for continuing to use a supplier who fails to meet their standards. This is certainly a risk for the company, who in the short term, stands to lose materials or services. However, the alternative risk is a loss of public or professional integrity. Through openness and transparency of the supplier selection process, holding suppliers accountable, and rejecting those who fail to meet their requirements organizations can take the critical first step in expanding their CSR strategy.

Improving partnerships between suppliers and building a network to collect and report their data allows companies such as FMC to generate a Scope 3 inventory. The case report provides an example of how a company or corporation can use a program, such as the SmartWay tool, to help improve reporting on the local level. As identified in the case report, even then, there are limitations in using such a tool. Simply the data has to exist, it has to be being measured or collected, and this is currently where FMC falls short. This is magnified even more on a global scale. For a global company, such as FMC, using the GLEC Framework or the GHG Protocol could provide a more detailed view of the organizations holistic Scope 3 emissions. Both methodologies require more detailed data to be available, and the collection or measurement of such data requires additional time, resources and software capabilities. Developing the business case for additional resources and software requires CSR strategists to show logistic optimizations and cost-savings associated with tracking global shipments. Having this data accessible, through the organization’s own practices as well as through engagement with third-party logistics contractors, is the next step for organizations to develop more comprehensive Scope 3 emission inventories.

For practical purposes, it is recommended to prioritize the Scope 3 activities for any organization choosing to measure its Scope 3 emissions. Determining priority is based on areas expected to have the most significant GHG emissions, as well as those that offer the most significant GHG reduction opportunities and are most relevant to

the company's business goals. Keeping in mind the business goals ensures that an organization's time and resources are appropriately allocated. If the goal is to engage the value chain partners in GHG emission management then programs like SmartWay provide tools to help improve communication and foster greater transparency of efforts made to reduce emissions. However, if the goal is to identify GHG reduction opportunities, set reduction targets and track performance then more detailed data will be required. As previously discussed collecting this data on a global scale is challenging. Preliminary estimates can be made by organizations to identify significant impact areas. Once identified, efforts on engagement with third party logistics providers and carriers to better calculate and report emissions should be undertaken. Because regional differences exist with regards to modes of transportation, units of measure, components of fuel and predominant fuel emission factors, efforts should be focused to standardize what can be and account for what cannot. Standardization of measuring and reporting practices will allow for comparison and benchmarking. Strategies can then be implemented and regulations put in place to help further reduce emissions locally, and then regionally, nationally and globally.

Chapter 6. **CONCLUSIONS & SUGGESTIONS**

6.1. Conclusions

When tasked with reporting emissions, organizations began by prioritizing the measuring and reporting of emissions due to direct operations (Scope 1) and electricity purchased (Scope 2). However, for many organizations the emissions generated throughout the value chain, the Scope 3 emissions often account for a more significant portion than their Scope 1 and 2 emissions. Despite the recognized need to include Scope 3 emissions in emissions reporting, there are inherent difficulties in doing so; including the time, energy and resources required to measure these emissions, the lack of standard protocols for measuring and reporting, and the reliance on third party suppliers to track and submit this information. Furthermore, there is a large degree of variability among companies in how emissions are generated, such that make comparing data on a larger scale more difficult, and without that standardization, reporting could have the potentially damaging effect of being penalizing to companies. Ideally an organization would own and operate their whole value chain. However, this is impractical, and therefore organizations must rely on engagement and CSR strategies to coordinate efforts with suppliers, customers and consumers to improve measuring and reporting. With time, this leads to benchmarking that can be used to establish protocols and standards, ultimately helping to reduce overall environmental and negative societal impacts.

This research includes examples of platforms and methodologies for measuring and reporting Scope 3 emissions. Each platform requires that companies, businesses or organizations respond to a simplified questionnaire. Stakeholders are also provided access to these responses improving awareness and helping to generate company goals and targets. However, because there is a lack of standard protocol, and because there are numerous platforms available, organizations are often called on to respond to multiple questionnaires. Not only is this inefficient, as there is likely to be redundant information, but with limited time and resources the quality of what is disclosed is also likely to be diminished. The purpose of this thesis is to answer the question of how

organizations can better engage with customers and suppliers to streamline the process of measuring and reporting Scope 3 emissions, in order that the company as a whole can provide accurate disclosures based on ESG principles. The case study of FMC Corporation showed that partnering with governmental and non-governmental organizations and engaging with suppliers are the first step in identifying scope 3 emissions. Having a holistic view of the value chain provides for better risk identification and opportunities to mitigate these risks. Engagement starts prior to employing a prospective supplier. For FMC, this is accomplished through the pre-qualification questionnaire and on a global scale with the support of Sedex. With a focus on Scope 3 emissions the next stage of engagement is partnering in a “green freight” program, for example the US EPA SmartWay® Program. This partnership provides experience, tools and other resources for organizations to prioritize their emissions reduction strategies based on risk and opportunity. Furthermore, they promote communication and engagement between corporations and suppliers, including third party logistics providers, for incorporating industry best practices when it comes to packaging reductions, increased fuel efficiencies and logistic optimizations.

Once a relationship is established corporations are better able to gather the necessary data to quantify their Scope 3 emissions, transitioning to a leader by today’s standards. Measuring and quantifying GHG emissions is complicated, there is no one methodology or tool which has been adapted by all sectors to define and calculate these emissions. However, several of the methodologies presented here have commonalities, including: distance travelled, weight, fuel consumption. In some cases, a methodology will build on a different methodology incorporating aspects of a simpler version as the breadth and scope of an organization’s Scope 3 emission inventory grows. For example, the GLEC Framework includes components of the EPA SmartWay tool for truck freight.

This document is intended to be a guidance for corporations, it supports identifying the strengths and weaknesses of varying options available with the concluding case study to showcase how an organization can begin and develop a CSR strategy for engaging with suppliers. Supplier engagement is the first step, but holding suppliers accountable is crucial to create a system for emissions measuring and reporting that will ultimately reduce their value chain’s negative impacts. Lastly, it is

not enough for an organization to engage, measure and take actions to reduce their emissions. They must report these initiatives publicly and control their story. With the increasing environmental-conscious public, investors and other stakeholders are demanding corporations be proactive towards addressing climate-related risks. There are many different avenues for communicating an organizations' environmental performance depending on the targeted audience. Executive summaries support traditional print or online CSR or sustainability reports. Online news outlets and social media provide sources of positive and negative stories about an organization's environmental performance and by incorporating social media into an organization's sustainability messaging they are better able to communicate the positive initiatives and progress they are achieving when they partner together.

6.2. Suggestions

The partnership with EPA SmartWay and FMC Corporation has been slowed due to the delayed release of the 2017 Shipper Tool and internal business changes occurring late in the year. Furthermore, research on an international scale is needed to understand how the SmartWay program compares to other "green freight" programs and if these are beneficial to companies like FMC. There are limitations in using the SmartWay reporting platform. The data has to exist, it has to be measured or collected, and this is currently where FMC falls short. However, by engaging their suppliers this data can be gathered, measured and reported.

To further understand current business practices and challenges facing organizations to initiate and expand their CSR strategies to include monitoring and reducing their environmental impacts interviews were conducted. The interviews were limited to industry experts who were recommended from personal communications with members of the sustainability team and procurement department at FMC. This method for selecting interviewees incorporates bias into the study. Similar to setting up the interviews the email survey included a limited number of recipients from prominent corporations. The number of individuals targeted was limited due to time and access. The individuals were identified through personal communications with academic and industry tutors with the goal to provide a diverse range of corporate representatives. By relying on personal communications bias is introduced, through the

subsequent interviews and surveys the methodologies and reporting platforms identified may be limited to select industries. Furthermore, the results showed an eagerness to develop partnerships and reduce environmental impacts of the organization and their suppliers, due to the limited number of responses this does not infer that other organizations are as eager or willing to participate in a partnership program. An additional survey should be conducted to reach a wider audience with questions aimed to receive an increase in quantitative results.

APPENDIX A: TCFD RISK AND FINANCIAL IMPACTS

Table 1 Examples of Climate-Related Risks and Potential Financial Impacts, sourced from Final Report: Recommendations of the Task Force on Climate-Related Financial Disclosures (TCFD), 2017a.

Type	Climate-Related Risks	Potential Financial Impacts
Transition Risks	Policy and Legal	
	<ul style="list-style-type: none"> – Increased pricing of GHG emissions – Enhanced emissions-reporting obligations – Mandates on and regulation of existing products and services – Exposure to litigation 	<ul style="list-style-type: none"> – Increased operating costs (e.g., higher compliance costs, increased insurance premiums) – Write-offs, asset impairment, and early retirement of existing assets due to policy changes – Increased costs and/or reduced demand for products and services resulting from fines and judgments
	Technology	
	<ul style="list-style-type: none"> – Substitution of existing products and services with lower emissions options – Unsuccessful investment in new technologies – Costs to transition to lower emissions technology 	<ul style="list-style-type: none"> – Write-offs and early retirement of existing assets – Reduced demand for products and services – Research and development (R&D) expenditures in new and alternative technologies – Capital investments in technology development – Costs to adopt/deploy new practices and processes
	Market	
	<ul style="list-style-type: none"> – Changing customer behavior – Uncertainty in market signals – Increased cost of raw materials 	<ul style="list-style-type: none"> – Reduced demand for goods and services due to shift in consumer preferences – Increased production costs due to changing input prices (e.g., energy, water) and output requirements (e.g., waste treatment) – Abrupt and unexpected shifts in energy costs – Change in revenue mix and sources, resulting in decreased revenues

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	– Re-pricing of assets (e.g., fossil fuel reserves, land valuations, securities valuations)
Reputation	
– Shifts in consumer preferences	– Reduced revenue from decreased demand for goods/services
– Stigmatization of sector	– Reduced revenue from decreased production capacity (e.g., delayed planning approvals, supply chain interruptions)
– Increased stakeholder concern or negative stakeholder feedback	– Reduced revenue from negative impacts on workforce management and planning (e.g., employee attraction and retention)
	– Reduction in capital availability
Acute (Short-Term)	– Reduced revenue from decreased production capacity (e.g., transport difficulties, supply chain interruptions)
– Increased severity of extreme weather events such as cyclones and floods	– Reduced revenue and higher costs from negative impacts on workforce (e.g., health, safety, absenteeism)
Chronic (Long-Term)	– Write-offs and early retirement of existing assets (e.g., damage to property and assets in “high-risk” locations)
– Changes in precipitation patterns and extreme variability in weather patterns	– Increased operating costs (e.g., inadequate water supply for hydroelectric plants or to cool nuclear and fossil fuel plants)
– Rising mean temperatures	– Increased capital costs (e.g., damage to facilities)
– Rising sea levels	– Reduced revenues from lower sales/output
	– Increased insurance premiums and potential for reduced availability of insurance on assets in “high-risk” locations

Physical Risks

APPENDIX B: GHG PROTOCOL SCOPE 3 CATEGORIES

Table 2 Description and Boundaries of Scope 3 Categories. Table sourced from Greenhouse Gas (GHG) Protocol, 2011.

Type	Climate-Related Opportunities	Potential Financial Impacts
Resource Efficiency	<ul style="list-style-type: none"> – Use of more efficient modes of transport – Use of more efficient production and distribution processes – Use of recycling – Move to more efficient buildings – Reduced water usage and consumption 	<ul style="list-style-type: none"> – Reduced operating costs (e.g., through efficiency gains and cost reductions) – Increased production capacity, resulting in increased revenues – Increased value of fixed assets (e.g., highly rated energy efficient buildings) – Benefits to workforce management and planning (e.g., improved health and safety, employee satisfaction) resulting in lower costs
Energy Source	<ul style="list-style-type: none"> – Use of lower-emission sources of energy – Use of supportive policy incentives – Use of new technologies – Participation in carbon market – Shift toward decentralized energy generation 	<ul style="list-style-type: none"> – Reduced operational costs (e.g., through use of lowest cost abatement) – Reduced exposure to future fossil fuel price increases – Reduced exposure to GHG emissions and therefore less sensitivity to changes in cost of carbon – Returns on investment in low-emission technology – Increased capital availability (e.g., as more investors favor lower-emissions producers) – Reputational benefits resulting in increased demand for goods/services
Products and Services	<ul style="list-style-type: none"> – Development and/or expansion of low emission goods and services – Development of climate adaptation and insurance risk solutions – Development of new products or services through R&D and innovation – Ability to diversify business 	<ul style="list-style-type: none"> – Increased revenue through demand for lower emissions products and services – Increased revenue through new solutions to adaptation needs (e.g., insurance risk transfer products and services) – Better competitive position to reflect shifting consumer

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Markets	<ul style="list-style-type: none"> – Access to new markets – Use of public-sector incentives – Access to new assets and locations needing insurance coverage 	<ul style="list-style-type: none"> – Increased revenues through access to new and emerging markets (e.g., partnerships with governments, development banks) – Increased diversification of financial assets (e.g., green bonds and infrastructure)
Resilience	<ul style="list-style-type: none"> – Participation in renewable energy programs and adoption of energy efficiency measures – Resource substitutes/diversification 	<ul style="list-style-type: none"> – Increased market valuation through resilience planning (e.g., infrastructure, land, buildings) – Increased reliability of supply chain and ability to operate under various conditions – Increased revenue through new products and services related to ensuring resiliency

APPENDIX C: EMAIL SURVEY RESPONSES

Table 3 Email Survey Responses, compiled by Kristen King, 2017.

Question	Companies				
	A	B	C	D	E
Is measuring and reporting carbon emissions important to your organization?	Reporting GHG emissions is very important. We've been doing it for a very long time, it's a big undertaking for the company, therefore to dedicate the resources it must be important.	Yes, very important, we have publicly stated emissions reduction goals and report on our progress annually in our CSR reports and to CDP. We have just set new emission reduction targets- 25% reduction by 2025 from a FY2017 baseline.	Yes, very important; we've been measuring, reporting and working to reduce our emissions since 2004.	Yes, it's very important. We report to CDP annually.	Measuring and reporting our direct emissions is not the highest priority as we are mostly offices. Indirect emissions though, we do measure and report emissions for our customers, who view it as very important otherwise they wouldn't be requesting this information.
How does your company measure and report carbon emissions?	The GHG Protocol to measure Scope 1 and Scope 2. Scope 3 emissions are usually	We use the GHG Protocol to measure Scope 1 and Scope 2 emissions in our owned and leased operations and we	We follow the GHG Protocol and report under the "control" approach for emissions Scope 1 and 2. In addition	We use the GHG Protocol to measure Scope 1 and 2 emissions for our owned and leased operations. We have	We measure using the Clean Cargo Working Group (CCWG) methodology.

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	reported by our suppliers through requests on CDP.	report emissions annually in our Corporate Responsibility Report.	select Scope 3 emissions are reported.	also reported to our supply chain through EcoVadis but have not requested that our suppliers provide us with their Scope 3 emissions.	
What internal barriers to measuring and reporting emissions have you experienced?	The systems for tracking are a bit of a barrier right now – we have undertaken two big acquisitions in the last 10 years (and are about to undergo another merger and division) and so it’s tough to get all the data for reporting to be consistent.	We want to be able to set a science based target, so we are working to quantify our Scope 3 emissions now. The biggest challenge is getting all of the necessary data along the supply chain, especially upstream at the farm level. We also have had challenges incorporating accurate data from our acquisitions over the years.	Specifically, to reporting scope 1 and 2 emissions, some of our challenges have included the size and breadth of facilities; managing ongoing changes in our facility portfolio with regards to our measuring process; and developing better tools for real-time emissions management.	There are some measurements that are hard to obtain such as miles traveled per ton of material transported as well as the number of miles the material travels by each type of mode. Some of this is third party but accounts for a large part of the emissions of our processes. This is due to the way our business lines account for mileage.	Scope 1 and Scope 2 (direct) emissions the biggest challenge is that many of our offices are rentals and limited in the control we can exert. Regarding Scope 3 (indirect) we work with alliances (e.g, CCWG) to mitigate the challenges but others exist around accurate data elements.

APPENDIX D: INTERVIEW QUESTIONS

1. What drivers exist for organizations to report direct and indirect emissions?
2. What are the current trends for organizations to report Scope 3 emissions due to logistic activity? Are there common frameworks being utilized?
3. What barriers exist to measuring and reporting these emissions?
4. What processes are being utilized to establish emission reduction goals and targets?
5. What, if any, government programs, partnerships or working groups are being promoted for organizations to garner better knowledge of their impacts?

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