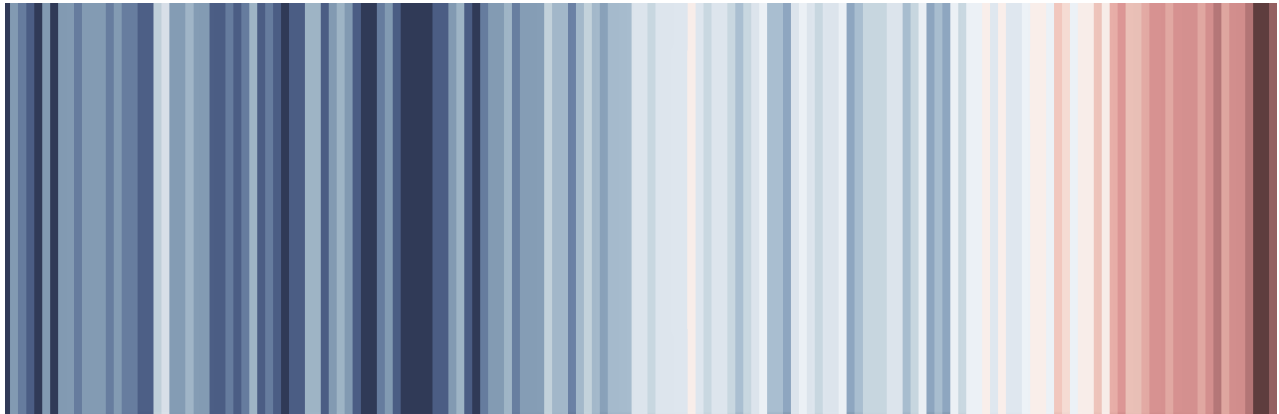




CHALMERS
UNIVERSITY OF TECHNOLOGY



Integration of environmental activities in Veoneer Sweden AB

Assessment of an implementation of the Greenhouse Gas Protocol

Master's thesis in Industrial Ecology

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Cover: Data visualisation with chronologically ordered stripes representing the differences in average global surface temperature from 1850-2019 (Hawkins, 2019)

Gothenburg, Sweden 2022

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Abstract

The integration of environmental activities with Veoneer as case company and the Greenhouse Gas Protocol as case activity was assessed. Veoneer's identity as manufacturing company was defined to be focused on quality and cost efficiency to supplying with safety products for enabling safer utilisation of vehicles. The environmental work is mainly based on compliance-driven reactions to key stakeholder expectations, while perspectives of the different actors in Veoneer concludes in high awareness of the need to take a more proactive role. The demand for a further developed environmental management system and environmental policy was additionally identified. Both can be combined with environmental measurements which would support improvements. A path on how to integrate and address the Greenhouse Gas Protocol within the existing quality approach was identified.

The Greenhouse Gas Protocol as accounting standard for emissions of companies' whole operational impacts was applied to assess how an implementation can be approached. For most of the categories, preliminary results could be developed to show how already existing data and reporting procedures could be used. Scope 1 makes up 3.05%, scope 2 1.67% and scope 3 95.28% of all emissions, which is in line with average automotive industry distribution.

An implementation requires the spreading of knowledge related to the benefits of environmental work in order to reach a critical mass to encourage a top-down directive. The protocol's function as an environmental accounting tool contributes to the company's ability to measure environmental performances. The natural involvement of employees and business partners in the data collection supports changing processes as well as it creates ripple effects in the value chain.

However, the correlation between financial and environmental accounting for the GHG Protocol application needs to be assessed further to produce even more convincing knowledge.

Keywords: Greenhouse Gas Protocol; Corporate sustainability; Environmental accounting; Environmental alignment; Veoneer Sweden; Change management; Sustainable leadership; Project communication; ESG; CSR

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Glossary

- ADAS** Advanced driver-assistance systems. 28
- AIAG** Automotive Industry Action Group. 36, 37
- BEV** Battery Electric Vehicle. 34, 44, 70, 72
- CC** Corporate Citizenship. 4
- CO₂** Carbon dioxide. V, 20, 23, 43, 57, 67
- CO₂eq** Carbon dioxide equivalent. ix, VI, VII, 20, 39, 43, 44, 64, 65, 70, 72
- CR** Corporate Responsibility. 4
- CS** Corporate Sustainability. xi, 4, 14, 15, 36, 76
- CSR** Corporate Social Responsibility. 4, 34, 47, 48, 57, 75, 77, 80, 82
- DECC** UK Government - Department of Energy & Climate Change. XXI, 63
- EEIO** Environmentally Extended Input-Output. X, XIII, XV, XVI, 23, 37, 72
- EMS** Environmental Management System. 16, 29, 53, 57, 58, 77–79, 82, 94
- EOL** End-of-life. xi, XX, XXIV, XXV, 20, 39, 41, 44, 72, 73
- ERP** Enterprise Resource Planning. XXIII, 40, 64, 69
- ESG** Environmental Social Governance. 20, 21, 29, 85, 87
- GBT** American Express Global Business Travel. 65
- GHG** Greenhouse gas. III, IV, IX, 19–21, 23, 37, 64, 67, 70
- GHG Protocol** Greenhouse Gas Protocol. ii, vii, xi, xii, I–III, IX–XII, XV, XVI, XIX, XXIII, XXVIII, 1–3, 17, 19–25, 27, 33–35, 37–39, 42–45, 47, 48, 52, 53, 55, 62, 64, 65, 67, 69, 75, 76, 80, 82–87, 90–94
- GRI** Global Reporting Initiative. 29
- GWP** Global Warming Potential. 20, 21, 43
- HR** Human Resources. XXIII, 65
- HRG** Hogg Robinson Group. 40, 65, 67
- HSE** Health Safety Environment. 36
- ICEV** Internal Combustion Engine Vehicle. 34, 44, 70, 72
- IPCC** Intergovernmental Panel on Climate Change. 34
- LCA** Life cycle assessment. XXIV, 20, 90
- NGO** Non-Governmental Organisation. 6
- RDAP** Reactive Defensive Accomodative Proactive. xi, 14, 15, 76, 77

SDG Sustainable Development Goal. 17, 19, 21, 28, 38, 45, 56, 80, 82

T&D system Transmission and distribution system. 24

TBL Triple bottom line. 3, 4, 16, 17, 20

TTW Tank-to-Wheel. 20, 63, 64

UN United Nations. 17, 38

WTT Well-to-Tank. 20, 44, 63

WTW Well-to-Wheel. 20, 44, 63, 64

1 Introduction

Climate change is changing the world as we know it and it is arguably humankind's biggest challenge yet. Increasing temperatures, rising ocean levels and human health are all effects of greenhouse gas emissions and is expected to disrupt the way society is functioning.

Global societies are accelerating their efforts to limiting the damage that pollution is inflicting on the planet with maximum temperature increase strategies such as the 2°C goal. Ambitious carbon reduction targets like the European Union's Green Deal net zero-emission by 2050 aim (Comission, 2019) emerge from visionary goals. As an increasing amount of people's environmental awareness has increased, governments, businesses and investors start to feel the pressure to adapt.

The limitation on global surface temperature increase is pressuring the automotive industry with, for instance, the EU's fleet emission limits (EC, 2020a). In the face of a shift in consumer behaviour, increased regulatory intervention and investors realising the advantages of sustainable companies (Lefkovitz, 2020), the industry is demanded to accelerate efforts. The industry is characterised by globally scaled companies with long-term investments, long-living products and complex supply chains. Revolutionary efforts are required to manage the necessary transition challenges.

The famed management quote "What gets measured gets managed", (Drucker, 1954), is universally usable for environmental work. Knowledge about environmental impacts is a prerequisite for being able to improve performance. Measurements for companies can be achieved through the use of the Greenhouse Gas Protocol (GHG Protocol), the most widely used emission reporting standard for publicly traded companies (GHG Protocol, NA).

The thesis project is conducted together with Veoneer Sweden, a national division of a global manufacturer of automotive components. The customers represent a large share of the automotive market's most well-known companies such as Honda, Daimler, Ford and Volvo (Veoneer, 2020c).

1.1 Aim

This study aims to explore how an implementation of the GHG Protocol can influence a company's greening process by evaluating the influence on the company's operation. While creating awareness of the project and its content with identifying and approaching relevant networks, the impacts on the decision-making procedures by approached actors are targeted additionally. What drives the company, how does

the management team make decisions and what values are lived by the employees are questions about the environmental performance to be answered throughout the report.

The particular aim for the GHG Protocol implementation is the evaluation of existing internal and external reporting procedures to identify to what extent emission calculations, which meet sufficient quality requirements, are enabled. Therefore, it is targeted to assess the availability of data and to analyse what data in which data collection procedure needs to be addressed to achieve sufficient emission calculation. The following research questions are derived from the formulated aim:

- How can the GHG Protocol increase the environmental understanding?
- In what ways can the emission quantification results of the GHG Protocol implementation contribute to corporate transitioning?
- How can the GHG Protocol implementation impact the industry?

1.2 Limitations

Boundaries for this project are set geographically with the consideration of only Veoneer's Swedish organisation. A full-scale implementation of the GHG Protocol is not a target, only how it possibly could be realised.

2 Corporate transitioning towards more sustainability

Companies can be located due to their operations' contribution to the value chain. The following chapter address sustainability work in companies, change processes and framework for the GHG Protocol. It concludes with an introduction of Veoneer Sweden.

2.1 Sustainability as topic in industrial performing

During the Earth Summit in Rio de Janeiro in 1992, the concept of a sustainable development of society was developed and put into the action plan for the 21st century. In the Agenda 21, sustainable development was defined by the triple bottom line (TBL) that included the dimension of: ecology, economy and society. Over time, the TBL has evolved into new approaches such as for people, planet and prosperity (United Nations, 2020) (Brønn and Brønn, 2019). Hence, sustainable corporate performance was defined to minimise the social and ecological impact while the operation is still running economically "viable" (Schneider, 2018).

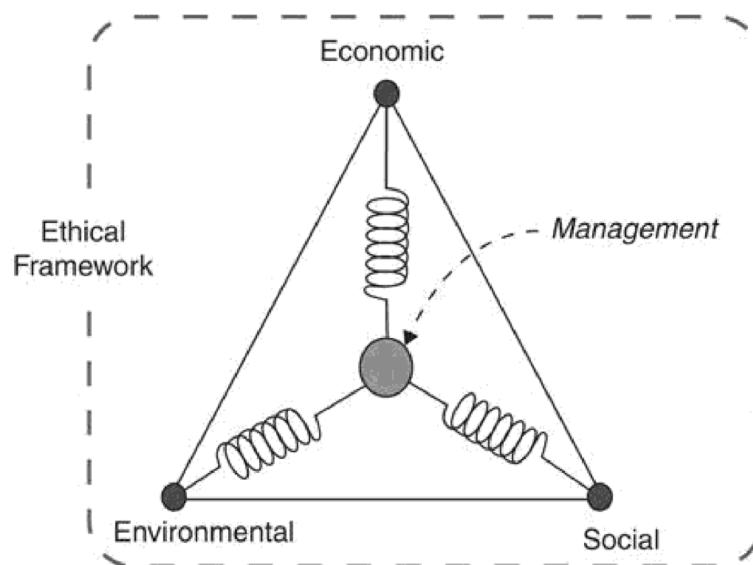


Figure 2.1: Triple bottom line according to Brønn and Brønn (2019)

Sustainable development is a relatively new and challenging topic to industries. The existing challenge consists of the long time shaping through economic interests while social and ecological issues have been more vague depending on the industry. The TBL is interconnected which means that the three dimensions need to be addressed at the same time, since all three are also impacted simultaneously. The management dilemma has been visualised by Brønn and Brønn (2019) (figure 2.1). The springs visualise the dynamic interlinkage in form of characterising the relationship as both, pulling and pushing (Schneider, 2018).

Environmental issues have traditionally been understood as a resource scarcity issue that has been solved by negotiated agreements with resource suppliers. Issues such as Earth's carrying capacity, emissions, material and energy use has quickly become issues connected to the company's operations and products. The perspective is new in the sense that these are topics that the company been able to externalise from their business operations.

Societal stakeholders increasingly advocate for companies to take a larger responsibility by greening their operations and increase the recyclability of products (Brønn and Brønn, 2019). In most greening operation changes demand knowledge and sustainability investment. It is also in opposition to the capitalistic paradigm of accumulating wealth and maximising profit for shareholders (Buch-Hansen, 2018).

In companies that manage to integrate sustainability into their operations and business activities as a strategic issue are expected to maintain the competitiveness of firms. There are different approaches to do this such as Corporate Sustainability (CS), Corporate Social Responsibility (CSR), Corporate Citizenship (CC) and Corporate Responsibility (CR). In CS, sustainability guides operations and business activities to maintain a competitive advantage. CSR focus is the company's business and philanthropic activities. CC is defined by the UN Global Compact and focus on business ethics. CR focus on legitimacy and avoid risks through honest and transparent stakeholder communication (Schneider, 2018). As Schaltegger et al. (2006) formulates appositely, it can be concluded that companies are "key contributors to economic, environmental and social well being".

2.1.1 Corporate environment

Companies pursue multiple purposes in a complex environment where they address internal and external actors. Each actor's perspective is referred to as micro-level (Thornton et al., 2012), while the company's culture is, at the macro-level, shaped by the company's identity and norms (figure 2.2). External expectations and pressures impact the corporation's behaviour (Mirvis et al., 2016) and drive change depending on the internal and external influences. The constant updating and negotiating of cultural values lead to new and different developments on the macro as well as on the micro-level (Alber, 1985).

At the macro-level, external expectations and pressures impact the corporation's behaviour (Mirvis et al., 2016). The corporate environment affects the organisation as well as its stakeholders. A stakeholder is described as an actor that has a stake in an issue (Clarkson, 1995). A stake could be the economic outcome, labour rights, governance or scandals involving the company. The creation of value for all involved

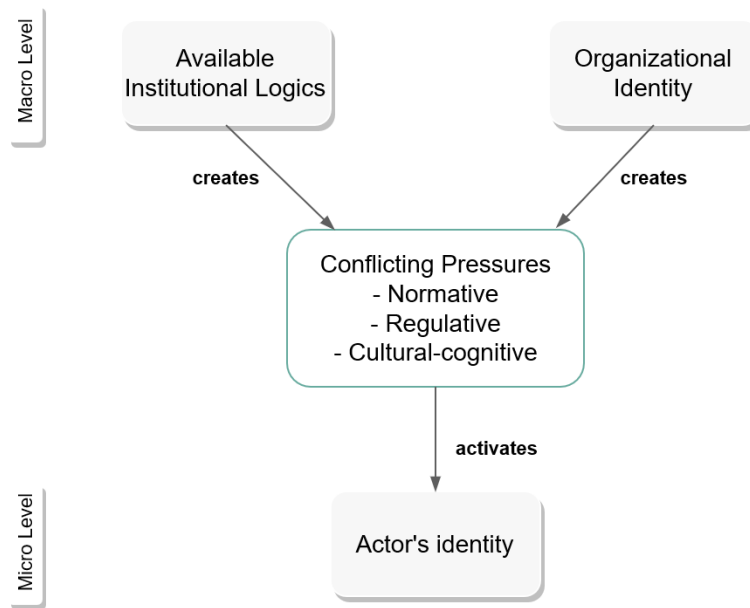


Figure 2.2: Model for cross-level institutional logics according to (Corbett et al., 2018) which has been developed from (Thornton et al., 2012)

parties is key to acknowledge their interests (Hörisch et al., 2014). The characteristics of a stakeholder is often based on power, urgency and legitimacy (Freeman et al., 2010). A primary stakeholder has direct influence over the issue since the stakeholder has urgency, legitimacy and power (Mitchell et al., 1997). A secondary stakeholder has an indirect influence since the stakeholder lack one or two of the characteristics (Clarkson, 1995). From the three characteristics, different types of stakeholders can be identified, see figure 2.3

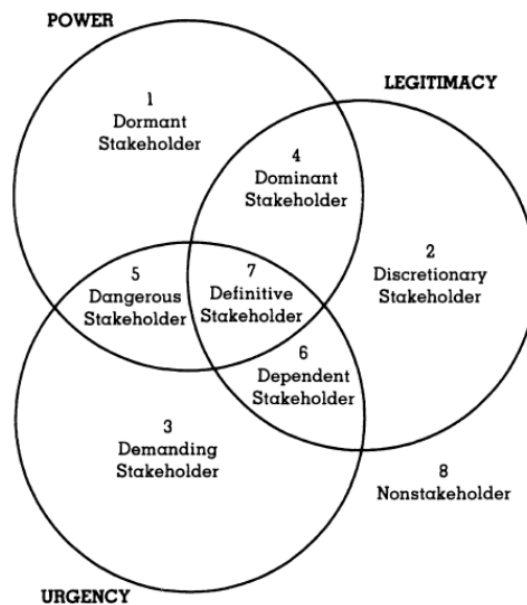


Figure 2.3: Model for stakeholder types defined from the characteristics power, urgency and legitimacy (İrge Şener et al., 2016)

Common stakeholders are competitors, employees, shareholders, customers, suppliers governments, investors, media, non-governmental organisations (NGO) etc (Clarkson, 1995). General external motivation to work with sustainability are, for example, public awareness and concern and NGOs (Cartwright, 2006). The expectations of stakeholders allow a valid interpretation of intentions and goals (Robert S. Kaplan, 1992). The creation of value for all involved parties is a key characteristic for the acknowledgement of their interests (Hörisch et al., 2014). An evaluation of each party's ability to influence and responsibility for the company's operation (Rohm, 2002) can identify how the expectations can be addressed by the company (Thornton et al., 2012).

Green institutional logics are important sustainability perspectives which are part of conventional institutional logics (Corbett et al., 2018). Institutional logics are stated as "socially constructed patterns of cultural symbols, cognitive schema, normative expectations, and material practices" (Jones et al., 2013) which can be shaped by family, religion, state, market, profession or corporations (Boltanski et al., 2006). New norms and new practices in relation to sustainable and environmental discourses are individually categorised as green logics (Bansal et al., 2012). Institutional logics shape practice, how business is done, what is prioritised and are often used to understand certain practices and discourses in companies.

On the macro-level, the company's multiple purposes define its culture, its integration in its natural environment and what makes a company continue with its business (Alber, 1985). The company itself defines its identity through the way of operating as well as the respective individuals work according to an identity. As Wickert et al. (2017) adds, the organisational identity describes what the company believes in. Organisational identity is the organisation's "central character, distinctiveness, and temporal continuity" (Alber, 1985) and is important to the company's self-perception (Corbett et al., 2018). Coexisting logics and organisational identities "are both enabling and constraining for individual organisational identities and practices" (Thornton et al., 2012). Focusing on corporate social responsibility, multinational companies usually adopt sustainability in three different ways (Wickert et al., 2017). In relation to the company's ambitions and drives, identical shaping adoption of sustainability can be substantially, selectively or symbolically.

- substantially - deepest understanding and most impacting adoption on the whole operation
- selectively - deep understanding but adoption only impacts selected parts of the operation
- symbolically - adoption of sustainability without impacts on the operation

Resulting goals, targets and decision-making processes are based on the company's perception and hence, influence the individuals on the micro level (Thornton et al., 2012). The identity can be extracted from the company's presentation such as mission statements, strategies, codes of conducts, rules, interests and agendas (Wickert et al., 2017). Thus, it can be stated that the identity is shaped by the company itself (Thornton et al., 2012).

2.1.2 Sustainable business models

The "business model is a conceptual tool" (Osterwalder et al., 2005) to understand how companies perceive their market. The three elements, value proposition, value creation and delivery and value capture define the business model (figure 2.4) (Bocken et al., 2014). Value proposition is the part of a business model which focus on a product or service. While value creation is the core of any business model examining new market opportunities, the value capture often consists of the exploration and definition of incoming revenue streams (Bocken et al., 2014). Concerning sustainability-related business models, Bocken et al. (2014) also developed eight different business models, which relate to value proposition, value creation and value capture.

- Maximise material productivity and energy efficiency
- Create value from waste
- Substitute with renewables and natural processes
- Deliver functionality, rather than ownership
- Adopt a stewardship role
- Encourage sufficiency
- Re-purpose the business for society/environment
- Develop scale-up solutions

For manufacturing companies, the product or the providing of a service is essential for the business purpose (Wells, 2015). The internal manufacturing and assembly are considered as being the value creation in the business model, while the value proposition consists of ensuring a smooth and consistent output (Wells, 2015). Manufacturing companies capture their value through cost efficient and profitable operation (Wells, 2015).

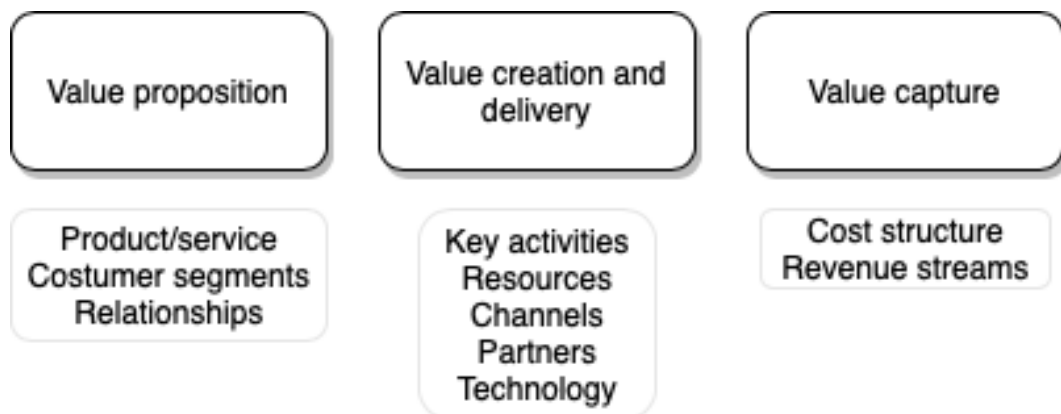


Figure 2.4: Three business model elements according to Bocken et al. (2014)

2.1.3 Change agents and their identity

In a change process, the company's identity is reevaluated and changed. Companies need to understand its purpose for business to find a new role and what it means for the value chain (Freeman et al., 2010). The change can be caused by new legislation,

a scandal or changing expectations and norms in society. Corporate identities and associated green logics shape each actor's identity create conflicts and cross-level pressure within the organisation between the old ways and the new ways that need to be adopted (Corbett et al., 2018). The following pressures describe the conflict:

- normative - prescriptive dimension which originates from professionalism and the need to establish legitimacy of practices, responsibilities, and duties
- regulative - from the establishment in the form of rules or binding conditions
- cognitive-cultural - social and industry expectations

A thorough explanation of the Corbett et al. (2018)'s model and its relation to change management can be found in the Appendix C.1.

Change processes can happen top-down or bottom-up. A top-down approach can be described as an implementation of innovations (Mirvis et al., 2016). Within the micro-level, change can happen faster through top-down approaches by higher managerial levels (Thornton et al., 2012) and thus, leading through defining the mission from conflicting pressures (Galpin and Whittington, 2012) (figure 2.2). Employee engagement can be achieved with a vision, inspiration, intellectual stimulation and individualised addressing (Galpin and Whittington, 2012) (Bass and Avolio, 1994). The effect of employees with more power is naturally higher but the channelisation of cross-level pressures can be still determining (Galpin and Whittington, 2012). The goal of a bottom-up approach, encouraging a critical mass, is similar as with top-down directives (Kotter et al., 1995). However, the effectiveness over time may vary and depends on the change agent's lasting commitment (Thornton et al., 2012). A bottom up approach is shaped by employees sticking out with a specific passion for a topic (Thornton et al., 2012) and is defined by entrepreneurship which is shaped by the development of innovations (Mirvis et al., 2016). An essential driving role play change agents who are people affecting others' "willingness to adopt new ideas" (Rogers, 2003).

Change agents with a particularly strong environmental identity, formal organizational roles who network disseminate environmental knowledge in the organisation that creates sustainability improvements and pushes for change can be described as environmental champions (Corbett et al., 2018). They are key drivers behind corporate green voluntary actions and are often more influential for bottom-up approaches than external stakeholders could be (Gliedt and Larson, 2018). The environmental champion makes the environmental work easier to grasp for other employees by acting as a translator of green issues in a business context (Corbett et al., 2018).

Change agents like the environmental champion can demand more efficiently top-down approaches. The ability to influence people is the differentiating factor of change agents and opinion leaders as the latter usually have momentum but cannot impact (Rogers, 2003). For instance, people who are passionate for the environment and who can convince other people adopting the attitude are opinion leaders, while change agents have the power or influence needed to impact in line with the opinion. In a successful change process, there is a successful translation of sustainability knowledge, identity and norms between the macro and micro-levels in the company (Bansal et al., 2012).

2.2 Corporate transition

Corporate transition is explained along a model which supports sufficiently the understanding of corporate environment illustrations. The environment of companies concerns different actors, their roles and impacts to other organisations.

2.2.1 Change management

Managing change is described as "the process of continually renewing an organisation's direction, structure, and capabilities to serve the ever-changing needs of external and internal" stakeholder (By, 2005). Change can be described as the disruption of ordinary operations when companies initiate something new. Functioning change management ensures organisational acceptance (Perkins, 2018) and avoiding failure is identified as general motivation for change.

There are several change management models but "The eight-stage model" developed by Kotter et al. (1995) is commonly used. The model was originally developed to decrease costs and higher efficiency but as since been used in other applications such as organizational transformation. The model takes inspiration from the older Lewin model which consists of an "unfreeze-change-refreeze" process (Hussain et al., 2018) which refers to three steps of sustainable change management. The eight-step model is an iterative process allowing changes for improvements be evaluated by going back and forth (Bucciarelli, 2015) (figure 2.5). The eight-step model has been criticised for not including the need for change properly, meaning the initial exploration of need and the potential outcome of the change process. There is also criticism connected to the assessment of power in the company to see the change process through (Bucciarelli, 2015).

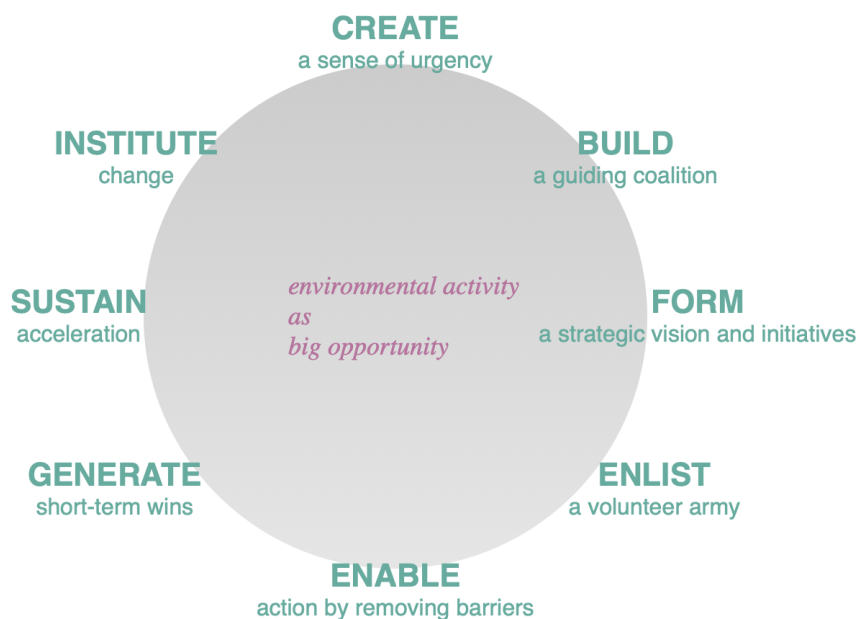


Figure 2.5: Eight steps of transitioning an organization according to Kotter et al. (1995)

Walking through the model is begins in "create a sense of urgency", where the organisation identifies and establishes a feeling that change is required for sustaining or improving businesses. The urgency can be perceived within management, in the organisation or from external sources. The change may come from a majority of managers, who agree that the current state is unacceptable and urgently needs to change (Kotter et al., 1995). Organisations can grasp urgency through internal messages of change, which could come from employees. Should similar messages reach the organisation from external sources such as analysts or media, it implies an even higher urgency (Appelbaum et al., 2012).

In "guiding coalition", a group of employees with sufficient formal power, key positions and expertise is formed. The more formal power such a coalition owns, the more promising is a successful result (Lines, 2007). Including all executive positions in the coalition might be difficult, since usually, not all can be convinced or passionate about the cause (Kotter et al., 1995).

The next step, "form a strategic vision and initiatives", includes the development of the vision as description of an improved future state and be very clear on how it is different from the current one. The vision needs to be communicative and with clear activities to appeal to employees as to other stakeholders (Aldemir, 2010).

In "enlist a volunteer army", the vision and strategy are communicated and announced within the organisation to encourage employees for changing behaviour. Weekly meetings provide employees with the opportunity to participate and voice change-related concerns, allowing the organisation to eliminate problems (Frahm and Brown, 2007). Leaders can strengthen motivation and encourage commitment through being inspirational role models (Kotter et al., 1995).

In "enable action", structures, skills, systems and supervisors are defined as four major change barrier categories i.e. clearness in vision, compensation schemes, employees behavioural change and long-term change (Appelbaum et al., 2012). The new vision should be easily adapted and clear with what actions to do. To encourage behavioural change compensation schemes should benefit actions aligned with the employee's self-interest. The compensation schemes could be connected to awards for performance goals of the future vision (Kotter et al., 1995). Undermining change should be addressed in all cases where the implementation is interrupted by misalignment of actions towards the vision.

Measured "short-term wins" in a long-term change process imply higher motivations to continuing the changing path (Kotter et al., 1995). Additional reward-schemes can be oriented towards reaching performance goals (Bucciarelli, 2015).

To "sustain acceleration", the changing process needs to, over time, become part of the company culture. A too early declaration of success before the change is fully integrated into the organisation is a potential pitfall (Kotter et al., 1995). In general, to sustain change requires that the organisation is patient, sticking to short-term wins and analyse and identifies processes misalignment to the desired future state Appelbaum et al. (2012).

In “institute change”, the organisation makes sure that the change is absorbed into the company culture. It is also important to change executive requirements, ensuring that upcoming generations of managers sustain the new state. Communication is still important to ensure that upcoming generations of managers align with the new state (Appelbaum et al., 2012).

2.2.2 Project communication

The aim of communication is to inform and get informed while creating acceptance (Stoehr, 2002). The message goes between sender and receiver and another message goes back as feedback in the communication process (Kliem, 2007). Communication is a way to share knowledge and to build commitment and motivation in the organisation. It is also a cross-level process shaping identities and linking internal stakeholders to visions and strategies essential for knowledge management in projects and the transition process.

The outgoing message from leadership in the change process needs to be "effective communication", Rajkumar (2010), where the effectiveness means formal message and through direct communication channels (Koskinen, 2004). Project communication that target the creation or support of a "sense of urgency" need to be transparent and up-to-date to achieve acceptance and support a learning process in the organisation (Kotter et al., 1995) (Sumanjeet, 2005).

Communication with the development of vision and strategies which are essential for knowledge management in projects (Sumanjeet, 2005). The way for sharing knowledge should be characterised by transparency and up-to-date content for achieving higher knowledge levels of the recipients (Sumanjeet, 2005). Kotter et al. (1995) address the importance of commitment with projects which is strengthened through motivating content. Depending on the project environment, different ways of communicating knowledge can anticipate and address higher commitment and higher motivation to participate more passionately.

Koskinen (2004) classified four categories of project environments to describe different kinds of content which is tailored for the different project environments: mechanical, organic, semi-mechanical and semi-organic. The first project environment, "mechanical", is defined by hard facts, formal rules, standardised rules and operations to support the increase of knowledge (Koskinen, 2004). Projects are successful when each member has sufficient skills in processing the communicated data (Koskinen, 2004). Hard facts increase legitimisation and support leadership which might have a boost for more ambitious alignment (Cartwright, 2006). In this project environment, facts, reputation, experiences and actions are the best motivations and legitimacy (Appelbaum et al., 2012) (Kotter et al., 1995). Hard facts are relatively convincing and might increase the sense of urgency such as emission numbers which picture the seriousness of the operation’s environmental impact. The opposite project environment, "organic", is described as getting things done and is based on trust and open communication within the project group (Ylinen and Gullkvist, 2013). Thus, communication is rather based on experiences with sharing intends to substitute existing knowledge (Koskinen, 2004).

The "semi-mechanical" project communication is a mixture of the previous two and most widely used. Here, the project member has explicit knowledge communication but with a multi-perspective approach (Kliem, 2007). For instance, through different departments, fields or historical stored data, communicated knowledge can be described as substitutive like in the second project environment (Koskinen, 2004). The fourth and last project's environment, "semi-organic", can be described with the way what research and development supplies with (Koskinen, 2004). Its communication adds new knowledge to its receivers. In this environment, usually, the level of explicitness is rather premature as the knowledge in the project is not fully developed yet (Koskinen, 2004).

2.3 Corporate governance for sustainability

Corporate governance is defined by the corporate adaption of sustainable development (Mccann and Sweet, 2013). In the adaptation, the company needs leadership, strategies and management tools to guide performance for staying accountable to shareholders and societal stakeholders.

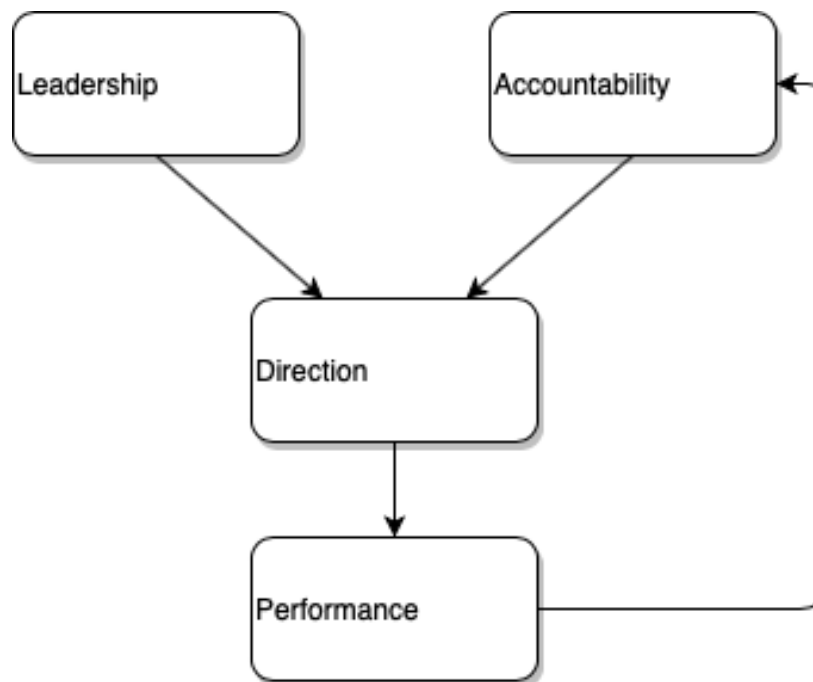


Figure 2.6: Simplified corporate governance (Cartwright, 2006)

2.3.1 Sustainable leadership

Sustainable leadership has an impact on the direction of the corporate sustainability work as well as on the performance. Both are shaped by the environmental champion (Cartwright, 2006) (figure 2.6). Sustainable leadership and the environmental champion have similar characteristics. Both operate across disciplinary knowledge domains and create change. A sustainable leader in a management position assigned with authority and decision-making powers can have significant influence over the

firm's sustainability work. The sustainable leader's understanding of sustainable development and the ability to use a broad system's perspective creates opportunities for improving the environmental performance (Corbett et al., 2018). Thus, the development of the sustainability work in the company is described as a focus on "current and future profits for an organisation" while the lives of all improve (McCann and Sweet, 2013).

The lack of environmental knowledge in the organisation can be an obstacle in the change process. Limited knowledge may prevent the company from identifying new ways of thinking how to adopt green practices in the operations (Corbett et al., 2018). Individual sustainable leaders understand to connect financial and ecological issues to improve the company's environmental performance. By development of a framework supporting the organisation's greening, the companies' understanding of needs for identifying environmental actions are facilitated (Schneider, 2018).

2.3.2 Alignment strategies and management

"Environmental integration means making sure that environmental concerns are fully considered in the decisions and activities" (EC, 2020b). This means that the company needs to develop strategies and goals for issues connected to the company's environmental impacts in the sustainability work. There are several types of sustainability strategies that connect financial and ecological issues that use energy and material savings as a means to improve the company's performance.

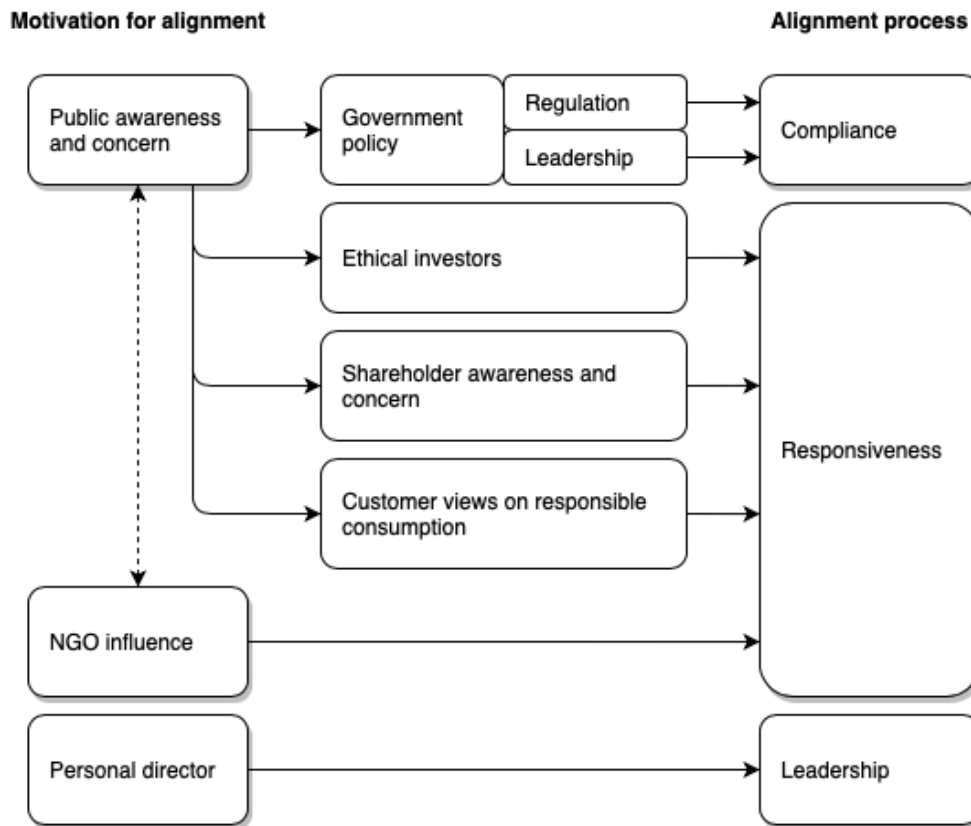


Figure 2.7: How some aligning processes can be reasoned (Cartwright, 2006)

2. Corporate transitioning towards more sustainability

In most cases, a firm's greening process starts with energy efficiency strategies such as energy savings in operations and production or working with carbon-neutral technologies. As the greening process continues, it is common that companies do resource-efficient measures such as minimising packaging materials and product weight.

Table 2.1: Comparison and allocation of the RDAP scale by Clarkson (1995) and the CS levels by Marrewijk and Werre (2003)

CS-Level	description	RDAP-scale	description
Pre-CS	<ul style="list-style-type: none"> - No ambition for CS - CS initiated by external pressures 	Reactive	<ul style="list-style-type: none"> - Regulations are disputed and CS investments are avoided - Denying of responsibility - Less than required
Compliance-driven CS	<ul style="list-style-type: none"> - Providing welfare to society within limits of regulation - Charity or stewardship considerations - Perceiving as duty and obligation 	Defensive	<ul style="list-style-type: none"> - Performance at the bare minimum regulation-wise - Admit sustainability but fight it -The least required
Profit-driven CS	<ul style="list-style-type: none"> - Integration of social, ethical and ecological aspects - Contribution to financial bottom line - CS as business case if profitable (improving reputation) 	Acco- modative	<ul style="list-style-type: none"> - Companies adhere to regulation and might even take further responsibility - Accept responsibility - Fulfilling all compliances
Caring CS	<ul style="list-style-type: none"> - Balancing economic, social & ecological concerns - Initiatives go beyond legal compliances and profit considerations - Focus on human potential, social responsibility and care for the planet 		
Synergistic CS	<ul style="list-style-type: none"> - Well balanced, functional solutions for value creation in economy, society and ecology - Win-win approach with all relevant stakeholder - Sustainability is important in itself 	Proactive	<ul style="list-style-type: none"> - Companies lead the pack and put heavy focus on sustainability and environmental investments - Anticipate responsibility - More than required
Holistic CS	<ul style="list-style-type: none"> - CS fully integrated and embedded in every aspect of the company - Aim is to contribute to quality and continuation of life of every being - Sustainability as only alternative since everything is mutually independent - Each person or organisation has an universal responsibility for all others 		

More and more companies are considering resource productive strategies like recycling or redesign measures (Pojasek, 2013). The sustainability strategies need to be aligned with the firm's missions, values, goals and business strategies where the issues in focus are addressed at all levels (Galpin and Whittington, 2012).

The need for alignment of financial and ecological issues can be influenced by stakeholder expectations as well as internal pressures such as bottom-up processes (figure 2.7). To avoid scandals and maintain society's licence to operate, the company needs to have a basic understanding of legal matters regulating environmental activities to satisfy external stakeholders.

The "Reactive, Defensive, Accommodative and Proactive -scale" (RDAP) is often used to characterise a company's ambition level in the sustainability work (Clarkson, 1995). The scale describes a company's ability to take on environmental responsibility from compliance to have a leadership role within an industry.

Marrewijk and Werre (2003) have developed the RDAP scale further to a more segregated distinguishing with six different ambition levels of CS (table 2.1). The first two levels are both described similarly. The split up at the CS scale (Marrewijk and Werre, 2003) is motivated in a profit-driven approach which eventually leads to an accommodative ambition level, due to the sole focus on profitability. The RDAP-scale by Clarkson (1995) considers the performance characteristics that a company operates along all compliance obligations and fulfils them out of responsibility-based reasons rather than to reach certain regulatory requirements. The core intent to operate accommodatively is not as determining as the CS-scale guides. A reason for aligning environmental work is compliance, which can be seen as a result of regulative pressures from stakeholders (Cartwright, 2006). Hence, fulfilling regulations can be directly linked to a compliance-driven CS ambition level.

The proactive ambition level which is characterised as "leading actions with anticipated responsibility" (Clarkson, 1995) is split by Marrewijk and Werre (2003) into a synergistic and holistic level. Using synergies adds sustainability to the value creation in the corporate supply chain and combines different system's forms. The holistic level targets sustainability as a fully integrated part of the whole system which is the optimal adoption of the green logic which stated the whole system's consideration. In both levels, sustainability needs to be applied progressively (Deloitte, 2016). Hence, both levels require proactivity.

2.3.3 ISO14001 as governance tool

ISO 14001 is a widely spread standard providing companies with management tools to grasp their environmental performance. One essential part is the implementation of an environmental management system (EMS). Its application usually functions as a conventional management system with structures for planning, acting, executing, monitoring and improving. A set of monitoring requirements target continuous improvements (ISO, 2015) which is managed by responsible personnel. As a result, the operation becomes steerable and the standard encourages optimisation. An environmental policy can be constructed to advise on how the company and its employees address sustainability, like a code of conduct. Additionally, an environmental policy underlines the company's commitment to an environmental discourse. The environmental part of the management system needs to be connected to the business model such as the improvement of the environmental performance in areas like resource efficiency and quality. Furthermore, the enabled structures allow to link and include the reduction of environmental stress through the company's operation to the business model.

2.4 Environmental accounting

Environmental accounting is important in the governance of corporate sustainability work, since the environmental impacts can be made measurable. It can be integrated in conventional accounting and influencing the steering and management approaches (Schaltegger et al., 2006). Kolk (2000) describes environmental accounting process as identification, measurement, accumulation, analysis, preparation, interpretation and communication of information. It can be used for planning, assessments and control of environmental work within the organisation. Another description of environmental accounting is the assistance of managing environmental risks and operational costs (Muralikrishna and Manickam, 2017). Sustainability accounting is either founded as a completely new corporate accounting structure or as a development of already existing "financial, cost or management accounting" (Schaltegger et al., 2006). In most cases, the indicators collected and used in the environmental accounting are based on the TBL. Sustainable accounting has three dimensions like the TBL illustrates (Brønn and Brønn, 2019). As Schaltegger et al. (2006) formulate appositely, companies are "key contributors to economic, environmental and social well being".

2.4.1 Applying Sustainable Development Goals (SDGs)

The UN developed, as part of their Agenda 2030 (United Nations, 2020), goals targeting sustainability in its three different dimensions to combat global challenges such as climate change, poverty, international cooperation and peace (figure 2.8). For instance, sustainability guidelines for organisations, companies and individuals can be built on the goals (GRI, 2020) as they are suitable as an initial way to approach sustainable development. It is common for companies to publish how

the goals are perceived in sustainability reports (PWC, 2018). The UN's earlier declarations of voicing and combating global unbalances such as the "Tripartite Declaration of Principles concerning Multinational Enterprises and Social Policy" (ILO, 1977), the "UN Global Compact Principles" (Compact, 2015) and the "UN Guiding Principles on Business and Human Rights" (UN, 2011) are meant to be constructive suggestions about what basic human rules should address. The SDGs are partly developed out of the existing declarations and thus, can also be treated as a suggestion towards more sustainable constitutions.

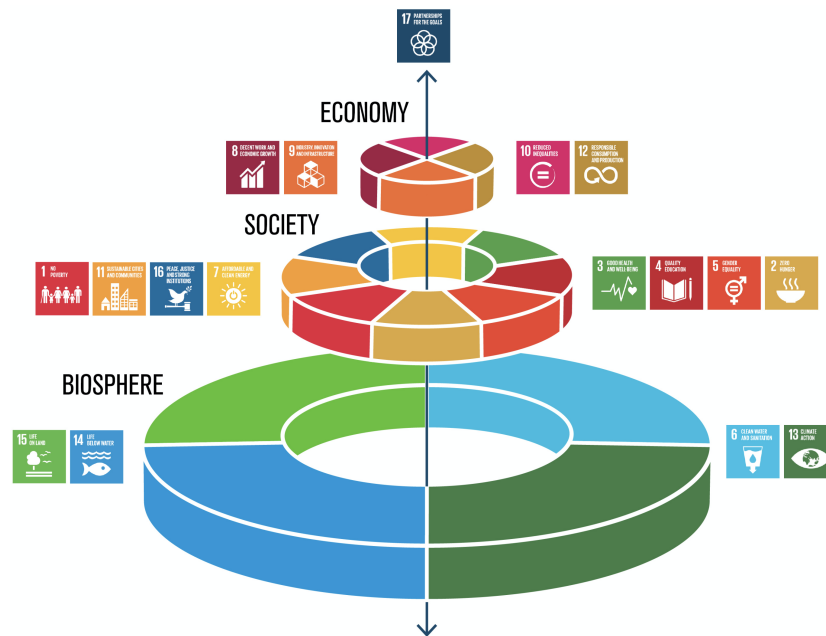


Figure 2.8: Sustainable Development Goals developed by the UN (United Nations, 2020) and visualised by Folke et al. (2016)

Selecting SDGs is at the same time a process of understanding sustainability (figure 2.8). The five components ecological, social-cultural, economic development, political and institutional in the flowchart describes challenges behind the TBL.

2.5 The greenhouse gas protocol

The GHG Protocol is an initiative for accounting emissions started through a collaboration between the World Resources Institute and the World Business Council for Sustainable Development with support from large corporations in the energy and automotive sector (GHG Protocol, NA). The protocol is increasingly used in large organisations. An estimation of 92% of the Fortune 500 companies use the standard (GHG Protocol, NA).The protocol is based on life cycle thinking and targets different aspects of the company's value chain (figure 2.10).

2. Corporate transitioning towards more sustainability

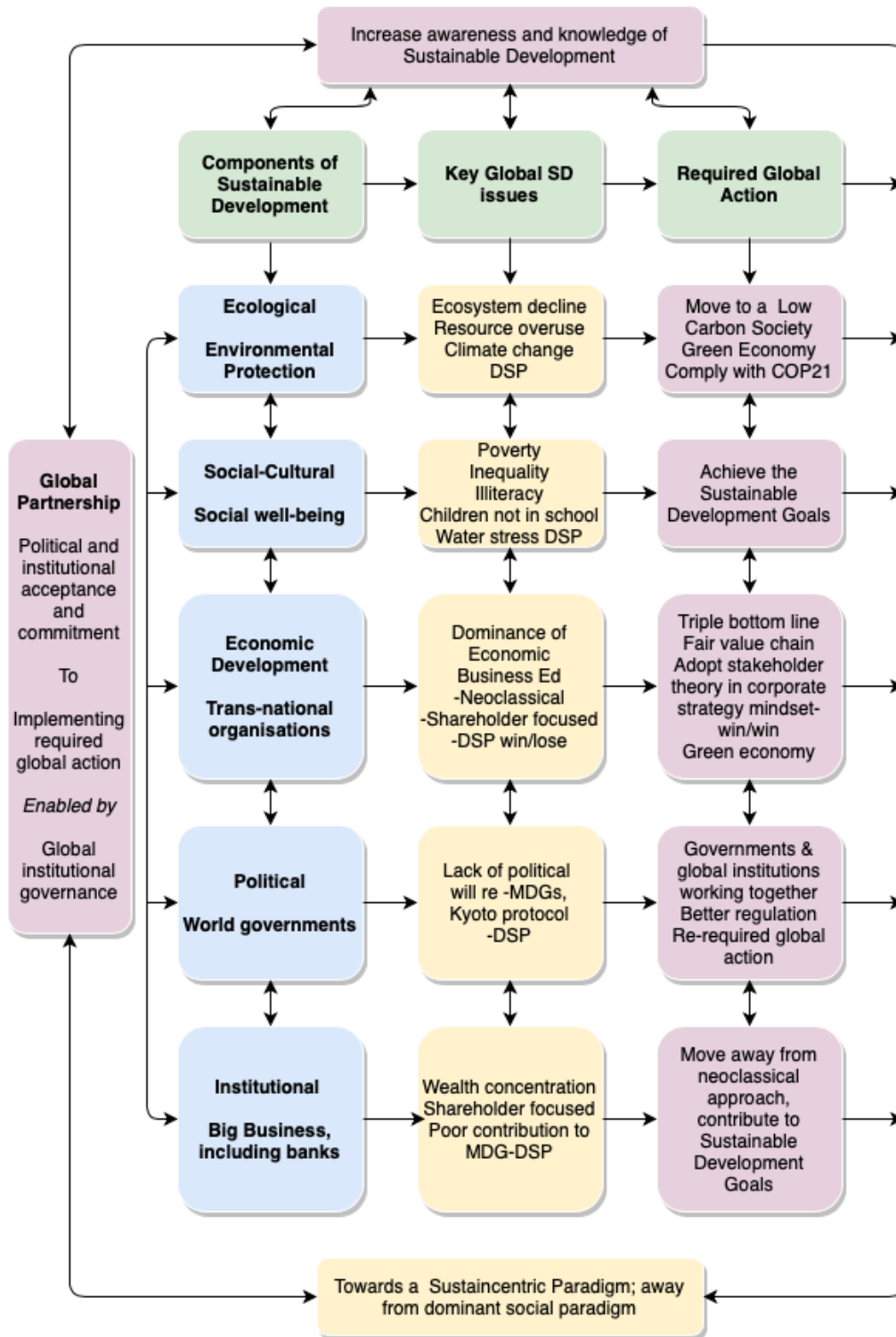


Figure 2.9: Conceptual framework for sustainability (Foley et al., 2016)



Figure 2.10: General value chain for producing companies (GRI, 2020)

The protocol targets different parts of the company’s operations and categorises them in scope 1, scope 2 and scope 3. Scope 1 covers the company’s core operations, scope 2 the company’s indirect emission and scope 3 the company’s supply chain emissions. The GHG Protocol use is also advised for the SDG approaching guidelines (GRI, 2020). Depending on the availability of information, the corporate standard offers different ways of calculating emissions. The outcome of scope 1 and scope 2 should be a part of any stakeholder communication while scope 3 is optional.

2.5.1 Business goals related to the GHG Protocol

When addressing environmental sustainability in a corporate context, it is recommended to include sustainability in the business model (Deloitte, 2016). The GHG Protocol provides an integrating approach to a formulation of different business goals (table 2.2). Although the integration into the business is an advanced target, the provided business goals can help companies to formulate opportunities on how to make use of the GHG Protocol in a substantial and thus not symbolical manner (Greenhouse Gas Protocol, 2004b) (Deloitte, 2016).

Table 2.2: Business goals which are applicable to achieve with an implementation of the GHG Protocol provided by the WRI & wbcSD (2011)

Business goal	Description
Identify and understand risks and opportunities associated with value chain emissions	<ul style="list-style-type: none"> - Risks in the value chain - New market opportunities - Investment and procurement decisions
Identify GHG reduction opportunities, set reduction targets, and track performance	<ul style="list-style-type: none"> - Hot-spot identification - Scope 3 reduction targets - Quantification and reporting of GHG emissions
Engage value chain partners in GHG management	<ul style="list-style-type: none"> - Strengthened collaboration with suppliers, customers, and other companies in the value chain - Expand supply chain accountability, transparency, and management - Greater transparency on companies’ engagement - Reduce energy use, costs, and risks in the supply chain - Higher future cost efficiency through improved supply chain efficiency
Enhance stakeholder information and corporate reputation through public reporting	<ul style="list-style-type: none"> - Improve corporate reputation and accountability - Meet needs of stakeholders, enhance stakeholder reputation, and improve stakeholder relationships through public disclosure, progress toward GHG targets, and demonstration of environmental stewardship - Disclosure of GHG emissions

In addition to the indispensable combination of all three dimensions of the TBL, the business goals also represent different levels of ambition (Greenhouse Gas Protocol, 2004b). It is it always the choice of the company since the ambition can also be described as a historical development (Deloitte, 2016).

2.5.2 Concepts in life cycle thinking

The GHG Protocol terminology is partially based on life cycle assessments (LCAs) and the most important ones are: up- and downstream, Well-to-Tank (WTT), Tank-to-Wheel (TTW), Global Warming Potential (GWP), CO₂ equivalent (CO₂eq) and Environmental Social Governance - ratings (ESG-ratings). "Upstream" processes occur in the value chain before a company's operation and "downstream" processes cover the value chain after companies' operation (figure 2.11). In the automotive industry, where the dominant emissions stem from fuel consumption, the terms "Well-to-Wheel" (WTW), TTW and WTT are more common and also dominant in this report (Domanovszky, 2014) ((figure 2.11)). WTT is the life cycle term cradle-to-gate which covers in other words the processes from raw material extraction until the gate of the production (figure 2.11). TTW is in life cycle terms: gate-to-grave and in other words the distribution after the production until the end-of-life (EOL). WTW refers to the full life cycle emissions from raw material extraction until the use-phase of the vehicles (wheel). TTW only covers the use-phase while WTT refers to life cycle emissions just until the use phase.

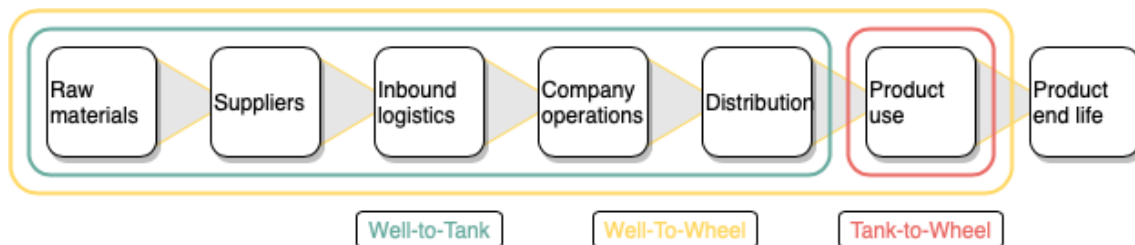


Figure 2.11: Definition of the boundaries where to allocate life cycle emissions and how to denote them according to Nordelöf et al. (2014)

GWP is an index to understand the impacts on global warming from different greenhouse gases (GHGs). The index normalises the global warming effects of several GHGs to the impact of CO₂ (Brander, 2012). The six most relevant gases are listed below for a time frame of 100 years (table 2.3). CO₂eq is a unit used to take different quantities of gases and their respective GWP into account and convert them to what the corresponding amount of CO₂ would be (Brander, 2012). "Emission factors" combine the GWP and activity-based data, resulting in a factor describing the emission intensity for a specific activity. The factor's unit consists usually of a CO₂eq divided by an activity or production rate.

Table 2.3: Greenhouse gases covered by the Kyoto Protocol (Brander, 2012)

Kyoto Protocol Greenhouse Gases		
Name	Chemical Description	GWP
Carbon dioxide	CO ₂	1
Methane	CH ₄	25
Nitrous oxide	N ₂ O	298
Hydrofluorocarbons	HFCs	124-14,800
Perfluorocarbons	PFCs	7,390-12,200
Sulfur hexafluoride	SF ₆	22,800
Nitrogen trifluoride	(NF ₃) ³	17,200

ESG refers to the three dimensions of sustainability and is a score that represents how a company addresses, and performs in, sustainability-related dimensions. It is used by investors and analysts in their decision making and risk evaluations. It is determined by a rating companies who's business idea is to analyse company performance, rate them and sell the ratings (Sustainalytics, 2020a). It also considers the business environment that the company acts in, as some risks may be unmanageable. ESG-risks that is deemed unmanageable are thus excluded and managed or manageable risks are included (Sustainalytics, 2020b).

2.5.3 The three different scopes

Emissions are categorised in three different scopes (figure 2.12) but it is only compulsory to publish scope 1 & 2 emissions. Scope 1 is characterised by direct emissions occurring in the direct responsibility of the reporting company, while scope 2 covers the indirect emissions which can be linked to energy use. Scope 3 is distinguished between up- and downstream processes. Potentially, the protocol contributes to environmental accounting efforts and thus, contributes to decision making. Efforts can be made in areas with relatively high expected reduction potential.

A comprehensive, comparable emission inventory gives organisations a clear picture of the different emission categories and their impact in the respective categories (fig 2.12). The GHG Protocol utilisation is also advised in the SDG application guidelines (GRI, 2020).

There are five levels of data quality which are listed in the following and sorted with lowest expected accuracy first (WRI & wbcscd, 2013). The higher the level of detail about the product, process or activity analysed, the better results can be expected (Greenhouse Gas Protocol, 2004b).

- Product level data - GHG emissions from cradle-to-gate
- Activity-, process-, or production line data - GHG emissions or information of production activities, processes and production lines
- Facility level data - GHG emissions or information of production facilities and operations
- Business unit level data - GHG emissions or information of the producing business units
- Corporate level data - GHG emissions or information of the entire producing corporation

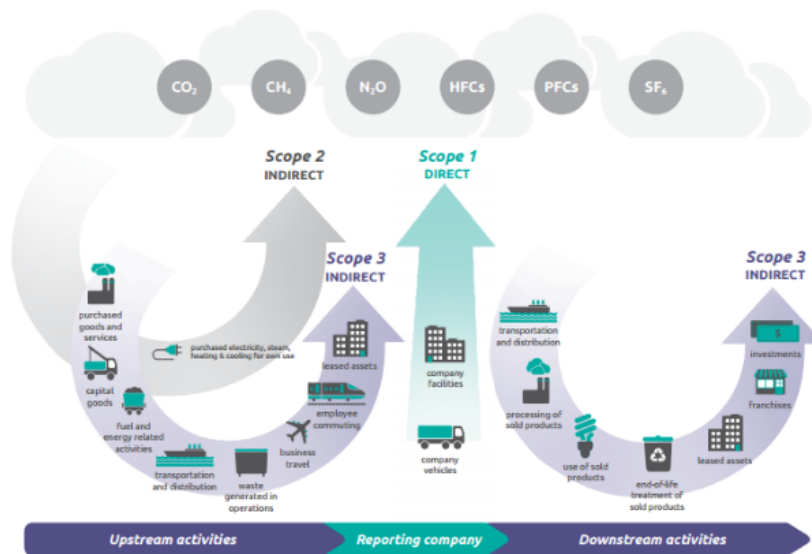


Figure 2.12: A visual representation of the different scopes and their subcategories from GHG Protocol (2016)

The GHG Protocol and its three different scopes have different characteristics in relation to a company’s responsibility and the ability to influence. The difference can be described with low to high responsibility for causing emissions on the one hand and with low to high potential to influence emissions on the other one.

2.5.4 Scope 1

Scope 1 is divided into three sub-categories, stationary- and mobile combustion and volatile gas emissions (figure 2.12) which are referred to as fugitive emissions by the GHG Protocol. Stationary combustion is characterized by all fossil fuel combustion which is not targeting propulsion as the main function. Common sources are diesel generators, furnaces and incinerators. Mobile combustion covers emissions from all vehicles owned by or in control of the reporting company. Production vehicles, internal transportation or for other non-road purposes are included, such as forklifts or lawnmowers but also cars, trucks or busses are common sources (Greenhouse Gas Protocol, 2004b). Fugitive emissions usually occur from service and maintenance of refrigeration devices.

2.5.5 Scope 2

Scope 2 addresses emissions originating from energy purchases as the emissions occur outside of the company’s area of control, namely at the energy producers facilities. However, the emissions are attributed to the reporting company since the production can be counted as result of the company’s purchasing efforts (Greenhouse Gas Protocol, 2004b). There are three sub-categories of scope 2, which are electricity, heat and cooling (Mary Sotos, 2015).

2.5.6 Scope 3

Scope 3 is split up in 15 different categories which are respectively introduced in the following. Three different calculation methods give initial guidance on how to approach each category (Greenhouse Gas Protocol, 2004b).

- Environmentally Extended Input-Output Factors (EEIO)
- Supplier surveys
- Life cycle emission factor

EEIO is an average-data method to include emissions attributed to the full life-cycle of an activity (Kitzes, 2013). Supplier survey is the request of supplier-specific information, such as activity data or emissions from the company facilitating the product or service to the reporting company (Greenhouse Gas Protocol, 2004b) Life cycle emission factors are usually based on already conducted life cycle assessments, providing high accuracy (Facanha and Horvath, 2007).

"Category 1 - Purchased goods and services" covers cradle-to-gate emissions caused by purchased tangible and intangible products (WRI & wbcscd, 2011).

"Category 2 - Capital goods" covers cradle-to-gate GHG emissions from finished products used for manufacturing, storing and selling (WRI & wbcscd, 2011) such as facilities, tools, manufacturing equipment or vehicles. To have a clear distinguishing between the first two categories, the GHG Protocol recommends the internal categorisation of the reporting company about purchased products, goods and services (WRI & wbcscd (2013)).

"Category 3 - Fuel and Energy related activities (not already included in Scope 1 and 2)" covers four energy related activities which are excluded in scope 1 and 2, such as transportation of fuel or distribution losses (WRI & wbcscd, 2013) (table 2.4). Additionally, upstream emissions of purchased fuels and the emissions while electricity production is included in this category.

"Category 4 - Upstream transportation and distribution" covers in- and outbound logistics owned or controlled by the reporting company. That transportation usually consists of the distribution and transportation between the reporting company's facilities and its suppliers. If the reporting company covers transportation or distribution costs between two different suppliers, the emissions need to be counted in category 1.

"Category 5 - Waste generated in operations" covers the emissions generated from waste disposal occurring at the reporting company's facilities. The two different calculation methods depending on the type of waste and its treatment lead to different results, as land-filled biogenic waste produces methane while the same material is CO₂ dominant if incinerated (WRI & wbcscd, 2013).

Table 2.4: Category 3 activities according to WRI & wbcSD (2013)

Activity	Description	For whom to apply
Upstream emissions of purchased fuels	Extraction, production, and transportation of fuels	End users of fuel
Upstream emissions of purchased electricity	Extraction, production, and transportation of fuels consumed in the generation of electricity, steam, heating, and cooling	End users of electricity, steam, heating, and cooling
Transmission and Distribution losses	Generation (upstream activities and combustion) of electricity, steam, heating, and cooling that is consumed (lost) in a T&D system –	End users of electricity, steam, heating, and cooling
Generation of purchased electricity that is sold to end users	Generation (upstream activities and combustion) of electricity, steam, heating, and cooling that is purchased by the reporting company and sold to end users	utility companies and energy retailers

"Category 6 - Business travel" covers emissions due to travel conducted with the purpose of business. Accounted for in road travelling are emissions from rental cars (external to operations) and employee-owned cars used in business travel. Emissions from staying at hotels, such as electricity consumption or fuel combustion for heating are also allocated to this category.

"Category 7 - Employee commuting" covers emissions from employee transportation to and from company facilities. The GHG Protocol guidelines outline the complexity of gathering information and suggest surveys as a method of collecting data (Greenhouse Gas Protocol, 2004a) (table 2.5).

Table 2.5: Data that the reporting company should collect

Data collection	Unit	Comment
Distance travelled	km	Per day
Number of days travelled per week	Number	Per vehicle type
Commuting days/week and working week/year	Number	
Region of residence and region of workplace	Region	Emission factors may vary
Carpooling, extent of use and number of users	Numbers	

As all employees may be unfeasible to survey, it is recommended to reach at least a quarter of them to obtain an approximate representation (WRI & wbcSD, 2013). It is important to consider that this is a GHG Protocol recommendation which is decoupled from any statistical surveys. Additionally, remote work can be accounted as part of commuting and thus, emissions occurring at the employees' place for the paid work time need to be included.

"Category 8 - Upstream leased assets" covers emissions which can be traced to leased assets such as "building space or vehicles" (WRI & wbcSD, 2011). The characterisation upstream in category 8 means the role of the reporting company as lessee. Determining for the emissions be allocated in scope 3 are the contracts and in particular who has operational or financial control (figure 2.13).

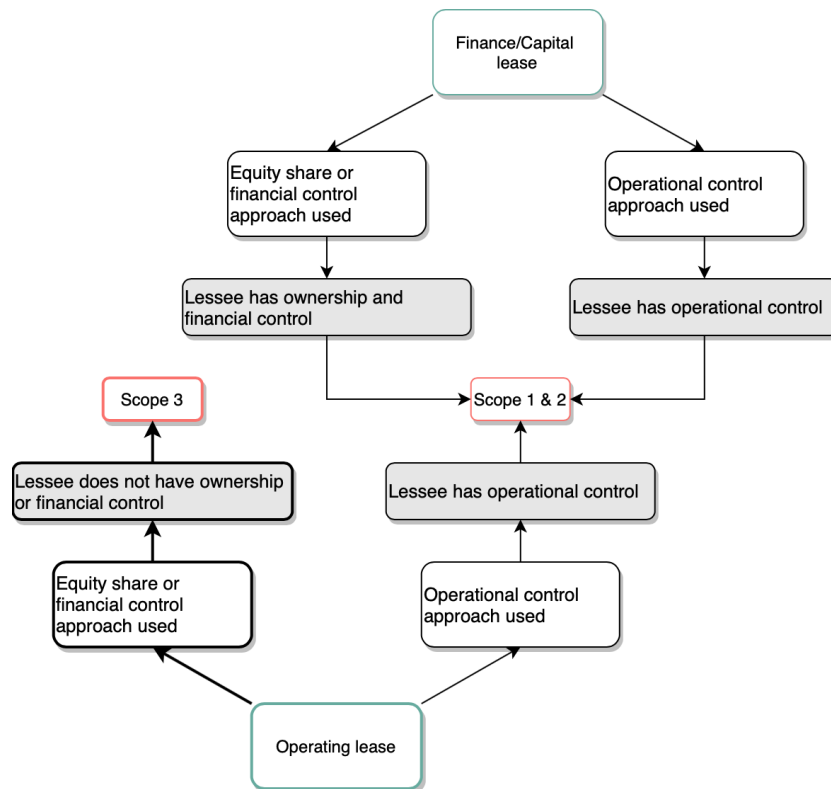


Figure 2.13: Category 8: Decision tree for approaching leased assets from the lessee's perspective derived from WRI & wbcSD (2011)

"Category 9 - Downstream transportation and distribution" covers emissions from transportation and distribution which are usually located in downstream activities from the company's facilities to the customer. The GHG Protocol defines this category's activities as being not a part of the company's economic responsibility (WRI & wbcSD, 2013). Besides from shipments, emissions from warehousing, retail and other downstream activities are included. Companies can also include emissions originating from customers' transportation to retail facilities, although it is no requirement.

"Category 10 - Processing of sold products" covers emissions from further processing steps before the delivery to end consumers (WRI & wbcSD, 2013). Common sources are assembly of components into another product. This category is only applicable if the reporting company does not supply the end consumer. Heat or electricity are the most common sources of emissions.

2. Corporate transitioning towards more sustainability

"Category 11 - Use of Sold Products" covers emissions occurred during the use of the finalised products. Knowledge about technical product specifications, use patterns and its behaviour over a life cycle is required when applying these emission calculations. The following three emission categories are identified (WRI & wbcSD, 2013).

- Energy consumption of products
- Fuel combustion
- Indirectly consumed energy through maintenance processes

"Category 12 - End-of-life treatment of sold products" covers emissions from the waste disposal or waste treatment of the product. The data collection is similar to category 5. Additionally, emissions from auxiliary products used for delivery or which provide any function to the product, such as packaging or instruction booklets need to be accounted for (WRI & wbcSD, 2013).

"Category 13 - Downstream leased assets" refers to cases in which the reporting company acts as a lessor. Depending on operational or financial control, emissions from the leased assets need to be allocated to scope 1 & 2 instead (WRI & wbcSD, 2013)(figure 2.14).

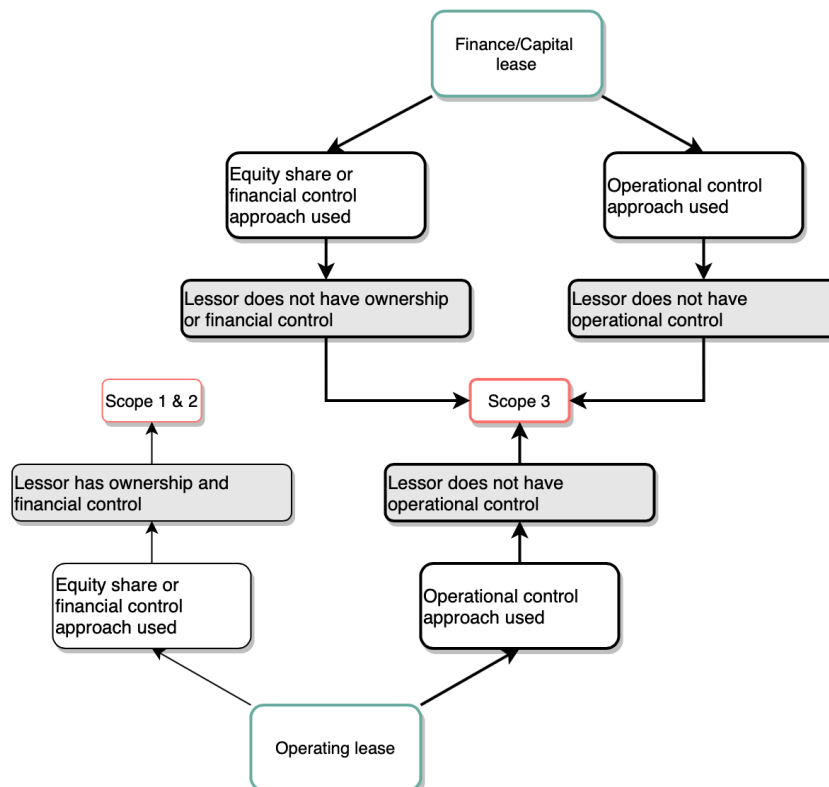


Figure 2.14: Category 13: Decision tree from the lessor's perspective (WRI & wbcSD, 2011)

"Category 14 - Franchises" is relevant if the company is a franchiser. The franchisee's scope 1 and 2 emissions are accounted in the reporting company's category 14, as the franchisee has both operational and financial control (WRI & wbcSD, 2011).

"Category 15 - Investments" covers emissions from the operations the reporting company invests in. Usually the emissions are based on the investee's scope 1 and 2 emissions (WRI & wbcSD, 2011). The GHG Protocol classifies four different types of investments as applicable:

- Equity investments,
- Project finance
- Debt investment
- Managed investments and client services

2.6 Veoneer

Veoneer is a Swedish automotive technology manufacturer, with several international subsections. The company was founded through a split from the vehicle safety company Autoliv in 2018 (Veoneer, 2018), so that the first full operating year was 2019. Through its origin as the active safety division of Autoliv, general processes, policies and measurement tools were inherited together with customer relationships. Veoneer is a global company whose customers represent most of the automotive conglomerates who are primarily active in Asia, Europe and North America.

The global automotive market in general and the three key customer markets of Veoneer in particular is under pressure by the automotive electrification shift in addition to carbon impact reduction in the production, transportation of products and use-phase.

Table 2.6: Facts about Veoneer in 2020 (Veoneer, 2020b)

Market Share (globally)	9% Safety, 22% restraint control and 5% brake system
Listed	New York Stock Exchange and can also be traded through the Swedish NASDAQ Stock Exchange
Net sales (million \$)	1900
Main customers	Honda, Daimler, Ford, General Motors, Hyundai
Number of employees globally	7100
Headquarter	Stockholm
National divisions	Canada, China, France, Germany India, Italy, Japan, Korea Romania, Sweden, United Kingdom, United States
Number of sites	30 (including 5 manufacturing sites)
Major shareholders	Institutional investors

2.6.1 Veoneer in numbers and strategies

Veoneer develops, designs and produces electronics with an emphasis on active safety, autonomous drive and advanced driving systems (ADAS). Veoneer has offices in 13 countries (table 2.6)

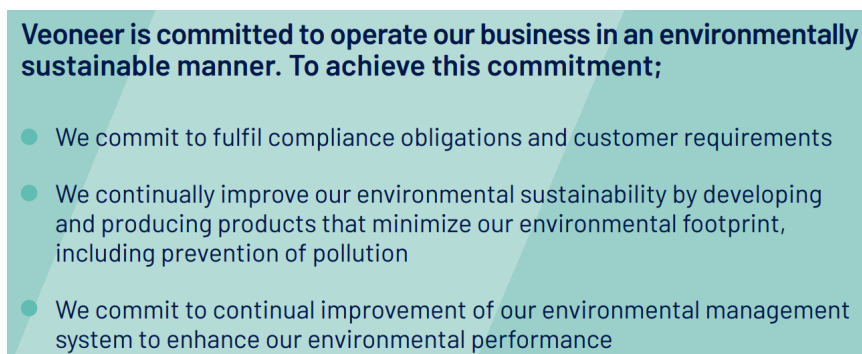
Table 2.7: Mission and strategy at Veoneer (Veoneer, 2020b)

Mission	"Create Trust in Mobility"
Values	"Flawless delivery, customer-centric collaboration and human-centric innovation"
Business Strategy	"Deliver innovative solutions that automotive manufacturers and drivers can trust."

Veoneer sees an automotive market at the brink of radical transition, which impacts the business landscape significantly (Veoneer, 2020b). To stay relevant in a market that has an increased focus on electrification and autonomous vehicles, Veoneer must create trust for their company and products in the eyes of customers and users. An aspect of that is legal compliance which is based on their code of ethics, a code which is also required to follow for their suppliers.

2.6.2 Sustainability strategies and organisation

Following the web presence, Veoneer introduces a growing interest in addressing sustainability related topics (Veoneer, 2020a). Veoneer contributes to the SDG target 3.6, which aims for halving "the number of global deaths and injuries from road traffic accidents" by 2020 (United Nations, 2019). The company is expected, by customers, to follow regulatory requirements in the markets they act within (Volvo, 2020). The company in turn demands the same from its suppliers. For instance, the company is obliged to have all its manufacturing sites ISO14001 certified. Veoneer desires, but does not strictly require, the same certification from suppliers. Similar to the regulatory compliance requirement, the demand originates from its customers (Veoneer, NAa).



Veoneer is committed to operate our business in an environmentally sustainable manner. To achieve this commitment;

- We commit to fulfil compliance obligations and customer requirements
- We continually improve our environmental sustainability by developing and producing products that minimize our environmental footprint, including prevention of pollution
- We commit to continual improvement of our environmental management system to enhance our environmental performance

Figure 2.15: Veoneer's environmental policy retrieved from Veoneer (NAa)

The three focus areas in the EMS are customer requirements compliance, continual performance improvements regarding environmental impacts of the products in the use-phase and in production and continuous improvements of the EMS (Veoneer, NAb) (figure 2.15). The environmental policy is a compliance of requirements put upon Veoneer due to the ISO 14001 certification (Veoneer, NAb).

In late February 2020, Veoneer published the first sustainability report which is based on Global Reporting Initiative (GRI) guidelines but not complied entirely (Veoneer, 2020b). The global organisation's scope 1 and 2 emissions are presented while providing a transparent way of how the numbers were calculated although no raw data is included. Additionally, the waste streams are displayed as a combination of recycling and incineration.

2.6.3 Veoneer's stakeholders

Veoneer has continuous stakeholder dialogues (Veoneer, 2020b). Their most important stakeholders are extracted from the annual and sustainability report.

Customers are naturally an important stakeholder for Veoneer. The companies listed in table 2.6 have a big influence on the company's operations as it is an upstream supplier and thus, has to remain an attractive business partner to exist. Many of the customers are inherited from Autoliv (Veoneer, 2020c). Automotive customers put requirements on their suppliers such as certification of standards, respecting human rights and local legislation.

To stay competitive, Veoneer is dependent on skilled employees who drive the technological development forward and deliver customer value. A majority of Veoneer employees work with research, development and engineering (Veoneer). Veoneer inherited most of its employees from its spin-off from Autoliv.

Veoneer recognises society to be a stakeholder and their wishes to ensure that companies follow legislation and treating people and the environment ethically. Veoneer sees the products as part of their societal engagement where they contribute to a reduction in traffic fatalities (Veoneer, 2020b). Their sustainability report also describe memberships in associations where Veoneer's findings are shared with researchers to benefit society. The company's societal engagement is also presented as an interest (Veoneer, 2020b).

Suppliers and other business partners are crucial for the company's ability to deliver products to customers. Veoneer prioritises material suppliers that are geographically close to their own locations and mainly consists of different electronic semi-conductor manufacturers (Veoneer, NAa). As with many parts of the company, supplier relationships were inherited from Autoliv.

Another identified stakeholder are investors and analysts. Investors offer attractive portfolios by using different types of non-financial scores and measures. Veoneer is mainly owned by institutional investors (Robert Eccles, 2019), who commonly find companies with a high ESG score as more attractive investment targets such as the Swedish state-owned pension fund "Fjärde AP-fonden", Alecta and Nordea Asset Management (CNN, 2020). To exemplify, Nordea includes ESG ratings as a criteria when assessing potential investments (Nordea, 2020).

Table 2.8: Stakeholders and their key interests (Veoneer, 2020b)

Stakeholder group	Key interests
Customers	Product features Product features Product safety Business ethics and integrity Customer success At the forefront of technology
Employees	Fair compensation Development Career opportunities Talent attraction and retention Business ethics and integrity Diversity and inclusion Safety and well-being Human rights
Potential employees	Career opportunities Safety and well-being
Society, including NGOs and local community	Industry leadership Business ethics and integrity Human rights Legal compliance Societal engagement Operational impact
Business partners and suppliers	Industry leadership and partnership Business ethics and integrity Human rights Legal compliance
Investors and analysts	Business ethics and integrity Technologies and Products Financial progress Human rights Legal compliance

2.6.4 Veoneer Sweden AB

To distinguish between the global and the national organisation, the five Swedish sites will be addressed as the Swedish organisation while the global organisation refers to all of Veoneer’s divisions in all operating countries. Except for Vårgårda, all national sites are declared as technology centres, which means a focus in research, development and general engineering. The Vårgårda site is also the only Swedish manufacturing plant (Veoneer, 2019).

The headquarter belongs to the global organisation and thus, the Stockholm site in table 2.9 refers to as tech centre. All Swedish tech centres, as well as the Vårgårda

manufacturing plant, are ISO 14001 certified. That is a step further than what was required by the customers. As of December 2019, Veoneer Sweden had 1579 registered employees, excluding consultants (AllaBolag).

Table 2.9: Facts about Veoneer Sweden AB(Veoneer, 2019)

Number of employees	1579
Number of sites	5 (excluding global headquarter)
Locations of sites	Stockholm, Gothenburg, Linköping, Skellefteå and Vårgårda (production site)

3 Method

The method aims for qualitative results, although the GHG Protocol results are used to add quantitative arguments. Quantitative data was expected to be used as hard facts for communicative reasons regarding the potential influence of the GHG Protocol. The presented methods were chosen to identify and develop benefits and drawbacks to enable the assessment on the application of environmental activities in companies. The following data collection and management directs the answering of the research questions. Since the focus lies on the country division of the company, the following referring to the company implies only the addressing of the country organisation.

3.1 Data collection

To conduct a GHG Protocol data availability assessment, the following section describes what kind of data was required to collect and where it was expected to be accessible. Primary and secondary data sources were approached, as it was important to receive information about the company itself but also about the context it exists in to understand its culture and internal processes. Additionally, a substantial amount of raw data was needed for the application of the GHG Protocol which could be gained through internal documents in addition to informal talks and interviews with employees, suppliers or business partners.

3.1.1 Literature search

An iterative literature search was undertaken to obtain information for answering the research questions. The main database was Google Scholar while the Chalmers library database and Summon were also used. Scientific articles published in renowned journals, reviews of methods and conference papers were found using the keywords:

- Corporate transition (ScienceDirect, Google scholar, Chalmers library, Researchgate): "Stakeholder theory", "Change management", "Corporate environment", "Change agents", "Change leadership", "Kotter" and "Stage model"
- Sustainability performance (ScienceDirect, Google scholar, Chalmers library, Researchgate, Summon): "Sustainability performance", "Corporate environment", "Institutional logics" and "Corporate sustainability"
- Environmental governance (ScienceDirect, Google scholar, Summon, Chalmers library): "Corporate governance" "Environmental governance" and "Corporate sustainability"

- Project communication (Chalmers library, Springer, Google scholar, Summon, Researchgate): "Communication" and "Project communication"
- Environmental accounting (Google scholar, Chalmers library, Researchgate): "Automotive CSR", "sustainable organisation", "sustainable leadership" and "Environmental accounting"
- GHG Protocol (Google scholar, Chalmers library, Summon): "GHG Protocol" and "Environmental accounting"
- Vehicle emission factors (Google Scholar, Chalmers library, ScienceDirect, Researchgate, Springer, Summon): "life cycle assessment BEV", "life cycle assessment ICEV", "emission factors GHG Protocol" and "IPCC emission factors"

3.1.2 Company information

The information about Veoneer was based on public and internal data. The publicly available information was annual reports, the CSR report and the company's homepage. The internal information was information on the intranet and local data systems such as documents, data-sheets, organisational charts and policies. Additionally, data was also collected from internal mail conversations. These sources were of both, primary and secondary character. Primary sources were mainly data sheets and mail conversations, while most of the information on the intranet were considered as secondary sources. Much of the GHG Protocol data was collected in Veoneer's supply chain such as freight forwarders, landlords, travel agencies and waste treatment companies. Volvo was approached with the purpose of sharing experiences about the calculations for the protocol (Group, 2017). Since most of the public information concerns the entire global company, this data was used to describe the company's global environment in the respective theory section about the company. Additionally, some publicly available rough facts and numbers were entered, describing the Swedish national section.

3.1.3 Interviews and informative interactions

Semi-structured interviews were the main data source for the understanding of Veoneer Sweden (Edwards and Holland, 2013). Additional exchange of information during meetings, remotely and in-person at site, occurred naturally during work hours or breaks. These conversations which are the basis for assessing the qualitative content are identified as informative talks. The informative talks, interviews and their respective content are presented together, as the conversations were similar. The interviews and talks were not transcribed and are not publicly available since many parts of the spoken words concern confidential information. One person was assigned as the interviewer, moving the conversation forward and staying focused on the agenda. The second person documented the talk and continually analysed responses given by the interviewee regarding the coverage of topics. The same person was also responsible to ask follow-up or clarification questions.

Table 3.1: List of targeted departments and business units in Veoneer to be approached for interviews or informative talks

Department/ Business unit	Veoneer organisation	Department-specific targeted topics
Finance and Accounting	Sweden	- Purchased goods & services - Investments - Franchises - General accounting
Application	Sweden	- Existing environmental solutions
Administration	Sweden	- Environmental strategies - Environmental reporting - EMS
Communications	Global	- Environmental reporting - CSR report in particular - Global perspective
Development Engineering	Sweden	- Product performances - Eco design
Facilities	Sweden	- Energy consumption - Fuel consumption from company owned vehicles - Environmental objectives
Quality	Sweden	- EMS - Company culture - Environmental coordination
Human Resources	Sweden	- Role of sustainability in hiring procedures - Business travel
Direct Purchase	Sweden	- Purchased goods & services
Indirect Purchase	Sweden	- Capital goods - Upstream transportation
Logistics & Scheduling	Sweden	- Transportation and distribution - Employee commuting - Environmental targets

The interviewees and people to talk with were selected based on formal position and access to data relevant for the GHG Protocol (table 3.2). Interviews with employees were conducted to become informed about different perspectives on the company's operation in general and the environmental work in particular, to nuance officially communicated information (table 3.1). The interviews were conducted with both authors of the thesis involved. Most of the confidential material was used to inform the context and the perspectives of the GHG Protocol. Managerial perception regarding the organisation's environmental performance was expected to support the exploration of changing processes (Ionescu et al., 2014) and enlighten the relation between global and Swedish organisation on the meso-level.

Since no direct interviews with all stakeholders were conducted, identified expectations are filtered through at least one person. Therefore, some input about general key interests could be supported with literature such as Frigant (2009) and Cioca

3. Method

et al. (2019). Only the key interests which are addressed in the publicly available information and confirmed through the interviewees as being relevant for the Swedish organisation were used.

Table 3.2: Conducted interviews and informative talks

Interviewee	Position	Department/ Business unit	Veoneer organisation	Length	Record
Maria Boström	Finance Manager	Finance and Accounting	Sweden	60 min	x
Maria Lissmatz	Controller	Finance and Accounting	Sweden	60 min	x
Emil Carlenius	Agile coach	Application	Sweden	30 min	
Daniel Åhlström	Managing Director Veoneer Sweden AB	Administration	Sweden	20 min	
Damien Gilbert	Health, Safety & Environmental (HSE) coordinator	Administration	France	60 min	x
Cathrine Stjärnekull	Director Corporate Communications	Communications	Global	60 min	x
Christian Svensson	Director Emerging Business	Development Engineering	Sweden	60 min	x
Niklas Rosenö	Facility & Security Manager	Facilities	Sweden	60 min	x
Karin Käck	Environmental coordinator	Quality	Sweden	90 min	x
Christer Ingmarsson	Engineering and Systems Quality Manager	Quality	Sweden	60 min	
Maria Engwall	Human Resources Administrator	Human Resources	Sweden	30 min	
Patrik Lindqvist	Category Manager	Purchase	Sweden	30 min	
Mats Bohman	Director Indirect Purchasing	Purchase	Sweden	60 min	
Daniel Peterson	Logistics Manager	Logistics & Scheduling	Sweden	60 min	
Anna Wahlström	Logistics Project Leader	Logistics & Scheduling	Sweden	60 min	
Pierre Hultstrand	Business Director	Purchase	Sweden	30 min	

3.1.4 Extracurricular education

The US-based Automotive Industry Action Group (AIAG) conducted a remote CS summit in April 2020. As a result of the projects participation, valuable impressions and insights into how the automotive sector perceives sustainability work in general

and the GHG Protocol scope 3 calculations in particular. The agenda contained sustainability-related keynotes which were mainly about addressing what environmental activities automotive companies could work with such as ISO14011, GHG Protocol and ISO 50001. Additionally, the AIAG organised a webinar about scope 3 calculation methods. The presented calculation methods relate to the obtainment of GHG emission numbers. Relevant content consisted of guidelines about how different categories can be approached and where data may be found and collected.

3.1.5 Process data and emission factor

A survey was initiated on employee commuting (table 3.3) to collect data in this particular category. With applying the three different calculation methods EEIO, supplier-survey and life cycle data, the amount of effort to put in calculations is partly decoupled from the recommendations in the protocol, due to the assessment approach of this project. The limiting factor of the calculation method was the availability of relevant and qualitative data.

Table 3.3: Data requested in the employee commuting survey

Data requested from respondents	Mandatory	Non-mandatory
Mode of transportation	X	
Average distance back-and-forth	X	
Number of commuting days/week	X	
Change requests		X
If number of commuting days/week <5		
Alternative mode of transportation	X	
Average distance back-and forth	X	
Number of commuting days	X	
If respondent is a car driver		
Fuel type	X	
Average fuel consumption/100km		X
Ride sharing and amount of people in vehicle	X	

3.2 Data management

3.2.1 Stakeholder analysis

The purpose of the stakeholder analysis is to provide further results with foundations to identify the company's identity and logic in operation. The collected answers in the interviews, the online and public descriptions about Veoneer and supportive literature was analysed to identify each actors stake. The classification of each stake was assessed according to the relative power of each stakeholder in combination with an evaluation of the legitimacy of stakeholders' key interests and with a weighting how urgent the stakeholder is pressuring the company (Mitchell et al., 1997). The stakeholders were categorized according to the classification system developed by Şener, which is displayed in figure 2.3 (İrge Şener et al., 2016). Especially the answers

from the directing manager and the global marketing director were used to verify the importance of each stakeholder and to identify key interests. Questions about important stakeholders for the national organisation in general and expectations and pressures experienced in particular through each interviewee's work, could support a thorough understanding of each stakeholder's role.

3.2.2 Macro and micro-level perspectives

The company information of the global and the national organisation are targeted to set in contrast. Therefore, the respective macro, meso and micro-level needs to be assessed regarding their impacting forces. The perspectives from all interviewees were used to identify how the stakeholder expectations shaped the environmental work of the company (Corbett et al., 2018). The public material was used to contrast the micro-level perspectives from most of the interviews.

Since the macro-level is shaped and impacted by external expectations and pressures, the stakeholder analysis supports the assessment of the macro-level. The global company's identity could be identified through public statements about the culture, mission and sustainability goals. Green logics could be identified through statements about the integration of sustainability in the global company's operation from public reports but also from perspectives shared during talks, interviews and observations in the company.

With support of the interviews with the national organisation's managing director, the meso-level considering the impacts of the macro to the micro-level could be determined. The cross-level pressures, normative, regulative and cultural-cognitive were assessed with the combination of statements about the specific impact and importance of the stakeholders. Identified expectations in the stakeholder analysis were combined with expressions about drivers for the organisational identity.

The micro-level perspectives were assessed through the identification of impacts on the daily work which were raised during the talks with employees. The statements were compared with the stakeholder expectations regarding legitimacy, urgency and power (Wickert et al., 2017). Furthermore, the different valuing of expectations led to classification along the different cross-level pressures. When all three levels are assessed, the analysed way of how the business can be impacted in the national organisation is planned to adapt towards the implementation of an environmental activity such as the GHG Protocol.

3.2.3 Identifying overlaps between the company's operation and SDGs

Through identified macro and micro-level drivers, the consequential follow-up step targeted which environmental activities would be natural for the company to work with. Through the identified cross-level pressures (normative, regulative, cultural-cognitive), environmental activities are assessed based on their viability for the company (Corbett et al., 2018). The UN SDGs provide a conceptual guideline to identify environmental targets (GRI, 2020). To shape the company's sustainability agenda, the identified activities were compared with Veoneer's present sustainability focus.

Through the definition of sustainability priorities combined with the outcome of the stakeholder analysis, businesses are encouraged to work with the environment promoting the climate action goal.

3.2.4 GHG data inventory

Data collection as a core activity in the GHG Protocol requires a system to store, manage and to further process with calculations (Greenhouse Gas Protocol, 2004b). Considering the approach to just assess the implementation of the protocol, no external software was used and a developed data management tool in Excel consisting of several interrelated sheets was sufficient. The core requirements for this concept's data tool is summarised in the following list:

- Storing - intuitive structure
- Managing - smart interface linkages
- Calculating - ability to develop results from raw data

The developed excel file contains one raw data sheet which is linked to sheets used for data collection in each category of the protocol. A second datasheet filters raw data while aggregating a whole year so that only site-specific process data for the full year is presented. Additionally, appropriate emission factors are added. The next sheets are grouped according to the different scopes and simply calculate the final emissions from the process data and the emission factors in the second data sheet. All emissions are summarised together for each scope in the last sheet to present the emission numbers as they are supposed to be published according to the GHG Protocol (Greenhouse Gas Protocol, 2004b).

The chosen base year for the emission inventory was 2019 as it is the last full year which is a requirement in the protocol (Greenhouse Gas Protocol, 2004b). The basic units chosen to standardise the collection of products, goods and materials, were the assessed flows of

- Mass: kg
- Volume: l
- Energy: kWh
- Currency: SEK
- Distance: km
- Emissions: CO₂eq

As Veoneer's products are mounted in vehicles, the processing, use and EOL phase emissions were assumed to be mass allocated. Therefore, the car market was simplified with only two different kinds of vehicles. The following equations are used for emission calculation for the processing of sold products. A rough overview of the managed data is presented in tables 3.4 & 3.5. More detailed explanations about the emission calculation methods for each scope can be found in appendix A.

$$\frac{\frac{kgCO_2eq}{BEV}}{kgBEV} = \frac{kgCO_2eq}{kgBEV} \quad (3.1)$$

$$\frac{\frac{kgCO_2eq}{ICEV}}{kgICEV} = \frac{kgCO_2eq}{kgICEV} \quad (3.2)$$

Table 3.4: GHG Protocol data which was collected and need to be managed 1/2

	Categories	Data points	Sources
S c o p e 1	Mobile combustion	Process data	Talks with departments: facility, research & development, quality, human resources (Nilsson, 2020)
		Emission factor	(DECC, 2012)
	Stationary combustion	Process data	Talks with department: facility, quality Internal energy reporting
		Emission factor	(DECC, 2012)
S c o p e 2	Electricity	Process data	Talks with departments: facility, quality Internal energy reporting
		Emission factor	(EEA, 2019)
	Heating	Process data	Talks with department: facility
		Emission factor	(EEA, 2019) (DECC, 2012)
S c o p e 3	Purchased goods & services	Process data	Talks with departments: direct purchasing, quality
		Emission factor	(DECC, 2012)
	Capital goods	Process data	Talks with department: indirect purchasing, finance
		Emission factor	(DECC, 2012)
	Fuel and energy related activities	Process data	Talks with departments: facility, quality, research and development human resources
		Emission factor	(DECC, 2012) (Moro and Lonza, 2018)
	Upstream transportation and distribution	Process & emissions data	Talks with departments: logistics, indirect purchasing Third party companies: freight forwarder ERP system
	Waste generated in operations	Process data	Talks with department: facility Third party companies: respective waste treatment companies for each site, landlords
		Emission factor	(Protocol, 2017)
	Business travel	Process & emission data	Talks with department: human resources Third party company: HRG
	Employee commuting	Process data	Talks with department: logistics, quality Survey (Nilsson, 2020)
		Emission factor	(DECC, 2012)

Table 3.5: GHG Protocol data which was collected and need to be managed 2/2

	Categories	Data points	Sources
S c o p e 3	Upstream leased assets	Process data	Talks with departments: facility, finance
		Emission factor	(EEA, 2019), (DECC, 2012)
	Downstream transportation and distribution	Process data	Talks with departments: logistics ERP system
		Emission factor	(ifeu Heidelberg, 2018)
	Processing of sold products	Process data	Talks with departments: research and development, sales (ACEA, 2020b), (ACEA, 2020a), (icct, 2019)
		Emission factor	(Pero et al., 2018)
	Use of sold products	Process data	Talks with departments: research and development, product testing (ACEA, 2020b), (ACEA, 2020a), (RAC, 2012)
		Emission factor	(Pero et al., 2018)
	End-of-Life treatment of sold products	Process data	Talks with departments: quality, research and development, product testing (ACEA, 2020a), (icct, 2019)
		Emission factor	(Concawe, 2018)
	Downstream leased assets	Process data	Talks with departments: facility, finance Third party company: lessee
		Emission factor	Third party company: lessee (EEA, 2019), (DECC, 2012)
	Franchises	Process data	Talks with department: finance
Investments	Process data	Talks with department: finance	

The use phase calculations were based on similar assumptions and simplifications with the addition of having an average vehicle life-time.

$$\frac{\frac{kgCO_2eq}{km} * yr * \frac{km}{yr}}{kgBEV} = \frac{kgCO_2eq}{kgBEV} \quad (3.3)$$

$$\frac{\frac{kgCO_2eq}{km} * yr * \frac{km}{yr}}{kgICEV} = \frac{kgCO_2eq}{kgICEV} \quad (3.4)$$

The EOL treatment of the products was also based on life cycle assumptions that mass allocated to average vehicle performances and thus, equations 3.1 & 3.2 could be applied.

3.2.5 Dissemination of knowledge

Four newsletters were created and sent out during the project phase. As the data inventory was expected to be fulfilled with data extraction from several departments in the company, communication functioned as a pathway to influence with knowledge, understanding and creation of awareness for the GHG Protocol. Dialogues were conducted as "the catalyst of change" (Rousseau et al., 2014) and motivated by literature, employees were approached based on estimations of the project environment. The reach out for information to employees and business partners served three different purposes. First, approached people got informed about the topic, which eventually haven't been familiar before. Employees who have participated in environmental activities outside of their work but had not found possibilities to do so within the company were encouraged or activated. A third objective was the building of environmental alliances and the creation of solid bonds between employees irrespectively of location and department.

Table 3.6: Map out of knowledge updates concerning the thesis project

Send out	Project environment	Characteristics	Content
<i>2nd Month</i>	Semi-organic	new and tacit information	- Introduction of the GHG Protocol - Presentation of the thesis project including background, goals, progress description, completed tasks
<i>4th Month</i>	Semi-mechanical	deeper and more specific information	- Introduction of the GHG Protocol - Initial scope 1 & 2 results - Presentation of the thesis project including goals, progress description, completed tasks
<i>5th Month</i>	Mechanical	new and company specific information	- Presentation of data assessment of the GHG Protocol - Approached methods for each category
<i>6th Month</i>	Mechanical	new and explicit information	- Presentation of GHG Protocol results for each category

As it is illustrated in figure 3.1, differences in knowledge were approximated and based on the expected impressions (Koskinen, 2004) (Sumanjeet, 2005). The contents reflect the findings and understanding of the implementation of the GHG Protocol at the point they were written. The type of communication was characterised, according to Koskinen (2004), classification categories of project environments to be contrasted with the feedback from the departments and management.

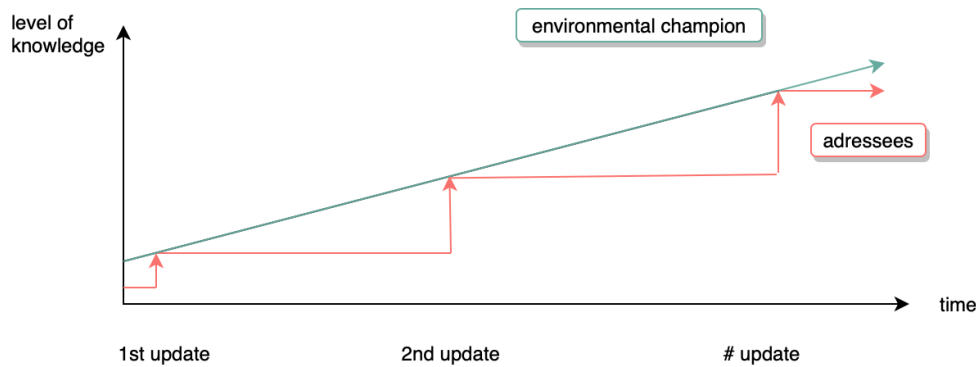


Figure 3.1: Learning curves during the development phase

3.3 Delimitations and assumptions

Since the level of detail and the level of quality in the GHG Protocol guidelines are no requirements, the following delimitations and assumptions are presented in a general way. The claim for transparency in this report is acknowledged with a detailed overview in the next two following chapters.

3.3.1 Delimitations

Only the five Swedish sites are considered while the global head office in Stockholm is not included. As already appeared in data collection, the results of understanding the internal environmental work are based on interviews, talks and observations. Hence, the perspectives are limited to only experienced impressions.

Due to time restrictions, parts of the data collection was closed before the data could be gained completely although information for "purchased products and services", "upstream transportation" or more varied product performance data were considered to be available. Difficulties in communicating could not always be solved in time.

Similar reasons are limiting the completeness of data in "waste management" and "upstream transportation". In these cases, communication issues with third party companies could not be overcome.

Externally assessed emission reports were difficult to evaluate regarding transparency how numbers were quantified. In the case of transportation, emissions are calculated according to the standard EN:16258 but the calculation method for business travel couldn't be verified (SIS, 2012).

For data collection in Scope 1, fugitive emissions are not covered as it was deemed to be a minor emission source for non-heavy industry which are primarily air condition refrigerant leaks for organisations (Greenhouse Gas Protocol, 2004b).

The aggregated GWP unit of CO₂eq is defined as emission unit for all emissions calculated in this report, but there are uncertainties for some of the emission reports in which it could not be verified whether the unit is CO₂ or CO₂eq.

The GHG Protocol requires the consideration of wastewater treatment as part of assessing waste treatment emissions, but Veoneer's wastewater occurring is expected to be not as significant as in heavy industries and hence, waste emissions were targeted without the consideration of wastewater.

To calculate emissions related to the GHG Protocol and to access concerning information, a non-disclosure agreement was signed with Veoneer. Hence, the report is limited in being transparent about all apprehended information. Only the information which could be sourced with publicly available information is included so that the publishing of this report could be confirmed by Veoneer representatives.

3.3.2 Assumptions

Since most of the data for the GHG Protocol emission calculations are not results of measurements by Veoneer, average data utilisation was chosen in most of the cases. Each assumption is explained in the corresponding result section of the three scopes.

For scope 1, the following assumptions were made:

- Mobile combustion: Average fuel consumption for vehicles with no GPS data; average fuel emission factor
- Stationary combustion: Average fuel emission factors

Scope 2 was assessed with the following assumptions.

- Electricity: Average Swedish emission factor
- Heat: Average Swedish emission factor

And finally, scope 3 categories were approached with the following assumptions.

- Purchased goods and services: exemplary average emission factor; only category's summarising groups of products and services
- Capital goods: exemplary average emission factor; only category's summarising groups of products and services
- Fuel- and energy related activities: UK based WTT emission factor fraction from WTW emissions; UK based distribution loss fractions
- Upstream transportation: CO₂eq in one emission report
- Waste generated in operations: 100% incineration
- Business travel: -
- Employee commuting: Survey results applied for the whole organisation; Average emission factor
- Upstream leased assets: Operational control for all leased sites
- Downstream transportation: -
- Processing of sold products: Average product, average car market, average vehicles, battery electric vehicle (BEV) & internal combustion engine vehicle (ICEV), average emission factors
- Use of sold products: Average product, average car market, average vehicles (BEV & ICEV), average life time, average emission factors
- EOL treatment: Average product, average car market, average vehicles (BEV & ICEV), average emission factors

- Downstream leased assets: operational control
- Franchises: -
- Investments: -

3.3.3 Analysis strategy

The analysis follows the research questions. First, the answer to “*How can the GHG Protocol increase the environmental understanding?*” addresses existing environmental activities. The ambition level is compared with the contrast of what is communicated publicly and how the environmental dimension is applied in the company to analyse the different pressures impact efficiency. In combination with the drivers of the different actors management, environmental coordinator and employees, the changing process of Veoneer Sweden can be evaluated. Based on the deep understanding of the drivers behind environmental efforts in the company, pathways on how the environmental dimension can be integrated into the operation are identified. The selection of potential SDGs support the analysis of how the green logics could be approached with a higher ambition. The final part of the answer compares a bottom-up management’s impact with eventual top-down directives. The GHG Protocol is linked to the work environment of responsible actors, to the cross level pressures influencing the decision making and to the company’s structures and strategy.

The question “*In what ways can the emission quantification results of the GHG Protocol implementation contribute to corporate transitioning?*” addresses the Kotter “Eight step model” to suggest actions in connection to the different changing steps. Furthermore, the protocol’s preliminary results are evaluated regarding practicability for identified transition process contributions.

The final question “*How can the GHG Protocol implementation impact the industry?*” is addresses potential ripple effects caused by the protocol and how it affects its operating environment.

4 Results

The results are divided into five parts. First, the interview results and perspectives are reported. Secondly, a stakeholder analysis of Veoneer's Swedish organisation's environmental work is developed out of the collected insights. The third section reports on the environmental communication within the company and the effectiveness of the newsletters produced during the master's thesis project. The fourth part is based on the interviews and other documentation on Veoneer's environmental work. There, the company's identity and logic of operation is identified and to be used in a comparison between the macro-level expectations, the role of the global organisation and the micro-level perceptions. The comparison will clarify the conflicting pressures between the macro and the micro-level. The final part presents preliminary results from the assessment of the GHG Protocol implementation.

4.1 Veoneer's cultural organisation

The observations and interviews in connection to Veoneer's environmental work were performed at Veoneer Sweden's facility in Vårgårda, in Linköping and online with employees from the global headquarter in Stockholm and Veoneer France. The material of Veoneer Global is mainly collected from the sustainability report published in 2020. The observations and interviews provided perspectives on the company's environmental work during the spring of 2020.

4.1.1 Macro-level impressions

The macro-level was collected through the publicly available information about Veoneer's environmental work in the sustainability report developed by Veoneer's global organisation. It was also covered by two interviews conducted with Veoneer employees in the Global and French organisation. The findings were that from a global perspective, the main focuses were on the quality of its products, attracting stakeholders and the understanding that the environmental work was recently initiated. Veoneer is a young company and was at the time developing the organisation. The environmental work was just to about to be implemented and needed to start somewhere. In the interview with the global director of communication who is responsible for the CSR report, the place to start was data collection for scope 1 & 2 energy-consuming processes in each country division. As the environmental work develops, it was expected that more aspects should be included. The focus on product quality was driven by customer-centric values. The company's experience with environmental work was not very developed, but there was a sense of

pressure by the industry and in particular customer companies who were publishing CSR reports. The decision to produce a public sustainability report was aimed at increasing corporate sustainability and communication towards current and potential stakeholders. As a side effect, employees could be motivated. The initial step was to publicly report and demonstrate the value of environmental activities and to develop the corporate sustainability. At the time of the interviews, there was no standardised reporting implemented. In the interview with an employee from the French organisation, responsible of the country divisions' environmental inventory data collection to the 2019 CSR report, the report system used was oriented at the GHG Protocol. The internal environmental reporting system was introduced as a foundation for scope 1 & 2 emissions, which was published in the sustainability report.

4.1.2 Meso-level impressions

The meso-level data was collected in observations and informal talks with people from the Swedish management team. Veoneer Sweden executive employees acted as an intermediate level between the global organisation and the company in Vårgårda. The Vårgårda facility as part of Veoneer was also split off from the Autoliv manufacturing site there in 2018. The main issues from the observations were choices of environmental activities and the development of the environmental work in a bottom-up approach. In the interview with the Swedish managing director, the main choices of environmental activities were until then driven by the need of legal compliance. Additional environmental activities were mostly developed through ideas from employees in a bottom-up process which was valued by the managing director. There was an indication that process was considered to continued. However, it was also acknowledged that there was a lack of information of the environmental performance as well as, at the time, missing strategic communication at the management level.

Veoneer Sweden implemented environmental activities such as the environmental management system ISO14001 as a response to customers' requests of certifying the manufacturing sites. The environmental management system was at the time inherited from Autoliv. An additional initiative by Veoneer Sweden, was to certify all office sites. In general, at the core of the company's values were high quality products. The company could be characterised as accommodative with a clear public commitment of responsibility towards sustainable and ecological matters (Clarkson, 1995). The ambition level was indicated by the implementation of the environmental management standard both in manufacturing and at the office sites. Internally the sustainability work was motivated and argued to be a matter of legislative compliance and important in the company's high-quality products. As result, the environmental coordinator was located at the quality department.

4.1.3 Micro-level impressions in Veoneer Sweden

The micro-level data was mainly collected in informal walk and talks and officially arranged interviews in the first half of 2020 that became an inventory of perspectives,

opinions and needs in the environmental work. A common sustainability concern were forward-looking guidelines for the environmental work. However, employees with fewer external contacts appeared to have fewer sustainability concerns than employees working in departments with external contacts or departments connected to manufacturing. In general, most of the employees had ideas about how their respective work environments could develop more sustainable processes, at the time of the interviews.

At some departments, the environmental work was subtle. The records provided by the indirect purchasing department had relevance for Veoneer's sustainability work since the director for the Swedish indirect purchasing aims for addressing global challenges Veoneer can target on a global level. Otherwise, the department is not involved in developing sustainable operations concerning the supply chain, since the employees fulfil executive functions are not being connected to the holistic impact of the company's logistic work. The same relevance to sustainability was found in the finance and accounting department. The internal accounting system for the records on investments etc. is based on receipts. The potential utilisation of their system as an interface for emission quantification efforts was not mentioned as part of the responsibility.

The logistics department showed interest in pushing for more sustainable solutions. There were already try-outs for more sustainable transportation options. Especially the cooperation for collecting transportation data was appreciated. The sales department received increasing questions and demands of eco-footprints of suppliers by customers. Through the extensive contact between the thesis project environment and the quality department, it was expressed both as concerns about the sustainability work and as a demand for work guidelines.

The perception was that the work needed specific goal-setting guidelines in which employees can develop, implement and improve sustainable ideas. A similar opinion could be recorded from the application department. Some employees felt concerned about the company's role as part of the automotive industry which is perceived as a major polluting one. There were also concerns from employees addressing the difficult challenges to identify incentives to green Veoneer's operation and how the company can push for a transition on the industry level. A group of passionate employees tried to shape and lead opinion on action for more environmentally friendly site solutions such as solar panels on rooftops or charging spots for vehicles.

Employees who worked closely with the product performance mentioned that they have already followed an approach of designing more energy-efficient products. Although the environment was not stated as the main reason, some employees felt compelled to contribute to a greener development. Some counts for the facilities which were mapped to become more efficient. Most of the employees had ideas how their respective department could contribute to more sustainability in Veoneer Sweden, but the missing precision in guidelines on implementation was mentioned as the biggest reason to why the sustainability work is addressed differently throughout the departments.

4.2 Stakeholder analysis

Stakes from different parties related to the existing environmental work, its functioning and drivers are presented in this section.

Stakeholder expectations and the resulting pressures were assessed with different perspectives and how respective expectations are perceived through the interview partners. An overview of the most relevant stakeholder groups and their general key interests are presented in table 4.1. The identified stakeholders match the ones the global organisation presented in their 2020 sustainability report (Veoneer, 2020b). However, the interests and expectations were assessed from the Swedish organisation's perspective. As the Swedish organisation is the focus of this report, the global Veoneer organisation assumes the role of a stakeholder.

4.2.1 Primary stakeholders

Three primary stakeholders, employees, customers and the global organisation, were identified as having direct impacts on Veoneer's Swedish organisation. The primary characteristic could be verified through interviews and talks with the employees.

The *employees* can be defined as definitive stakeholders with stakes in the company were job security, stability and job satisfaction. The interviewees' stakes in the environmental work were interests in the company culture that encourages sustainability which underlines their characteristic as primary stakeholder regarding that topic. The employees had high legitimacy through professional skills and could have environmental demands on the company. Further, the employees had high power through the control over the organisations day-to-day activities and product development. All interviewees expressed high urgency through the need of the company acting more sustainable (İrge Şener et al., 2016). The employees expected specific goal-setting guidelines and, strategies about Veoneer's role in greening the automotive sector with a role-model approach, aiming for a leadership position when it comes to sustainability work.

The *customers* who are in business-to-consumer relationships are exposed to consumer demands of reduced product carbon footprints and reduced supply chain emissions. This creates increased pressures on suppliers like Veoneer (Daimler, 2018)(Honda, 2020)(VCC, 2019) which makes customers definitive stakeholders. Customers have power as they are Veoneer's source of income. As a supplier, Veoneer depends on customers especially if they are bigger and more influential companies. Customers have legitimacy through knowledge in the industry's environmental impacts. The customers have urgency through increasing demands from consumers of reduced supply chain carbon footprints (Daimler, 2018)(İrge Şener et al., 2016). The customer power was acknowledged in the interviews and talks with people in management positions of Veoneer Sweden. The implementation of the ISO14001 standard originated from such customer expectations leading to certified manufacturing plants and all office sites in Veoneer. Other customer demands were lowering electricity consumption and weight reductions in the vehicle market in 2020.

Table 4.1: Identified stakeholder, their aggregated key interests and identified environmental expectations on Veoneer

Stakeholder	Key interests	Expectations
Primary stakeholders		
Employees	Career opportunities Career development Financial security Job security Socially ethical organisation Environmentally responsible	- Sustainability guidelines - Strategies how to impact the whole industry being greener - Active role in sustainable development - Industry leadership regarding environmental work
Customers	Qualitatively excellent products Technical know-how Business ethics Legal compliance	- Energy efficient products - Environmentally friendly innovations - Emission reporting - ISO14001 certification
Global organisation	Attractiveness for investors Legal compliance High quality organisation High ethical standards	- Compliance to environmental policy - Work to increase ESG-rating - Adoption of global mission
Secondary stakeholders		
Society, Environment, Media	Socially ethical organisation Environmental responsibility Legal compliance Local involvement Long-term commitment Environmental sustainability	- Contribution to the Paris agreement - Proactive role in environmental work - Zero emissions - Sustainable resource use
Business partners	Business ethics Legal compliance Long-term commitment	
Government	Legal compliance	- Energy mapping - No use of conflict minerals - Carbon neutral by 2050 - Paris agreement

The *Global Organisation's* stake in Veoneer's environmental work came from expectations on the sustainability work such as legal environmental compliance and working culture which should be addressed with the code of conduct and the company's policies on environment and critical raw material. Important aspects in the ambition to become attractive to investors. This made the global organisation a definitive stakeholder with power and complete authority over the Swedish organisation. The Global organisation's legitimacy comes from its position as owner of the country division. The company's mindset about sustainability was shaped through the global organisation's initiative to develop sustainability reports in 2020. Ur-

gency characterises this activity (İrge Şener et al., 2016). In addition, the global organisation expects high quality products and manufacturing standards.

4.2.2 Secondary stakeholders

The secondary stakeholders were primarily identified for Veoneer’s Swedish organisation. The main secondary stakeholders were Society, business partners and governments. Veoneer Sweden acts in a national arena and contributes only indirectly to the global organisation’s attractiveness on the international stock exchange trades. However the interest from investors were channelled from the global organisation to Veoneer Sweden. This made investors a secondary stakeholder to Veoneer Sweden.

Society, environment and media were partly responsible to shape the employees’ understanding, awareness and the importance of environmental actions. The employees were also shaped by Veoneer’s promotion of environmental action. An important media outlet was the Swedish business newspaper “Dagens Industri” focusing on the business landscape in general and in particular on Swedish companies’ sustainability performance (DI, 2020). An important news cycle were the global climate protests and regulators’ ambitious emission reduction targets which led to increased investments in greener pension funds (Eric Parrando, 2019). The Paris agreement was negotiated by governments but its compliance is needed from society. Society as a stakeholder are defined as a dependant stakeholder since as a stakeholder group, in general, it lacks power to influence actors in the automotive industry (İrge Şener et al., 2016). On the other hand, society has the power to influence the automotive industry’s customers and the legitimacy in setting environmental targets. The urgency for action is created through social movements such as climate demonstrations and sustainability rankings in newspapers (DI, 2020).

Business partners such as freight forwarders, travel agencies or waste treatment companies were identified as stakeholders with a general interest in environmental work of Veoneer Sweden. However, no significant stakes in relation to the GHG Protocol were identified. However, important were legal compliance and business ethics in business relations and the key interests. Business partners are categorised as discretionary stakeholders as they lack both power and urgency. They can have legitimacy in putting demands on partners, such as not doing business with the unethical industries for example (İrge Şener et al., 2016).

The stakeholder *government* extended to include both the European commission and the Swedish government. The European Green Deal (Comission, 2019) and the Swedish environmental quality objectives (EEA, 2015) indicate the importance of environmental work in the coming decades. In 2020, carbon neutrality in 2050 (EU) or 2045 (Sweden) is expected to need significant contribution by the economy. A national example from Sweden, is the compulsory reporting on energy requiring activities (Swedish Energy Agency, 2018). On an EU level, there are regulations and guides on conflict materials for companies to follow (OECD, 2013). Governments

are defined as dominant stakeholders, as they have both power and legitimacy to put demands on Veoneer Sweden. However, they lack urgency as the regulations address on Veoneer's customers rather than Veoneer directly which may create expectations from customers (İrge Şener et al., 2016).

4.3 Environmental coordination and communication

At the time of the study, there were several environmental activities going on. Most of the environmental activities happen in the company's micro-level, i.e among the employees. An important role in the environmental work at Veoneer was the environmental coordinator, who was coordinating and communicating the environmental work. This section reports on the environmental coordinators role and continues with the environmental communication.

4.3.1 The environmental coordinator role

Several environmental activities were taking place among employees with a passion for sustainable solutions. These happened both in parallel and in coordination with the environmental coordinator. The role of the environmental coordinator became a connecting node for all sustainability work in Veoneer Sweden. In the organisation, the environmental coordinator of Veoneer Sweden was located in the Quality department. The main environmental responsibilities was the compliance with the ISO14001, maintaining the EMS and educating employees in how to adopt ISO1400 guidelines.

The role shifted between different environmental coordinators with the global Veoneer group and had different job descriptions depending on the different country divisions. For example, the environmental coordinator in the French country division was more focused on the data collection to the GHG Protocol and less on compliance and maintaining the EMS.

The Swedish environmental coordinator was a part of an extensive internal and external network (figure 4.1). The network became a widespread communication network including the highest management level in the Swedish organisational hierarchy. The relationship was two-way communication and on equal footing: The environmental coordinator position represented the environmental competence within Veoneer and indicated that environmental quality mattered. Environmental interests were widely spread throughout the organisation and at different hierarchical levels. The communication in the international network was focused on accessing information on what the automotive industry identified as future environmental activities.

4.3.2 The environmental coordinator and communication

The environmental coordinator benefited from the communication within the network in two ways. Firstly, the opportunity to inform decisions and secondly by increased oversight and listening in to decision-making by the leading department managers. In this capacity the environmental coordinator could be described as an environmental champion and the role allowed to empower and inspire employees by introducing new and more sustainable ideas. At the same time, the environmental coordinator could introduce environmental topics with clear goals in different settings and positions in the network. As the environmental coordinator was pushing for change, the environmental coordinator also defined the position of a change agent throughout an extensive network in the organisation.

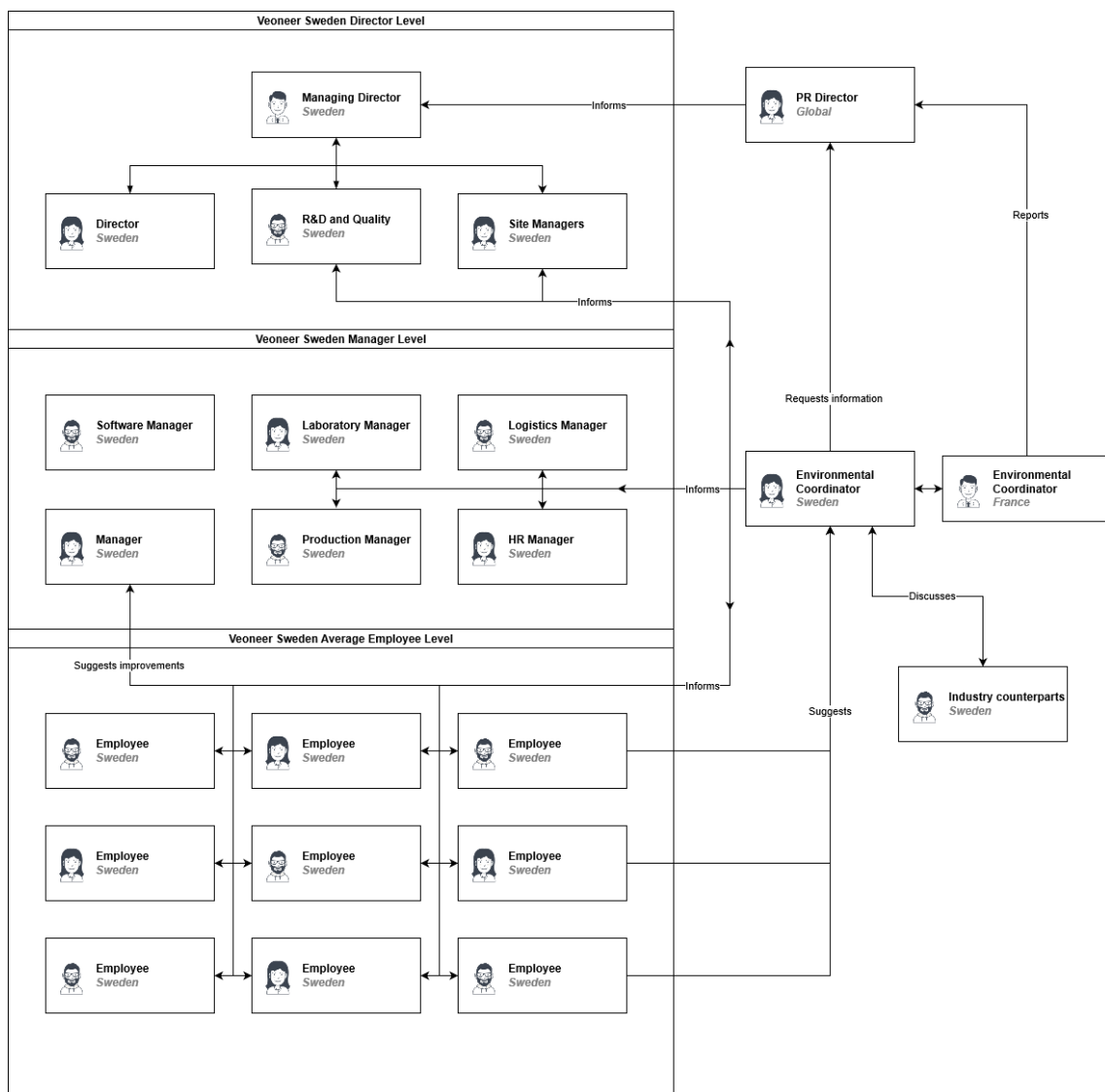


Figure 4.1: Simplified illustration of the network, which is based on the as most important recognised connections

4.3.3 The project newsletters

During the thesis project, the aim was to reach as far out as possible with news about the ongoing assessment of the GHG Protocol. The feedback was intended to support analysing the possible impact of employees trying to change and understand the sustainability strategies which are essential for a company-wide integration and thorough implementation of the GHG Protocol.

Four newsletters were distributed as an attempt to communicate the project's progress with updates, targets, recent findings and the GHG Protocol in general. All four newsletters are attached in D. Whenever new employees were approached, the most recent newsletter was attached to provide the latest news to facilitate an effective the conversation. Before sending the newsletters, the content was reviewed by the environmental coordinator for a third opinion, receive feedback on content, understandability, and confidentiality.

In *Newsletter 1*, the target group was all employees who already had contact with the thesis project. In general, the newsletters were read, and the authors received valuable feedback through the interviews, the requests of clarifications in e-mails, around the coffee table and in corridor meetings. Based on the questions the authors received, people were curious and interested to learn more about the GHG Protocol. It was also clear from the clarifying questions that employees developed new thinking.

Newsletter 2 targeted a broader audience, as more people became interested and approached the authors for more information about the GHG Protocol-related data collection. The newsletters received a number of new subscribers since the approached employees were interested in staying informed about progress. The second newsletter contained the first GHG Protocol results for scope 1 & 2. The feedback on the letter mainly consisted of follow up questions about the data collection and emission calculation methods. In the walk and talks, it was apparent that the newsletter also produced increased understanding of the GHG Protocol.

The audience to *Newsletter 3* increased slightly but not as much as from the first to the second newsletter. The letter was published at the end of the data collection. This newsletter was almost three times as long as the previous ones and aimed at communicating results for increasing the understanding of the protocol's impacts. Since the letter was published at the end of the project there was little time to receive feedback.

Addressing the same audience as with number 3, *Newsletter 4* had the purpose of presenting the outcome of each category. The fourth newsletter used the previous one as a template, to display the results understandably. In each corresponding section, the outcome of the data collection and emission quantification was presented. The newsletter was send out as official end of the thesis project after the final presentation with the management team was finished so that no feedback could be received.

4.4 Organisational identity and logics in Veoneer

The context of Veoneer's operation was explored through Veoneer's global organisational identity. With the further assessment of green institutional logics, impacts of these macro-level pressures on Veoneer Sweden allow to define the micro-level identity of the Swedish organisation. Results of different perspectives on an industry and individual level in Veoneer are addressed first, while the identity and logics are presented afterwards also based on the different stakeholder expectations.

4.4.1 Macro-level organisational identity

The global organisation's identity was mainly explored by using the sustainability report. In the 2020 sustainability report, the mission was about creating trust through a high safety function of manufactured products. According to the mission statement Veoneer identified itself with "high quality" to "ensure trust in the products' performance". That points out what the company believed in (Wickert et al., 2017) and underlined the focus on safety as an important goal. The most important value, "product quality", was identified as an important topic and was often addressed in the sustainability report.

The 2020 mission statement lacked of sustainability values that could guide employees' ability to develop and apply ideas, as it was the common practice during the time of assessment. The presentation of SDG 3.6, addressing road traffic accidents, in the sustainability report had a symbolic value of connecting to sustainability and the environmental dimension. There were more connections to sustainability, however not explicitly addressed in the strategic communication as Veoneer admitted the company's responsibility for the environment and acknowledged the need for change in the automotive industry. In the environmental field, this is believed to have happened through regulation as the sustainability strategy addressed "regulations for legal compliance". Another example was the acknowledgement of the, by early 2020, upcoming carbon neutrality goals in the EU. At this point in time, sustainability was considered an add on with no direct indication of business integration. This was indicated in the public statements by a lacking alignment between strategic statements, concrete pathways and sustainability activities.

4.4.2 Veoneer Global's green institutional logics

A part of the organisational identity are the institutional logics, the practices, norms and thinking that guides the greening of products and services. Although the environmental dimension was an add-on and lacked integration in the global company's strategic work, green logics or norms could be identified by the activities that were also mentioned in the sustainability report.

The compliance with environmental regulation was important which implies the green logic "regulation". In general, the environmental activities were focused on the company's own operations where Veoneer global was economically and legally responsible.

Veoneer seemed to orientate sustainability efforts along other companies from the industry. The indications were that Veoneer followed the trend of similar companies who published CSR reports. The sustainability report's message was the transition in the automotive industry. It was also important that Veoneer global was perceived as a responsible company regarding the environment and sustainability. These statements indicate that it was important to market a green corporate image indicating the green logic "marketing image". The decision to publish a sustainability report was also based on attracting stakeholders like customers and shareholders. The image of a green company was also indicated by the ISO 14001 EMS.

4.4.3 Micro-level actors' identity

The micro-level identity is defined by actors' knowledge, routines, and sense making of problems (Corbett et al., 2018). At the micro-level, environmental operations were more developed than it was reported publicly. The company logics reported in Veoneer's CSR report were present also at the micro-level and shaped the Swedish employees' working culture. The employees were committed to the core values of maximum safety products which shaped mainly their everyday work. The quality and safety aspects were important as indicated by the efficiency approaches in the production such as decreasing fault tolerances and aiming for maximum safety.

The perception at the micro-level was that Veoneer Sweden was taking on the role of becoming the role model in the global organisation in comparison with the other national division organisations. This high ambition among the employees was passionate and also shaped by the current societal discourses on how to align with the Paris agreement. Among the employees, there was a discussion of reducing CO₂ emission from the facilities by the company doing more symbolic actions such as installing solar panels of the facility's roof tops or charging stations for electric vehicles at the parking lots. Some employees voiced that there was lacking of a common agenda for the environmental work and raised demands for a company guidelines on environmental work.

At the micro-level, there was an emerging green logic through the discovery of cost savings of energy and material. Veoneer Sweden encouraged initiatives to develop energy and resource efficiency measures and to increase quality by implementing more environmentally friendly production. Some of these environmental activities were cost savings such as scrap reduction in production and improving energy efficiency. The measures were mostly discussed as quality improvements of the product and manufacturing. Veoneer Sweden used the experiences from the micro-level as an argument to implement recycling and waste management measures at other Swedish sites.

4.4.4 Cross-level pressures

The cross-level pressures are conflicting elements in an organisation that can prevent change and create conflicts in the organisational identity (Corbett et al., 2018). These conflicts could be normative and cultural-cognitive within the organisation. Normative pressures relate to the professional responsibility of executing work and

legitimacy of practice. The regulative relates to established rules and the organisations access to resources and the cognitive-social relates to shared understanding of society and industry reality. In relation to the environmental work, there are similarities and differences between the macro- and micro-levels (table 4.2).

The normative pressure indicates that the identity between the global organisation and the Swedish organisation were slightly different. The two levels shared the green logic “marketing image” but for different reasons. At the global level the legitimacy issue was connected to the organisation’s image and perception of taking responsibility. In the Swedish organisation employees expressed more urgency and ethical concerns for sustainability in their professional roles as well as the company’s legitimacy. From a regulative perspective, they shared the green logic of regulations. However, the Swedish employees asked for more guidance in the environmental work. The main difference between the levels was the understanding of environmental work. At the global level it was mainly considered to be done by standards such as the EMS or commit to ongoing issues. In the Swedish organisation, employees were experimenting with different environmental activities and developed the green logic cost efficiency. The change in the Swedish organisation was further emphasised by the discourse in the Swedish society in general and reporting in the media.

Table 4.2: Pressures in Veoneer

Pressure	Macro-level (Veoneer Global)	Micro-Level (Swedish organisation)
Normative	<ul style="list-style-type: none"> · Professionalism includes sustainability · Legitimacy in taking societal responsibility 	<ul style="list-style-type: none"> · Professional and moral responsibility of sustainable development · Necessary for company legitimacy
Regulative	<ul style="list-style-type: none"> · Legal environmental compliance · Environmental management systems · The Sustainable development goals 	<ul style="list-style-type: none"> · Legal environmental compliance · Environmental management system and the need of an environmental guide-book
Cultural-cognitive	<ul style="list-style-type: none"> · Understanding the importance to society and the industry transition 	<ul style="list-style-type: none"> · Understanding of cost savings through energy and material savings such as recycling and waste management · The urgency of societal climate action · Understanding of increased product quality in environmental products

4.5 Data inventory of the GHG Protocol

The data management takes place in a developed excel file which supplies with pie charts (figure 4.2). All categories which could be successfully quantified with emissions are visualised with its relative contribution in figure 4.2. In the following, all scopes’ results are presented in detail so that it also gets apparent why not every category is represented with an emission number.

4.5.1 Scope 1

Calculating emissions stemming from fossil fuel combustion required extensive mapping of company fuel use. The relative share of stationary and mobile combustion

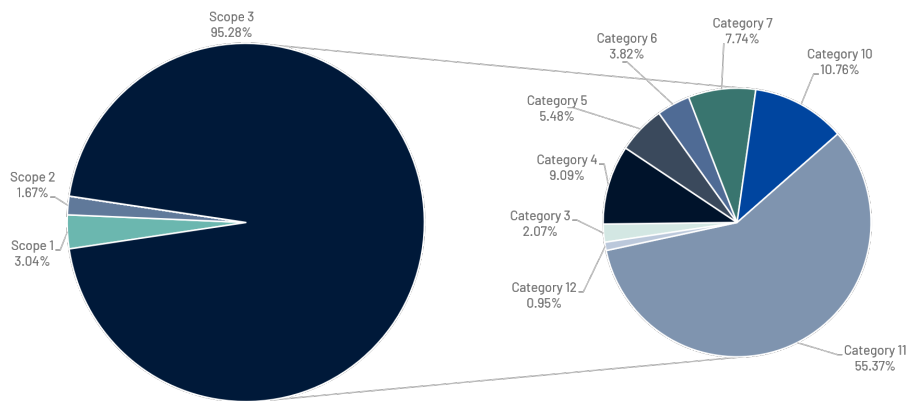


Figure 4.2: Results for all scopes and categories in scope 3 which have been applicable

to the total scope 1 emissions can be seen in figure 4.3, which shows a significant share of mobile combustion. Through interviews with the facility manager and examination of internal documents, it appeared that stationary combustion was not widespread at Veoneer. In 2019, just two generators required fossil fuel. Internal documentation about mobile combustion activities and conversations with employees responsible for vehicles led to the identification of several vehicle types and in many cases, activity data.

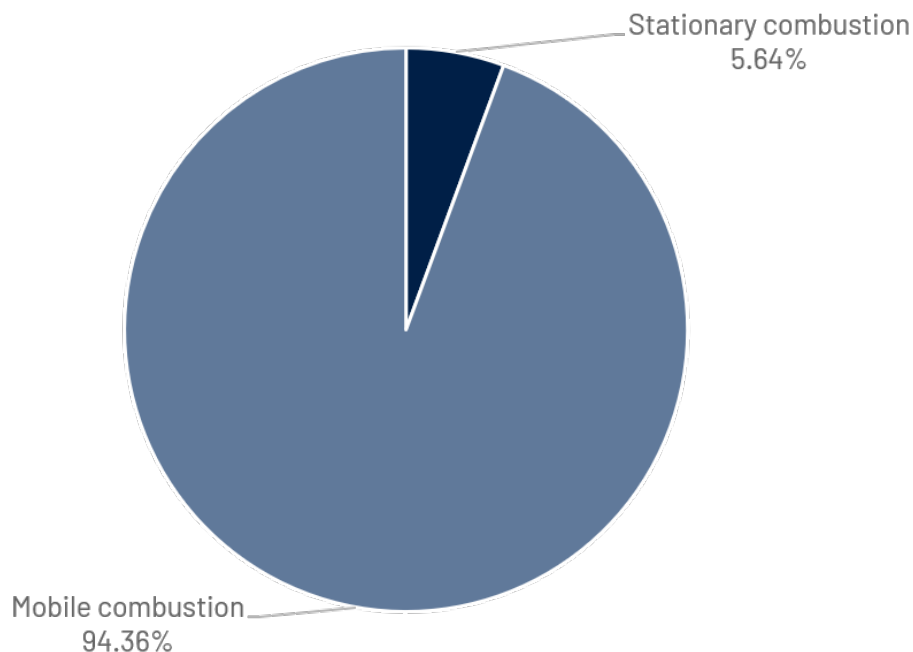


Figure 4.3: Fraction of scope 1 emissions for collected data

In the cases where registration numbers were available, average fuel consumption could be obtained through Nilsson (2020), which collects its data from the Swedish

governmental road traffic registry. For vehicles with no average emissions available, an assumption of the average of the existing vehicles with the same engine type was applied. Although all obvious persons in charge were approached, there is no final certainty that all mobile combustion units were collected.

4.5.2 Scope 2

The energy-related data covered by scope 2 was assessed through an internal system dedicated to energy and fuel-related information, building the base for the mandatory energy reporting to the Swedish government. The resulting emissions were divided into different types of energy, electricity and heating (figure 4.4).

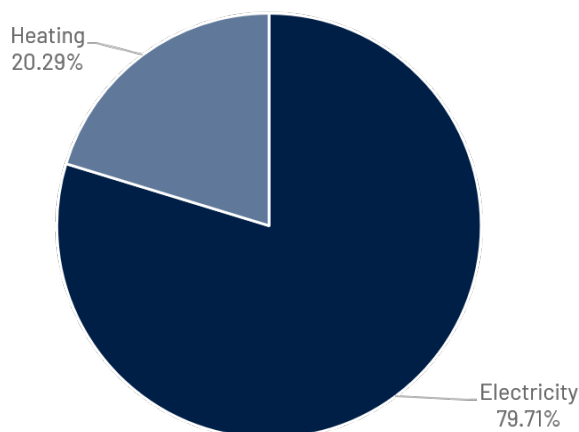


Figure 4.4: Distribution of scope 2 emissions

The electricity data for 2019 is complete, except for two months for respectively two sites. Information about the energy consumption due to heating could only be acquired for the Vårgårda manufacturing plant, as it is the only plant where Veoneer receives consumption information. Emissions were quantified through a location-based method which means that activity data for 2019 was extracted and combined with emission factors for the average Swedish energy mix. Same is also valid for heat production (EEA, 2019).

4.5.3 Scope 3

The categories with finalised emission numbers are aggregated and put in relation in figure 4.5. In the following parts, accessed data for each category is introduced. In cases in which the data quantity allowed to result in final emission numbers, pie charts visualise relative shares of respective subcategories.

Table 4.3 provides with an overview of the results for scope 3 categories and summarises concerns about completion of assessed data and calculated numbers. All shown results are not absolute but could give hints about each category's contribution to the sum of all assessed emissions. An confirming hint, that the assessed

shares are roughly in the expected range for a manufacturing company for electric components is given by the paper Alexander Farsan (2018).

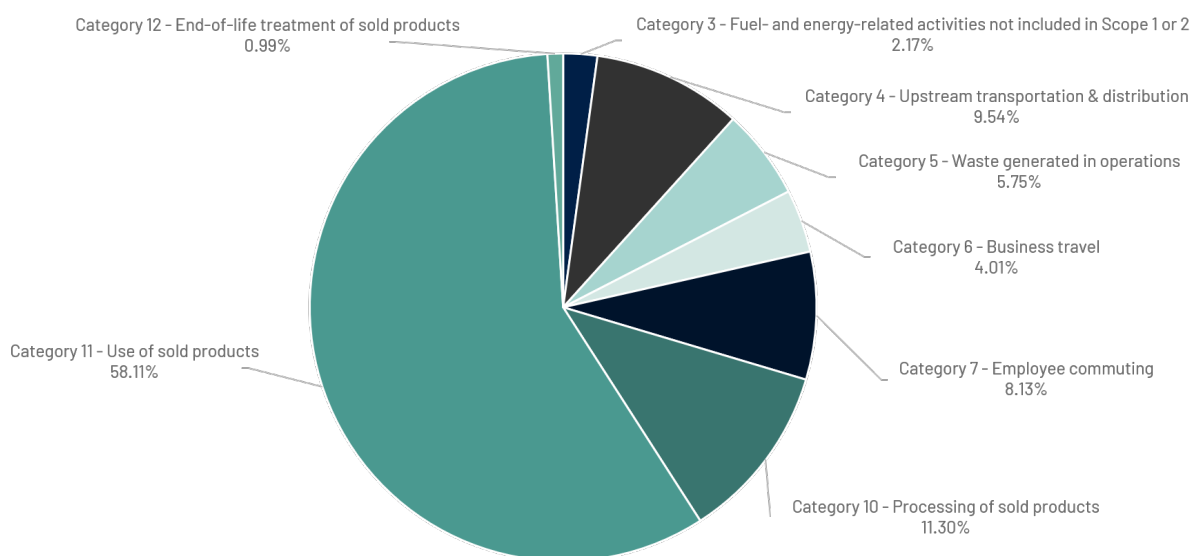


Figure 4.5: Relative distribution of emissions from categories where calculations could be finalised

Table 4.3: Scope 3 relative emissions per category

Scope 3 - Categories	Relative share of Scope 3	Comments
Purchased products & services	-	not sufficient data collected
Capital goods	-	not sufficient data collected
Fuel- and energy-related activities not included in Scope 1 or 2	2.17%	
Upstream transportation and distribution	9.54%	not complete
Waste generated in operations	5.75%	not complete
Business travel	4.01%	not complete
Employee commuting	8.13%	
Upstream leased assets	-	Scope 1 & 2
Downstream transportation and distribution	-	not sufficient data collected
Processing of sold products	11.30%	
Use of sold products	58.11%	not complete
End-of-life treatment of sold products	0.99%	
Downstream leased assets	-	not sufficient data collected
Franchises	-	not applicable
Investments	-	not applicable

Category 1 - Purchased goods and services

In Veoneer, the corporate purchasing function is divided into two departments, namely direct- and indirect purchasing. The protocol suggests distinguishing between purchased products and services and capital goods (category 2) to orient at the reporting company's organisation. Veoneer's direct purchasing department is identified for covering all purchases in this category. Despite continuous approaches through several channels, the urgency and importance of contributing with the following data couldn't be transported convincingly enough to the affected department.

- List of purchased product categories
- Quantities of purchased products and services
- Mass of purchased products and services

Since the data gathering process has not gone further than the initial reaching out phase and it could not have been assessed if available data allows more thorough calculations, the planned calculation method is targeting the use of average data. Furthermore, it was intended to apply average emission factors for product categories which were expected to receive from the direct purchasing department.

Category 2 - Capital goods

As stated in the previous category, capital goods in Veoneer are all products and services covered by the indirect purchasing department which also supplied with the relevant data. The included categories about travel (category 6) and energy use in the facilities (scope 2) are not considered. The following information could be collected.

- Category master for all products and services in the responsibility of indirect purchasing
- Categories from finance for all capital goods
- Spend based information for each finance category

Considering the large quantity and diversity of all products and services characterised as capital goods, the calculation method follows the approach of initial estimations on each category. Due to the availability of spend-based information, the most obvious procedure targets spend based emission factors. All emission factors can be found in the appendix (section A.3.2). The factors could be retrieved from GHG Protocol guidelines created by the UK government's Department of Energy & Climate Change. With using the currency exchange rate from the 13th of May 2020 (1£=12.08SEK), the emission factors have been converted to Swedish krona. Listed emission factors cover 94.18% of all sub-categories.

Since the received information about expenditures are categorised differently in the finance department than it is done in the category master of the purchase department, the last step of linking the emission factors to the allocated sub-categories could not be succeeded with.

Category 3 - Fuel and Energy related activities (not already included in Scope 1 and 2)

Allocated emissions (figure 4.6) were assessed by using fuel quantities collected to estimate scope 1 emissions. As category 3 represents the WTT emissions of fuel, its emission factor can be calculated through subtracting a use-phase emission factor (TTW) from a WTW emission factor.

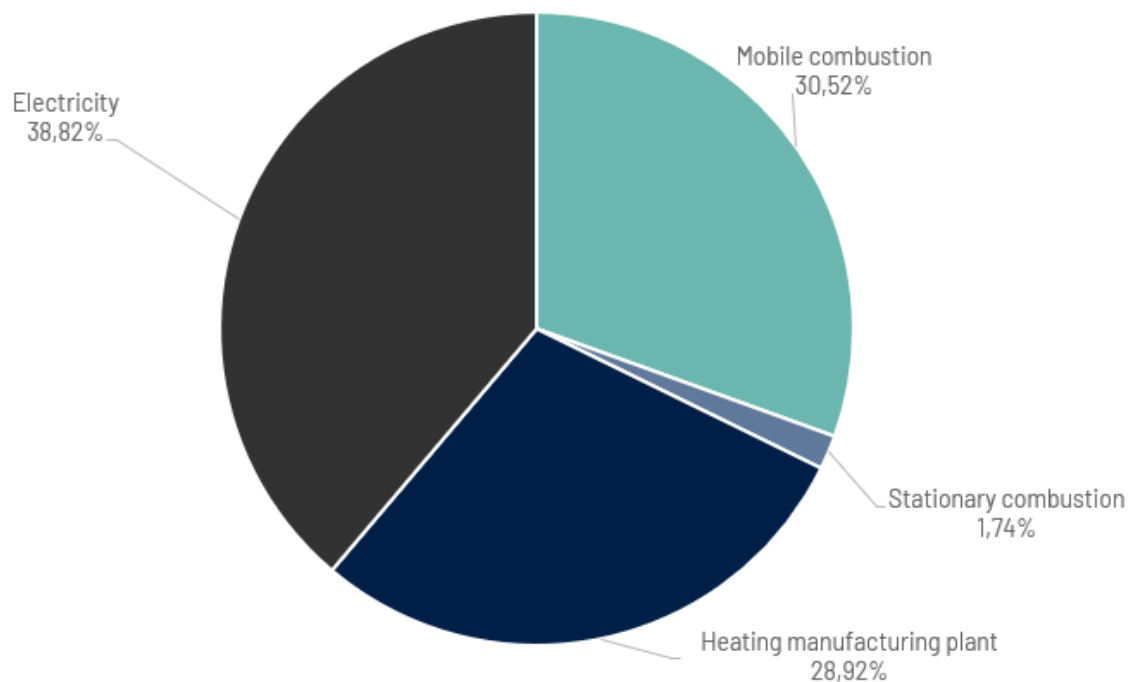


Figure 4.6: Distribution of upstream emissions for the scope 1 and 2 activities

For scope 2, emissions which can be attributed to category 3 relates to distribution losses and other upstream emissions such as the delivery of fuel to a power plant. For electricity, an emission factor was calculated through subtracting the use-phase emission factor for the Swedish energy mix with the corresponding life cycle factor (Moro and Lonza, 2018). When quantifying heat, the emission factor from the UK database DECC (2012) was assumed to reflect Swedish numbers and was extrapolated through the electricity emission factors for both countries to calculate a new heat emission factor. As the energy type was district heating, an additional 5% to reflect transportation losses were included, which is recommended by the Department of Energy & Climate Change (DECC). Although it makes up a significant share of the total category 3 emissions, it is not certain that it reflects reality due to the assumptions. Emission factors from DECC Annex 1 were applied to calculate emissions that should be attributed to category 3 (DECC, 2012). The calculation method can be declared as average-data based since available emission factors are not supplier-specific.

Category 4 - Upstream Transportation and Distribution

As stated in the theory, all transportation which is owned by the reporting company is counted as upstream transportation and as it is practice for Veoneer Sweden, the transportation of all products or components purchased for the production is in the responsibility of Veoneer. Additionally, transportation of sold products which are not finished in the contracted time frame is incurred. Since the overview of especially purchased goods (category 1) could not be made available for the project, the results are concentrating on the identified reporting procedures which could potentially lead to entire emission calculations of upstream transportation. The second followed pathway was the approach of several logistic companies.

Through the enterprise resource planning (ERP) system, it is possible to extract information about all shipments. Due to the storage in one system, the potential in establishing coherent emission calculations with the already stored information was identified but was not used for this project's approach. Outweighing the time efforts which are required for developing a data screening, extraction and life cycle calculation procedure, the approach of used forwarders was chosen. The characterisation of this assessment as initial screening underlines the comply with a supplier survey method. After all logistic companies used in 2019 have been approached to supply with emission reports, the following facts can be extracted from the responses:

- Seven out of eleven identified forwarders supplied with emission reports
- Two emission reports are only available for compensation
- Large variety in quantity and transparency of included information

For instance, the variety of reports go from one aggregated emission number with no information about what emissions are included or if it is WTW or TTW to detailed lists of shipments and related information about distance, mass, mode of transport, warehousing and the split-up of life cycle emissions. The bare minimum for reporting towards the GHG Protocol consists of showing the final emission number for the whole category, so that the least common denominator gained with the aggregated emission number is sufficient enough, although the number of received reports is not covering all upstream shipments and it is necessary to assume CO₂eq for unclearly reported GHG emissions. Since the emissions could be already collected in their final state, no additional emission factors are needed. The results as visualised in figure 4.5 are only covering the emissions from the received emission reports.

Category 5 - Waste Generated in Operations

Emissions generated from the company's waste management procedures require contact with business partners as Veoneer does not treat waste by themselves. The environmental coordinator could provide with two out of five sites' waste management treatment companies. To retrieve more information regarding the other sites supplier, responsible site managers in the respective offices were contacted. It became apparent that some sites resided in buildings where other companies also rented space. In one case the landlord had collection statistics for the entire building but not per tenant. The emissions were allocated according to floor space, as this was

the only information that was accessible for both the entire building and Veoneer's share of it. Available data types are represented in table 4.4. A supplier-specific method with average emission factors was applied. Emission reports were requested from the waste management companies without success. Emission factors from the GHG Protocol for incineration activities were used (Protocol, 2017).

Table 4.4: Data available from each office's waste management responsible third party

Office	Waste Mass	Waste Type(s)	Waste emissions
Vårgårda	Yes	Yes	Avoided emissions
Linköping	Yes	Yes	No
Skellefteå	Yes	Yes	No
Stockholm	Yes	No	No
Gothenburg	No	No	No

Since emissions could be calculated only for four sites, the results in figure 4.7 could be visualised except for the Gothenburg office. Additionally, it was not identified how to distinguish between office and production waste for the Vårgårda site, so that the high relative contribution of Vårgårda waste can be traced down to it being the only production site in Sweden.

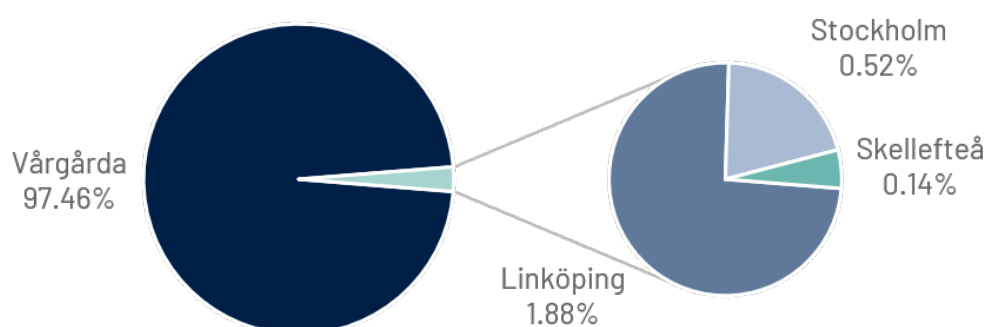


Figure 4.7: Share of total CO₂eq emissions derived from the available data and the emission factor by site

Category 6 - Business Travel

The sixth category addresses emissions generated as a result of travel due to business purposes. As part of the assessment how Veoneer is handling business travel, communications with the HR department lead to the information that business travels are either booked individually or via a travel agency. The identified travel agency is Hogg Robinson Group (HRG) and covers only flights. It cannot be excluded that some air travel is booked individually, but it is assumed that HRG covers all flights. All other travel is managed by the hand-in of receipts at the HR department which arranges appropriate refunding. Regarding the ongoing acquisition of HRG by American Express Global Business Travel (GBT) for the European Nordic area, HRG is only relevant for the time until early 2020.

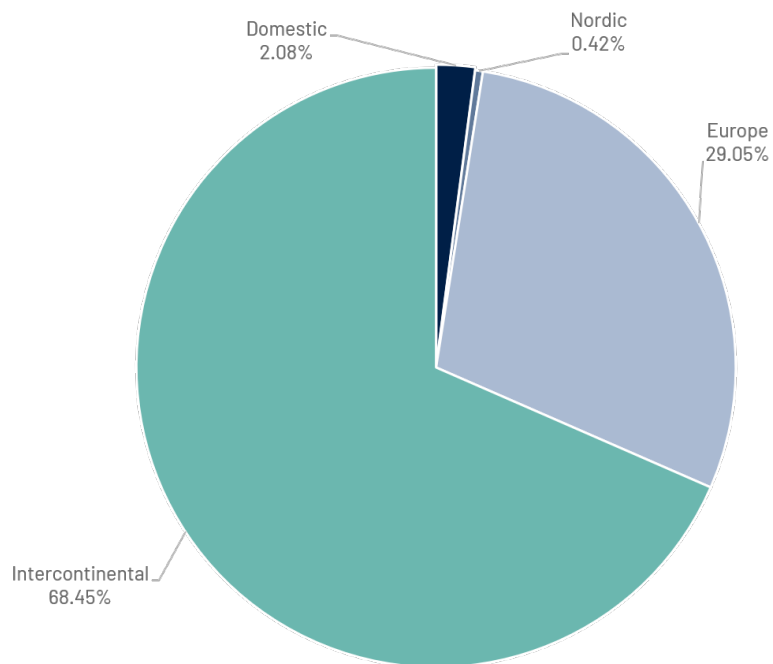


Figure 4.8: Relative share of air business travel emissions classified by destination areas for Veoneer Sweden AB in 2019

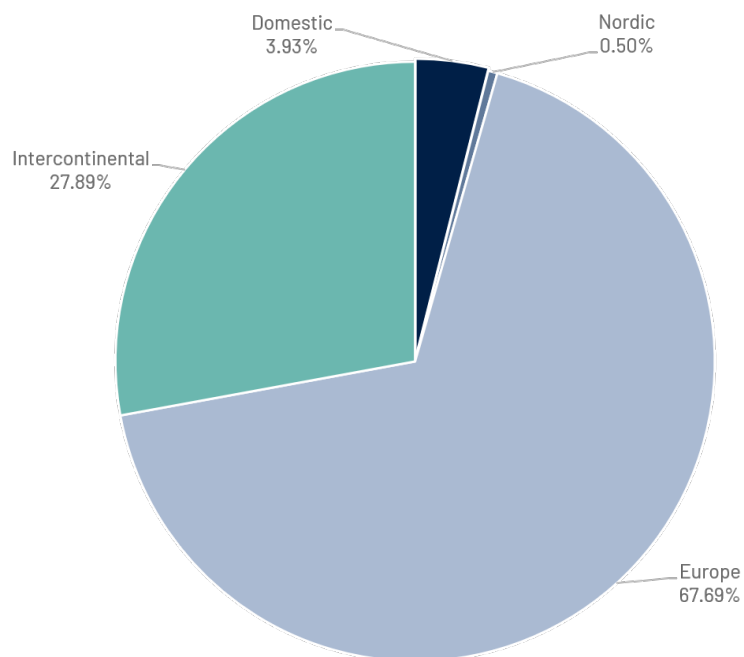


Figure 4.9: Relative share of amounts of flights due to business travelling classified by destination areas for Veoneer Sweden AB in 2019

In figure 4.8 the respective relative shares of total CO₂ emissions are visualised. It could not be clarified if the emissions are only covering CO₂ or the combining equivalent of all caused GHGs. The second figure 4.9 shows the relative quantities of conducted flights in 2019 and allows identification of a relatively higher contribution of intercontinental flights.

Since HRG already provides with emission reports, the supplier-specific method was the obvious choice. Additionally, per-flight data was requested to gain more insight into the travelling like which flights are the main driver and if it is possible to identify strategies for reducing air travel. The received data was grouped into different categories. Flights were ordered into domestic, Nordics (Denmark, Norway, Iceland, Finland, excluding Sweden), European (excluding Nordics) and intercontinental. The European flights make up a significant share of 2019 travel air travel.

Category 7 - Employee Commuting

When estimating emissions generated by employees' trips to and from work, an online survey provider was used to create a poll. The logistics department offered itself to be a test group to survey. Throughout the development of the form, continuous communication and consultation with Anna Wahlström, a logistic project manager, was conducted in each iteration of the survey.

An overwhelming majority of respondents reported that they use a car as their primary mode of transportation when commuting to the office. As can be seen in figures 4.10, most respondents used it as their only commuting mode.

Using information about average fuel consumption, commuting distance, frequency and fuel type, the emissions could be estimated through multiplying the quantity of fuel used and the emission factors provided by the GHG Protocol (Protocol, 2017). For the base year 2019, 225 working days with 25 days of paid leave are accounted. The number of employees used for extrapolation was collected in February 2020 which means that actual numbers during the year 2019 might have been different.

Only one of the respondents stated to carpooling to work, with one additional person in the car. Most respondents who did not choose car as primary mode of transport, still stated that they went with a car about one day per week, as the weather had an impact on their choice. They did not choose to carpool on those occasions.

Several respondents requested public transportation improvements such as better bus connections to the Vårgårda facility, cheaper public transport tickets or chartered buses from Fristad so that employees residing in Borås can travel to Vårgårda. Other respondents suggested that they carpool more frequently or work from home one day per week, given that the company finds it acceptable.

Since the coverage of the poll was done in a single department and location, and an average emission number per employee was simplified to use for extrapolation to the whole Swedish organisation, the relative share in figure 4.12 is just picturing the distribution of employees.

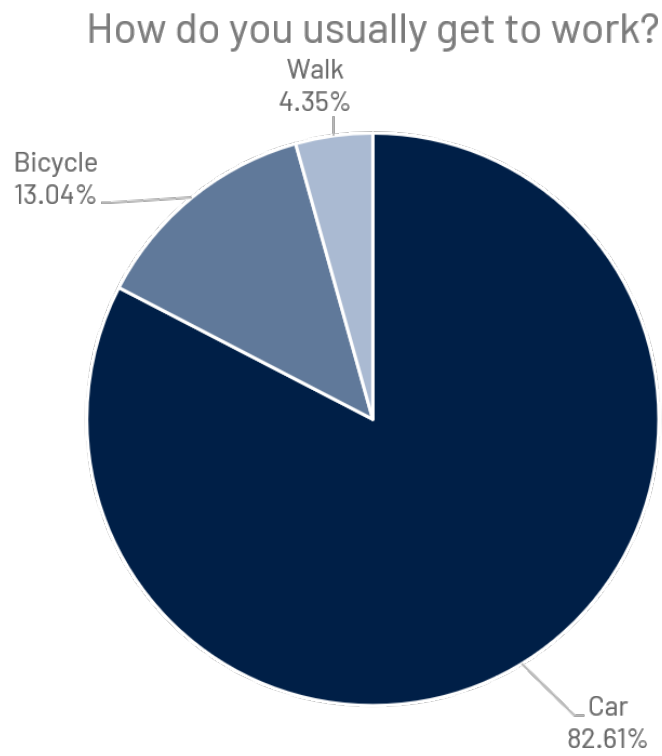


Figure 4.10: Primary choice of transportation

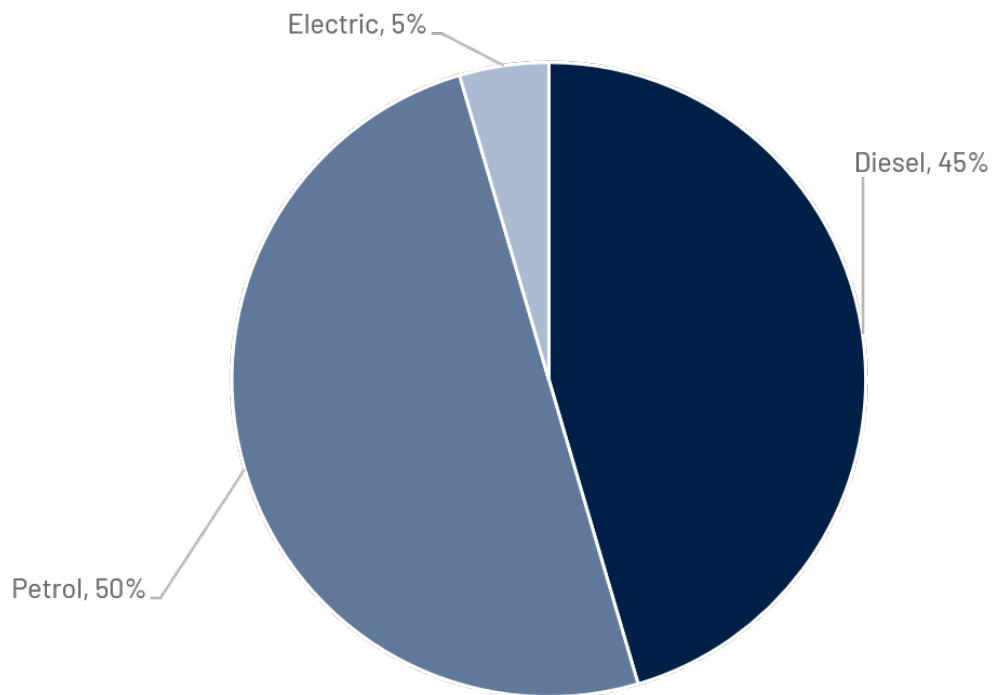


Figure 4.11: Shares of different engines used for car commuting

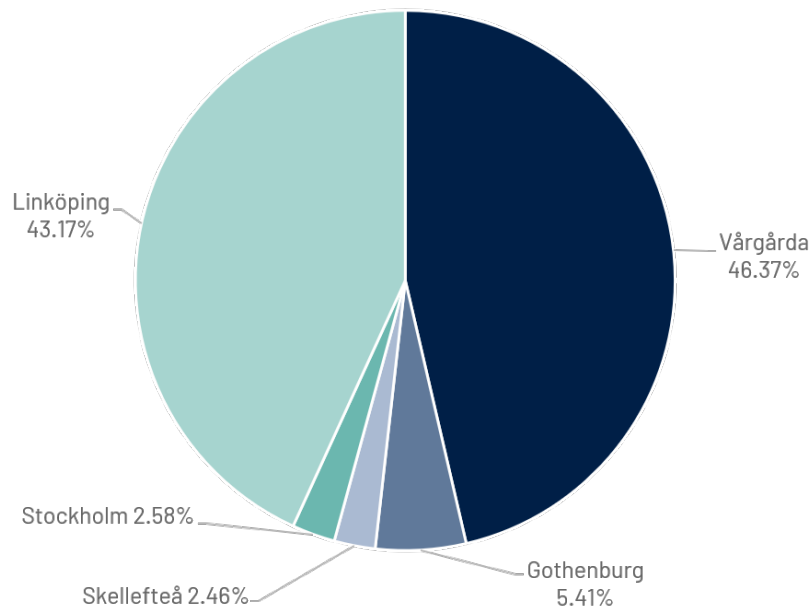


Figure 4.12: Calculated emissions from the survey extrapolated for the whole Swedish organisation in 2019

Category 8 - Upstream leased assets

The decision whether the emissions of upstream leased assets are counted in category 8 depends on the leasing agreement. The specific agreements for the not by Veoneer owned sites could not entirely be clarified so that operational control or ownership and financial control are assumed. Hence, all the emissions from leased facilities of Veoneer Sweden are already counted in scope 1 & 2. Other assets leased by Veoneer couldn't be identified which is confirmed by the finance department.

Category 9 - Downstream Transportation and Distribution

As already spotted in category 4, upstream transportation, all shipments' information is stored in the internal ERP system. It is not part of the assessment of this project to develop a procedure on how to use the stored information in a way to receive emission numbers. But the kind of available data was assessed as well as potential calculation pathways were identified.

- Shipment number, customer, shipment address, quantity of shipped products, mass
- EcoTransIT as calculation tool (ifeu Heidelberg, 2018)

Through recommendations of the GHG Protocol itself and shared information behind one forwarder's calculations, EcoTransIT is identified as an initial emission calculating tool (ifeu Heidelberg, 2018). Due to missing information about for instance, the used mode of transport and load factors, the pathway of using EcoTransIT for emission calculations is not successful in contributing to emission number calculations.

Category 10 - Processing of sold products

As Veoneer is a supplier of products that are used in automobiles, there are added emissions between the time that their product is delivered to their customer and it is used by the end consumer. Veoneer employees were asked what equipment is required to mount the products in a car (table 4.5).

- Overview of total sales in 2019 including absolute numbers in amount of pieces per product category
- Product performance data for one out of four product groups
- Identification of assembly steps at the customer sites

Table 4.5: Used average data for category 10

Data	Value	Source
BEV production-phase emissions	0.0598 kg CO ₂ eq/km	Pero et al. (2018)
Assumed market share BEV	0.1%	ACEA (2020a)
ICEV production-phase emissions	0.0331 kg CO ₂ eq/km	Pero et al. (2018)
Assumed market share ICEV	99.9%	ACEA (2020a)
Average mass for vehicles (EU28)	1892 kg	icct (2019)
Average life-time of vehicles	11.2 years	ACEA (2020b)
Average travelled distance per year (Sweden)	12240 km	ACEA (2020a)

The available data is limited in its level of detail about the specific procedures, which are internal knowledge of the customers, and in its completeness regarding the product performance information. It was decided to estimate the GHG emissions only for screening reasons to achieve more knowledge about the approximate contribution of the processing of sold products category to the total scope 3 emissions. Hence, the average data method is used to continue with the emission calculating process.

Considering the low amount of information about the specific product, a literature study about already conducted life cycle assessments for vehicles was undertaken. An average EU car for BEV and ICEV was selected as representing the average car which is equipped with Veoneer's products out of simplification reasons and contributing to the estimating approach.

The average EU28 mass of vehicles is used as an assumption to describe the average car which is equipped with Veoneer's products although the customers are situated worldwide and the average EU28 average vehicle mass might not necessarily be the average mass of Veoneer customer cars (table 4.5). A similar assumption is an average distance a car is used per year. An assumption which is more decoupled from the real market situation consists of the general simplification of the car market into only two different kinds of vehicles sharing the market. 0.1% of the cars used in the EU are electric vehicles (ACEA, 2020a) so that the assumption of 99.9% ICEVs is probably leading to a worse case than a scenario closer to reality would allow.

$$\frac{0.0598 \frac{kgCO_2eq}{km} * 11.2yr * 12,240 \frac{km}{yr}}{1894kgBEV} = 4.328 \frac{kgCO_2eq}{kgBEV} \quad (4.1)$$

$$\frac{0.0331 \frac{kgCO_2eq}{km} * 11.2yr * 12,240 \frac{km}{yr}}{1894kgICEV} = 2.398 \frac{kgCO_2eq}{kgICEV} \quad (4.2)$$

Category 11 - Use of Sold Products

To estimate the emissions stemming from the use-phase of the products, product data needed to be accessed. From informative talks with employees of the prototype testing facility and research and development department, electricity consumption of the products in use and their weight contribution to the total mass of the vehicle could be accessed. Since the overview of the quantity of sold products is also relevant for calculating emissions in the use phase, the sales information which has been approached during category 10 are also used in this category's calculations. Available and collected data:

- Identified impacts: electricity consumption, weight
- Overview of total sales in 2019 including absolute numbers in amount of pieces per product category
- Product performance data for one out of four product groups

Based on the broad level of information about the actual processes in the vehicles during use and as result of the missing linkage between the products and the specific car they are applied in, the usage of average data was chosen as a way to calculate emissions. Considering the necessary assumptions and simplifications to get a final number, the approach and evaluation of this category's emission numbers can be characterised similarly to the previous category as just initial screenings to set the outcome in relation with the whole scope's emissions.

The used emission data overlaps with the ones presented in Table 4.5 with the exceptions of life cycle emissions for the use instead of the production phase and the added relative share of the net usage of cars during their lifetime. Since the relation between electricity consumption and emissions in a vehicle during its use could not be identified, the following calculations consider only the impact of weight.

Table 4.6: Identified average data which is used to proceed with emission calculation for the use-phase

Data	Value	Source
BEV use-phase emissions	0.0693 kg CO ₂ eq/km	Pero et al. (2018)
Market share BEV (EU)	0.1%	ACEA (2020a)
ICEV use-phase emissions	0.1707 kg CO ₂ eq/km	Pero et al. (2018)
Assumed market share ICEV	99.9%	ACEA (2020a)
Average mass for vehicles (EU28)	1892 kg	icct (2019)
Average life-time of vehicles	11.2 years	ACEA (2020b)
Average travelled distance per year (Sweden)	12240 km	ACEA (2020a)
Relative share of cars in use during their lifetime	3%	RAC (2012)

To include the electricity consumption of Veoneer’s products during the use phase, further assessments with especial focus on the emission factor for electricity consumed in vehicles need to be conducted. Emissions per kg of car weight for BEV and ICEV:

$$\frac{0.0694 \frac{kgCO_2eq}{km} * 11.2yr * 12,240 \frac{km}{yr}}{1894kgBEV} = 5.018 \frac{kgCO_2eq}{kgBEV} \quad (4.3)$$

$$\frac{0.1707 \frac{kgCO_2eq}{km} * 11.2yr * 12,240 \frac{km}{yr}}{1894kgICEV} = 12.353 \frac{kgCO_2eq}{kgICEV} \quad (4.4)$$

The final step of receiving final emission numbers consists of the multiplication of the products’ weight and the numbers sold according to the market shares of BEV and ICEV with the shown CO₂eq per weight of both vehicle kinds respectively.

Category 12 - End-of-life treatment of sold products

Because of a low level of available knowledge about EOL treatment for the products, this category was treated with a lower priority throughout the project compared to other categories. Circularity as a way to keep products away from final disposing solutions is detected as an opportunity but not implemented or applied at any point. Since there are no identified measurements or reporting procedures about EOL treatments available, the calculation method is related to the use of EEIO factors. It was targeted to relate the total mass of the sold products for 2019 to the average EOL emissions of vehicles per mass for being able to conduct a mass allocation. The same sales overview as in the previous two categories is used as a basis for the calculation of the total mass of sold products.

Table 4.7: Collected life cycle data for EOL procedures

Data	Value	Source
BEV EOL emissions (EU)	500 kg CO ₂ eq/vehicle	Concawe (2018)
Market share BEV (EU)	0.1%	ACEA (2020a)
ICEV EOL emissions (EU)	400 kg CO ₂ eq/vehicle	Concawe (2018)
Assumed market share ICEV	99.9%	ACEA (2020a)
Average mass for vehicles (EU28)	1892 kg	icct (2019)

The used emission factors are simplified while assuming EU EOL emission data as globally applicable. Similar assumptions are done with the market share of BEV and for the ICEV share like it is already described in category 11 & 12. The first calculation step targets the CO₂eq allocated per kg of the vehicles and is shown in the following:

$$\frac{500 \frac{kgCO_2eq}{BEV}}{1894kgBEV} = 0.264 \frac{kgCO_2eq}{kgBEV} \quad (4.5)$$

$$\frac{400 \frac{kgCO_2eq}{ICEV}}{1894kgICEV} = 0.211 \frac{kgCO_2eq}{kgICEV} \quad (4.6)$$

To receive the total contribution of the EOL emissions of all sold products, the total mass of sold products for each vehicle category according to their respective market share was multiplied.

Category 13 - Downstream leased assets

Emissions coming from the use of property which belongs to, but is not operated by, Veoneer requires contact with the lessee. Autoliv, the company of which Veoneer was formerly a part, rents office space in the Vårgårda facility which is owned by Veoneer. According to communication with the finance department, it is the only asset leased by the Swedish organisation to other companies. As is suggested by the protocol, scope 1 and 2 emissions were requested of the Autoliv Vårgårda operations as those would be the corresponding downstream leased assets emissions for Veoneer. Autoliv's environmental coordinator could not supply the project with requested information until the data collection for the report was finished.

Category 14 - Franchises

Veoneer Sweden does not own any franchises which could be verified through the interviews with the finance department.

Category 15 - Investments

Similar to the previous category, the finance department could confirm that Veoneer Sweden owns no investments.

5 Analysis

The analysis structure is oriented along the three research questions and hence, split into three part. The first part addresses Veoneer's identity finding reasons why environmental sustainability was not an integrated part of the organisation and what improvements might be applicable through existing structures.

The second part looks closer on the connection of Veoneer's position in a change process and how the GHG Protocol could be used to take further steps.

The third part explains how Veoneer Sweden and its business environment would benefit on a macro-level from a GHG Protocol implementation and what effects it may have.

5.1 Environmental understanding with the GHG Protocol

The first analysis section looks deeper on why the environmental dimension is not entirely integrated in Veoneer Sweden's business strategy at the time of the thesis project. The reasoning and evidence which is used to build this case is described next.

The existing environmental activities of Veoneer Sweden like the ISO 14001 or the CSR report comes from external expectations. Even energy-saving efforts in production are based on a general quality and efficiency approach which is due to a normative pressure of delivering high safety products. Additionally, the awareness of Veoneer Sweden's environmental impact is limited in the supply chain and the production. The assessed missing environmental strategy does not align with the public statements acknowledging the need for change and awareness of the climate crisis. Furthermore, employees show engagement but lack clear guidelines to channel ideas related to environmental solutions. How can Veoneer increase the environmental understanding? Measuring the environmental performance could be one activity in line with the acknowledgement of the climate crisis like it is stated in public communication. The GHG Protocol as an environmental accounting tool enables emission quantification of the impact of the entire company's operation and hence, addresses the lack of information. Decision-making in favor of better environmental performance benefits from an accounting standard like the GHG Protocol. The reasons for why the environmental dimension is not included in Veoneer Sweden's identity leads to possible solutions with a GHG Protocol implementation which is described in the following sections.

In the first part, Veoneer's ambition level, based on identified existing environmental work, is defined using Clarkson (1995)'s RDAP scale relation of green logics and respective ambitious behaviour.

The second part (5.1.2) deals with the three different cross level pressures which describing elements according to Corbett et al. (2018) help evaluating the respective pressure in relation to its impact on the corporate identity. The outcome of each pressure analysis leads towards a clear statement regarding what should be addressed and changed strategically in Veoneer Sweden. The target is to find a way envisioning a sustainability role model and hence, sustainability as integrated dimension in the identity.

In the third part (5.1.3) the institutional green logics are used to express the discourse between the two values environment and quality.

The fourth part (5.1.4) incorporates the role of Veoneer Sweden and its actors as mediators with the global organisation and the potential impact on a green transition in the company.

In all parts, the GHG Protocol takes a major role when it comes to improvements and pathways towards more CS.

5.1.1 Veoneer's environmental ambition

The ambition level is defined by the green institutional logics which are be supported by the impressions from actors in Veoneer's corporate environment and with how environmental activities are approached. The ambition level of Veoneer Sweden concerning environmental work can be defined as accommodative. As a reaction of the global mission, no sustainability is included in the Swedish mission statement. Additionally, the green logics "regulation", "cost-efficiency" and "marketing image" point towards an accommodative ambition level (Clarkson, 1995). The Swedish employees are not aligned with the Swedish mission, as they are raising more ambitious ideas in an effort to push the Swedish organisation towards a higher ambition. The compliance-driven implementation of the ISO14001 also highlighted the accommodative ambition, as it was implemented as reaction to customer expectations but is applied at more sites than they require. However, the everyday work in the Swedish high-quality manufacturing site lacked an integrated sustainability dimension and thus, prohibited higher ambition than accommodative.

5.1.2 Cross-level pressures and the corporate identity

The cross-level pressures originate in macro-level influences. Therefore, the macro-level influence on Veoneer Sweden's identity is analysed with a closer look on the cross-level pressures normative, regulative and cultural-cognitive. For each cross-level pressure, the respective descriptors are evaluated along specific characteristics for each pressure.

The cross-level pressure analysis starts with *normative* pressures, which represent aspects of professionalism, legitimacy of practice, responsibilities and duties (Corbett et al., 2018). The aspects ambition level, stakeholder influence, environmental activities and corporate identity are also used for the assessment.

Veoneer's global ambition level regarding environmental efforts was previously defined as accommodative. While the RDAP definition states defensive ambition as "admitting sustainability but fighting it" (Clarkson, 1995), Veoneer Sweden's perception is the admission of sustainability but instead of fighting it, the company lacks knowledge and understanding on how to operate accordingly. The motivation of its accommodativeness is also a result of dominant aspects like following the current trend and admitting a need for change in the industry. That can also be seen as a professional attitude in trying to not miss the current discourse. Since the company just started to locate themselves regarding environmental activities in early 2020, the responsibility for more green activities was acknowledged in the CSR report, but consequent actions or any duties could not be derived from the public 2020 statements.

Since the environmental activities which were in place in Veoneer Sweden in 2020 mainly can be based on stakeholder expectation, the aspects stakeholder influence and environmental activities, regarding the cross-level pressure normative, is analysed in a combined manner. Stakeholder had a huge influence on the implemented environmental activities in Veoneer at the time. Especially the stakeholder Veoneer global, customers and investors were sources of cross-level pressures. Veoneer Sweden was mainly reacting to demands such as the ISO14001 and the EMS. Hence, the EMS is formulated generically so that employees can't derive strategic guidelines for their every day work. The legitimacy of practice is quality which means that further-reaching sustainability efforts also need to be understood as quality impacting aspects.

The most dominant pressure, addressing professionalism and legitimacy of practice, are the values "quality" and "product safety" which shaped the company's identity. Responsibility is acknowledged but no duties were derived yet.

The descriptors for *regulative* pressures are established rules and "binding conditions that enable organisational access to resources" (Corbett et al., 2018). Veoneer's legislation, stakeholder influences and the environmental work are aspects which are looked at more closely.

Starting with legislation, environmental regulations set by the Swedish government or the EU target car manufacturers and their fleets rather than an electronic device manufacturer such as Veoneer. That means, established rules or binding conditions for a sustainable business are not too pressuring on Veoneer from legislators. Higher influence was detected from secondary stakeholders and, in particular, from business partners and society. The combination of a society that is demanding the need for action from the regulators with public strikes, a country-wide discourse in the media and regulators who have the power to set boundaries, the pressure on Veoneer is expected to increase like acknowledged by the Swedish managing director. Similar to legislators, secondary stakeholders are not very impacting on existing rules or

binding conditions but the public discourse and overall pressure on regulators was expected to increase.

Some of the environmental activities such as the ISO14001, the EMS or the environmental policy established some new rules considering waste sorting or energy saving behaviour. The efforts should be extended, so that the amount of knowledge-spreading can increase and target the resources and efforts which were observed for internal quality related topics.

Cultural-cognitive pressures are described as societal and industry expectations mirroring the company's understanding of social reality (Corbett et al., 2018). Company culture impacting stakeholders, a contrast of quality and environmental activities are the aspects which are looked closer at.

Employees who are passionate about the environment were trying to shape the company culture. Passionate people found each other and joined forces to increase their influence. Similar to social groups who demanded more sustainable operations, employees questioned Veoneer's operation and its contribution to the automotive industry. The raised concerns about Veoneer's sustainable future were similar to what was shaping the public discourse about the environment in early 2020. Employees who realised that the company needed greener processes, without knowing how to get there, match with observations from other industry representatives who are acknowledging the need for a green transition while not acting accordingly.

Quality as a core of the identity functions as an example of how well adapted a global dogma can be. All employees know exactly how to work professionally towards the highest quality targets. The communication about quality is so engaging that everyone fully understands how essential quality is for the competitiveness of the products and hence, the competitiveness of the whole company. The environmental dimension needs to be acknowledged further than just its pure existence.

The dependency on the global organisation may be a reason for why Veoneer Sweden has not been more ambitious and promoted corporate sustainability strategies. For all different pressures reaching Veoneer Sweden, the company goes on, while reacting to primary stakeholders. Especially the global company sets normative pressures and it is unclear to what extent the Swedish organisation can take independent strategic decisions on a level which can affect the company culture to a significant extent. This might be a reason why the Swedish management team continues with the decentralised approach of environmental ideas through employees.

5.1.3 Green logics addressing environmental activities

After understanding the difficult position of Veoneer Sweden as national division of a global organisation and all the different pressures shaping the company's operation and culture, the logics behind its identity and practices are analysed. The question is how to find a practical way of using the dependant situation of Veoneer Sweden and understanding the operation better so that the environmental work can be improved without changing the strategy on a large scale necessarily. A particular

lens is to identify reasons why the logics regulation, cost-efficiency and marketing-image dominate differently and how communication might improve environmental understanding. Therefore, the three logics are analysed separately while targeting an answer to how the logics could influence the company's sustainability work better.

The logic *regulation* is partly based on regulative pressures. This logic was not dominating Veoneer Sweden's sustainability culture, since the environmental regulations which were active at the time were not impacting and harming the business. An interesting fact, which shows how powerful regulations could be, is that the Veoneer's most ambitious environmental activity is the ISO14001 which is kind of a regulation. It is interesting because the standard was implemented and successfully certified, which showed that a regulation could work. Especially, it shows that Veoneer can define regulations or apply existing ones. Additionally, the company value Veoneer builds is success on, quality, is lived with a lot of regulations in manufacturing and huge amounts of controlling procedures and standards throughout the company's operation. That leads to the conclusion that regulations could be an efficient way to implement further-reaching environmental activities.

But the environmental engagement and understanding of the employees didn't compete with the understanding of the term quality. The internal discussions and presentations regarding technological topics which relate to the core of the company are segregated across projects or teams. Again, understanding would increase when there is clear and strict communication. For instance, the implemented EMS which sets guidelines for the environmental work globally is too vague and was also inherited from Autoliv, the company Veoneer was spun off from. The wording of the environmental policy in 2020 exemplified that the implementation of environmental activities were not aligned with the understanding of the need to transition the company (Veoneer, 2020b). For instance, the terminology of the environmental policy reveals differences between recommendations and obligations for which parts the words "should" and "must" are used (IEC, 2020). The policy requires suppliers to comply with laws and regulations while an EMS just "should" be implemented (Veoneer, 2020b). In contrast, words of obligation are used for other parts of the supplier policy such as "must" which appears in several sections, while "should" only appears when covering the EMS, indicating a non-mandatory recommendation (IEC, 2020).

The logic *cost-efficiency* was identified mainly as efficiency efforts in manufacturing such as problem targeting, avoidance of scrap and fault management. Additionally, material and energy savings were identified to be a core characteristic of Veoneer working along cost-efficiency. Many employees internalised material and energy saving as part of their every day work. Something similar needs to be achieved for sustainability. Once the value is fully integrated in the people's behaviours and routines, the logic is self-sustaining which means employees develop the idea further and further. This bottom-up development could be linked to the current structuring of sustainability ideas in Veoneer Sweden. There is the hope that with more time and more resources, ideas can be developed regarding how to apply more environmentally friendly solutions in every employee's respective work field. Besides

material and energy savings, which are already also environmentally beneficial efforts, this logic could be applied more ambitiously with more developed activities. Most important is the understanding of the relation between cost-efficiency efforts and environmental benefits. Therefore, a lot of background knowledge needs to be communicated.

The logic *marketing-image* is shaping how Veoneer wants to be perceived from a stakeholder's perspective since the company wants to present themselves as company who understood the need for transition. In this paragraph, the SDGs are addressed as an example of how existing procedures, behaviours and characteristics can be understood in a sustainable way.

Veoneer as a global company discovered the way of publishing sustainability related topics in a CSR report in 2020. The only published SDG shows the limit of the sustainability scope at Veoneer. More SDGs could already be mentioned without further effort.

Two of SDG 7's sub-targets apply to Veoneer. 7.2 states the increasing share of renewable energy in the energy mix and can be approached through only selecting suppliers that can meet that demand. Additionally, efforts of including renewable energy sources in contract with providers were already in progress.

Target 7.3 describes energy-efficiency improvements as a way to contribute to more sustainable energy consumption. Since Veoneer sells electronic products, energy-efficiency during use is also beneficial for meeting customer expectations. Also energy-saving ideas were already mentioned by employees in the product development department, meaning that there are already existing efforts which could be used for marketing purposes.

Goal 12 covers sustainable consumption and production with specific targets, as waste avoidance and natural resource management. 12.6 concerns sustainability reporting and its integration in the business model. Through the first CSR report published in 2020, the global company took an initial step to contribute to this SDG. Goal 13, climate action, is a relevant goal for all organisations, nations and individuals. To reduce a company's environmental footprint, the SDG guidelines suggest an emission inventory for identifying hot-spots and applying effective improvements (United Nations, 2020). As efficiency in climate improvements is one of the objectives of the GHG Protocol, goal 13 can be considered as the key SDG of a GHG Protocol implementation.

Some of the SDGs pick up efforts based on the green logics. That linkage between SDGs and green logics could be an essential step for employees adapting new focus areas and hence, channeling sustainability efforts while simultaneously, Veoneer can show way more actions than at the time in early 2020.

The published statements about the acknowledgement of the climate crisis and the need for change in the 2020 CSR report were not combined with sufficient environmental activities at the time. Therefore, measurable targets, as the SDG guidelines suggest, could be an additional solution to gain information about impacts and

increase understanding for the relation between the business operations and environmental performance. Emission reduction targets can be used to present Veoneer as the green and understanding company they were envisioning in 2020. The environmental coordinator would play a key role but would require more resources.

5.1.4 Who can change Veoneer?

After it became clearer how Veoneer Sweden is pressured, how the company is affected by it and how existing logics could be extended to reach a more sustainable culture and overall operation, this section covers the micro-level actors. Which persons and with what strategical approaches can the identified chances be addressed. Therefore, the role of the management team and the employees are compared with the identified strategies of a top-down and bottom-up process. The aim is to have a closer look on existing procedures which could be used and extended for more sustainability. In the final summarising part, the role of the environmental coordinator is analysed, in particular to find a way how Veoneer Sweden as actor can achieve a stronger position.

Starting with the *Swedish management* team, there was no active environmental strategy identified. As mentioned, the biggest pressures came from the global organisation which was shaped by customers', shareholders' and regulators' expectations. Due to increasing expectations on Veoneer's environmental performance, their efforts grow and are expected to keep growing in the future. Instead of reacting to demands and regulations, the identification of current interests and the anticipation of future environmental regulations would lead to a global environmental strategy, which the Swedish organisation and the management team could adopt. Usually, measurements support strategic decisions which also includes the environmental performance, but it stayed unclear to what extent the Swedish organisation can implement sustainability decisions on a strategic level independently from the global organisation. That means, a top-down approach was assumed to have to come from the global headquarter rather than from the Swedish management team. Considering the perspective of the *Swedish employees*, there was a bottom-up development identified which was shaped by encouraged employees. They initiated the claim that Veoneer Sweden should be a role model for sustainability work. Since this claim is raised by employees and not through official public communication by Veoneer, it can be stated that Veoneer had an intrinsic pressure for change which came in a bottom-up manner.

In the case of a continued bottom-up process, encouraged employees need to see and recognise each other's environmental work. As experienced with the newsletters, engaged employees who join forces could affect more employees to contribute with ideas. Ideas about installing solar cells on the roofs or charging stations in the parking spots were only developed further because environmentally passionate employees found each other and joined together as an interest group. Regarding the positive and encouraged feedback employees gave to the thesis newsletter, communication can be considered to be important for a positive feedback loop, encouraging

and strengthening employees in their engagement. Externally reporting with the CSR report and internally with the EMS, SDGs or through informing about different ongoing sustainability topics, like the newsletter, could create this positive feedback loop.

In summary, that means that there can be either a top-down process demanded or the bottom-up process continues. But Veoneer Sweden's position is uncertain regarding concrete demands for a global strategy while the decentralised bottom-up development hasn't shown enough impacts yet. The managing director, as representative of the management team and as legally responsible person, reacted to the global strategies while having a sense of the increasing legitimacy of sustainability. Together with employees who are characterised with having urgency, Veoneer Sweden would gain power in demanding more ambition from the global company. An important role for unifying the strengths of the management team's legitimacy and the employees' urgency could be the environmental coordinator.

The environmental coordinator owns the internal environmental communication and aims for unity of Veoneer Sweden, so that Veoneer Sweden might become a primary stakeholder for the global company regarding sustainability topics. The environmental coordinators role requires more responsibilities than just the primary work which is the compliance of the ISO14001 standard. Coordinating measurements for environmental performance like the GHG Protocol can be a positive change of the role. Being a change agent impacting a company's identity nationwide would require influence. However, that the role being located in the quality department can be considered as advantageous, since quality is the core value of Veoneer and the aim must be to spread the understanding of quality and sustainability as belonging together.

Veoneer Sweden started to change slowly and without major impacts on the big scale operations. But there is a potential that the company culture could adapt changes step by step.

5.2 GHG emission quantification to facilitate transition

This section firstly analyses and describes Veoneer's position in a corporate transition towards a more environmentally informed and aware organisation using Kotter's 8-step change management model (Kotter et al., 1995). It describes relevant steps in a transition process so that Veoneer's obstacles can be identified and which hinder a full-scale corporate transition. The GHG Protocols contribution as an enabling tool to the change model steps that would follow after Veoneer moves further to the next step in the change management process, is also analysed.

Secondly, the challenges in data gathering for the GHG Protocol are analysed, describing what actors control the collection process, what affect the results' quality and how these challenges affect the GHG Protocol value as a change-aiding tool.

5.2.1 Positioning Veoneer Sweden in the transition

The actors' reaction to the cross-level pressures are used to locate potential concepts on how to initiate a change process. In particular, a bottom-up and a top-down approach is compared with the step "create a sense of urgency" while the next changing step "Enlisting a voluntary army" is compared with existing environmental networking. In both steps, the GHG Protocol is intended to assist pathways to concrete success.

With a proper implementation and integration of the GHG Protocol, Veoneer would have the quantification tools to measure and understand its environmental impact. However, Veoneer is stuck at the first step, "create a sense of urgency", as the organisation has not established a sufficient feeling that change is required to improve business and thus, does not gain the desired driving forces.

The environmental coordinator, managers and passionate employees try to gain a top-down response but the approach has not reached the global executive team's focus yet. Thus, the sense of urgency exist on a micro-level but is not fully developed in the corporate macro-level. In the Kotter model, a voiced need for change can originate in a bottom-up manner, but the initiative for managing the change must be top-down, as employees with sufficient power and leadership is crucial for success. Micro-level actors voicing the need for macro-level action can be considered to be a cross-level conflict, as the levels sense of urgency is not aligned yet. On a macro-level, the talk about a green transition could be recognised and also acknowledged in public reports, but the aligning statements on calling out a transition internally was missing. Thus, as long as there is a misalignment between macro and micro-level urgency, Veoneer will remain in the first step of the Kotter model. Once the understanding of the urgency is fully established and enforced by the macro-level, the GHG Protocol can efficiently contribute to the next steps.

The data collection for the GHG Protocol automatically contributes to the next step, *Enlisting a volunteer army*. Since the data collection for the protocol's emission calculations required approaching several different departments in the company, the range of involvement, encouragement and information spreading becomes relatively high. To extract useful data, employees must first be informed regarding corporate environmental activities and thus creates interest in aiding the transition. Employees' interest and involvement in sustainability work was experienced during the search for data using existing internal reporting procedures. When data was requested for the GHG Protocol, employees were given a brief education about the purpose of the data acquisition which lead to an increase of awareness about the GHG Protocol in general, and the respective relation of the approached person to it in particular. Hence, the data reach-out could contribute to the changing step "enlist a volunteer army", since the increased understanding of its purpose highlights the importance of environmental work, which sparked interest for many employees. As can be extracted from the interviews, employees raised ideas about working with sustainability in their respective departments but lacked a linking strategy. The GHG Protocol data collection creates an environmental network within the company as each department is contacted and receives a clear value as a "baseline" which can

be worked on and improved in following years. Cross-functional groups and teams from different departments could accelerate the change.

GHG Protocol implementation would assist change makers when it comes to making the environmental work understandable and measurable, which otherwise is a challenge since there is no way to track performance. The *enabling action by removing barriers* step is linked to the emission accounting characteristic of the GHG Protocol. Since not being able to efficiently manage the environmental performance is an obstacle, the protocol's emission results can partly support the removal of this obstacle. The green logic of having steerable operation can be aligned, so that changes are more likely to be adapted with environmental concerns. As the GHG Protocol is affected by activities in the entire organisation, departments can measure their impact on the total environmental footprint of the company. Thus, the GHG Protocol has an impact on the corporate environmental work.

5.2.2 Data availability and its challenges

The assessment of a GHG Protocol implementation are analysed regarding identified data-related obstacles, challenges and level of quality which affect the value that emission quantification adds to the environmental work, and thus to its contribution to corporate sustainability. A detailed assessment of each GHG Protocol category findings is located in the appendix (section B).

Data availability challenges for the GHG Protocol arise from the following four sources.

- The reporting company itself
- Supply chain partners
- Business partners
- Life cycle databases

Activity data of all three scopes' processes covered or owned by Veoneer is available in the company's internal reporting procedures. Obstacles consist of varying data storage. For instance, data related to vehicle operations or rail business travel do not always contain sufficient information to enable emission calculations, as collected data rather may be in the form of amount of money spent than amount of fuel used. To overcome this obstacle, the company must increase organisational knowledge about the GHG Protocol and its related data, which will ensure that useful information is recorded in formats that can be used for emission quantification with sufficient data quality. Knowledge also enables standardisation for reporting departments, which is needed to guarantee consistency and comparability.

Data access through different external sources such as suppliers, customers or other business partners is another challenge. Collected information varies even more in quality, transparency and detail compared to Veoneer's internal data. Due to different levels of experience in emission reporting and data structure, supplied emission information was difficult to compare. How the data collection for each scope and category could be improved is specified in Appendix B. Since there is no support from an emission calculating standard, the results needed to be examined for reliability.

To overcome this challenge, the use of standardised emission quantification methods need to be used in the data-supplying organisations, such as the GHG Protocol. A potential strategy could be to require emission reporting in the GHG Protocol format in contracts with business partners. An equal understanding throughout the whole industry of what data is needed and what emission data quality is sufficient would be beneficial for the data exchange with third-party companies. It also gives Veoneer a better basis for comparing potential partners environmental performance.

5.3 The GHG protocol's impact on the industry

This section analysed the consequences that an implementation of the GHG Protocol in Veoneer may have on its operating environment. Firstly, Veoneer's position in the automotive supply chain and the up- and downstream impacts of an implementation through the ripple effects that scope 3 data collection generates and what is expected of Veoneer, is explained.

Secondly, the potential creation of more circular practices are described, as a result of attempting to reduce emissions related to material use and waste management processes, aligning financial results and environmental performance.

Finally, the GHG Protocols impact on corporate ESG-scoring is analysed and the effects that the score has on an industrial actors' attractiveness and financial performance over time, highlighting the importance of solid environmental work to stay relevant as an investment object.

Veoneer is positioned as a supplier to car manufacturers that are much bigger organisations in comparison. In turn, Veoneer has suppliers of its own, placing them as an intermediate actor in the automotive supply chain. For a full quantification of all three scopes of the GHG Protocol, Veoneer would have to collect data from both suppliers and customers.

5.3.1 Up- and downstream impacts

The implementation of the full GHG Protocol has effects outside of Veoneer's organisation on the macro-level, as emission results show that Veoneer's operation causes emissions along the whole value chain. Upstream, the use of the GHG Protocol at Veoneer causes environmental ripple effects through pressuring suppliers to quantify emissions and take environmental work seriously in an effort to deliver customer value and remain an attractive supplier. Downstream, Veoneer can showcase their environmental performance to car manufacturers which makes them comparable to competitors and in turn allows customers to be more informed about their environmental impact.

The GHG Protocol implementation can create pressure on the reporting company but it also, in turn, can be used to put pressure on *upstream* actors. Generally, if

supplying companies can provide accurate emission information about their products' cradle-to-gate footprint, the reporting company can consider emissions when selecting suppliers. Thus, the reporting company has power and influence over its sustainable development but also on its suppliers to be compatible. Such desires are voiced by Veoneer's customers where the carbon footprint reduction of products is one of the top priorities for Veoneer's second-largest customer, Daimler (by sales in 2019 (Veoneer, 2020a)), (Daimler, 2018). Reduction is impossible to target without high-quality emission information, which a proper use of the GHG Protocol provides. In turn, Veoneer will not be able to provide solid data to customers without in turn forcing their suppliers to quantify their impacts, which causes a ripple effect upstream in the value chain.

Veoneer's *downstream* value chain actors, customers, value environmental and energy performance in their materiality analyses. Veoneer's customer Honda, identifies "Responding to climate change and energy issues" (Honda, 2020) as a top sustainability priority. Furthermore, stakeholders from Volvo Car Corporation value "fuel economy and car emissions" (VCC, 2019) as their highest priority. In contrast, the core identity of Veoneer to deliver "car and traffic safety" is only the second-highest valued topic. Thus, the environmental performance of Veoneer and its products becomes increasingly more important as a sales argument. The GHG Protocol creates a solid foundation for tracking carbon reduction which enables customers to have a standardised base for comparison when selecting suppliers. In turn, when environmental performance is a basis for comparison, it puts more pressure on industrial actors to further reduce emissions. In addition, by using the GHG Protocol to quantify its environmental impact, Veoneer can highlight their impact on customer scope 3 results, as they also use the same standard to communicate their emissions.

Finally, a horizontal perspective is applied to identify pressures Veoneer Sweden sends out. Decoupled from any kind of business relation, published of emission inventories is identified as another way how the GHG Protocol implementation can cause ripple effects. As an increasing amount of companies report voluntary scope 3 inventories, competitors and other industry actors are pressured to keep up. Such pressure can be seen at Veoneer, who feel pressured and expected to report their own numbers.

5.3.2 Circular economy as a result of the GHG Protocol

Having used the GHG Protocol to form a baseline emission inventory, efficient reduction activities may begin. Given that Veoneer is characterised by the green logic "cost efficiency", circular initiatives becomes a natural next step to take a higher ambition into account (Clarkson, 1995). Firstly, it allows Veoneer to reduce emissions, material use and waste management at the same time. Secondly, it ties Veoneer closer to customers and suppliers, strengthening their position.

Emission reduction from material use and to waste management is identified and compared with potential circular approaches. Purchased material is a major expense

for manufacturing companies, which is why Veoneer strives for optimal production quality to ensure efficient material use and minimal waste generation. For the same reason, waste management is also an activity which a manufacturer targets for optimisation since it is a costly activity which does not add value to the delivered products. Material efficiency and waste management minimization also reduces organisational emissions which motivates for circular practices such as remanufacturing, reuse and material recycling. Thus, given the GHG Protocol as an additional tool to measure corporate performance aside from financial result, the company can align financial benefits with environmental impact reduction.

Collaboration in the supply chain and improved customer relationship is compared with circular approaches. Circular practices strengthen the relationship between Veoneer and other value chain actors, as collaboration is key to ensure take-back management for products and material recycling. Through closer communication between Veoneer and its business partners, it creates a better internal understanding of its operating environment and enables it to develop products together with customers. Together with the more complex supply chain required by circular activities, such practices solidifies Veoneer's position as a valuable partner, as it will be harder for a customer to change suppliers.

5.3.3 Relevance of the ESG score

ESG-scores are used by investors to identify companies with sustainable practices and to compare potential investments in terms of sustainability. High-rated companies have a comparatively better financial performance over time, which is why investors take the ESG-score into account (Morningstar, 2020),(Witold Henisz, 2019). Veoneer's green logic "marketing image" could work for environmental rankings, where communicating solid sustainability increases the ability to attract investors. Having an implemented emission inventory using the GHG Protocol increases its ability to strengthen its ESG-score as it highlights low hanging fruits and emission hot spots. That makes it more intuitive to showcase and market its impact reduction progress in a trustworthy and understandable manner.

6 Discussion

Before the conclusion sums up the results, some parts which the project perceived to be sub-optimal and optimal are discussed in this section. Additionally, results are put in relation to understand the report's outcome.

6.1 Strengths and weaknesses

The results are shaped by general industry impressions or opinions, which are mainly supported by similar perspectives. Through the complexity of the value chain, and thus, the protocol, the results did not meet publishing quality and completeness. Although data was expected to be available for several categories, the time limitation and communication barriers could not be overcome in all cases. The protocol's distinction in the three scopes is reasonable on the current level of knowledge, as most of the companies publish scope 1 and 2. Hence, these emissions can be compared. Scope 3 is considered as being too broad to enable a thorough comparison of results with other companies. Additionally, the protocol occasionally has weak rules on calculation method and data requirements.

6.1.1 Literature in the field

The literature about each introduced topic is well researched and approaches on how to merge and combine each topic are covered by research topics. When it comes to the big picture, which covers the whole operation of a company, the research methods could be identified as not always being closely focused on the application. The data of the company was considered to be the foundation of the report's assessment so that the found information about the company are addressed in this section as well.

Since the collection of internal company information depended solely on the respective responsible department, the scope and level of detail in information and data correlated with the willingness of cooperation. However, the thorough processing of operation data, the very broad approach of analysing the whole company and considering the time frame of only a couple of months for familiarisation with the company and data collection, the gained insights picture the company's state on a rough level at the first half of 2020. The essential columns of Veoneer Sweden's environmental work and a possible professional data collection could be assessed on a sufficient level. Through many fruitful talks with employees independently from

each other, the general alignment of each insight validates the picture of the company as described in this report.

Regarding this thesis' focus on Veoneer's Swedish organisation and the sourcing of publicly available information, mainly from the global company, the assessed reports and online information take only one perspective out of the many internal voices. The relationship between the Swedish and global part was only partly covered but provides the base for an interesting future analysis about, for instance, the communication, exchange of information, the way how macro-level pressures are channelled or about the in-depth alignment between global and Swedish strategies.

Although completeness was not affected by the non disclosure agreement, the number of arguments were sometimes limited. The signed agreement restricted a stronger reasoning for presented arguments in some parts of the report, especially in the analysis as well as in some result sections. Furthermore, the content of the interviews cannot be shared on a detailed level. Despite some lack of reasoning in the report, the strongest arguments were still able to be stated and the analysis was possible to conduct as planned.

6.1.2 Choice of methods

While the theory introduce the reasoning, from corporate transition to the GHG Protocol, the project communication as a key part of method and results is not sufficiently integrated. With assessing the corporate environment and the whole strategical reasoning of a company, the generic statements supporting the use of already existing information, reporting procedures and networks lead to sufficient results. Although most of the messages are sufficiently supported with literature, the specificity of data for the case Veoneer Sweden could not have been met in all aspects. To exemplify, the impact of shareholders are mainly gathered through Swedish industry media coverage. Furthermore, shareholder expectations and pressures put on Veoneer were assessed through employees who themselves based their impressions on secondary sources.

Concerning the GHG Protocol guidelines, the publishing rules for scope 3 are voluntary. For instance, there is no requirement to publish scope 3 emissions. The complexity to combine different kinds of industries makes it difficult to set standards but a similar orientation, like the approach of scope 1 & 2, would be appreciated for the future development of scope 3. Perhaps through specific categories for certain industries, locations or other more specific characteristics. The biggest reliability uncertainty of estimated or calculated GHG Protocol results was experienced from the use of average data in life cycle databases. Several assumptions cause difficulties in assessing consistency within the calculation method. As the protocol's overall adoption by industries increases, the number of related emission factors may improve which could lead to higher accuracy. LCAs are another possible assessment to target the collection and utilisation of data for resulting in emission numbers. Further assessments about how an LCA can contribute to the integration of the GHG Protocol is needed to be considered as an additional alternative.

There is no significant difference between the people who got interviewed and received newsletters since there are only a few more people who were addressed by

updates than interviewed. Thus, the impression of the newsletters' impact in comparison with the outcome of the interviews implies a lower effect by the newsletters. Follow-up talks with interviewees were significantly more constructive since the topic was already familiar.

6.1.3 Limitations and assumptions

All the delimitation and assumptions are summarised and presented in chapter 3.3. Generality of the study

This study's approach targeted generality, because of the preliminary and implementationary approach of the GHG Protocol. Hence, the general recommendations should be transferable, although the specific case of Veoneer Sweden needs to be considered. If the progress of environmental work is on a similar level, then the results can be applied, decoupled from the industry or sector as long as it is a producing company with a complex supply chain.

6.2 Contributions from the study

The strength of this study consists of the combination of change management ideas, cross-level pressures and having a close-to-practice approach with the GHG Protocol as environmental activity. The lack of merging literature for this method is the gap that the thesis fills. Additionally, the integration of communication as an encompassing drive is another new research focus concerning the implementation of environmental activities.

6.2.1 New knowledge contributions to the field

It can be concluded that the project's approach leaves remaining potential in quality from both the academic and the company perspective. Future separation is recommended in potential follow-up investigations about the GHG Protocol in Veoneer Sweden and in further research about how to develop integrative corporate structures on how to enable an efficient combination of ecology, economy and society. Veoneer reached out to assess the possibility of a GHG Protocol implementation and initiated the project. Lack of knowledge on the company's side combined with the educational gap of the GHG Protocol in the Industrial Ecology master's program resulted in the project having to fulfil separate demands. On one hand, the company desired a thorough and individualised assessment on how the protocol can be addressed, minimising additional effort. On the other hand, the academic framework needed to be formed around the task, so that a new research perspective could be developed.

The generality can be perceived as new contribution, since the GHG Protocol was used to support manufacturing companies' environmental work. The thorough assessment of the roles of macro- and micro-level actors in a global organisation could also be perceived as relevant perspective added to a change step, where the company identifies and locates themselves in a new knowledge field such as sustainability.

6.2.2 Results contradicting or supporting previous studies

Previous studies were mainly used to find and apply a pathway on how to identify different facets and logics behind corporate environmental sustainability. Therefore, it can be summarised that this report combines different studies and uses the interlinkages to make suggestions on how to increase sustainability. Additionally, the qualitative results of the GHG Protocol could be confirmed to be roughly as other studies and papers described. All studies which were used for the methods of analysing were identified as being supportive such as studies for:

- company corporate environment,
- identifying different cross-level pressures,
- assessing the ambition level,
- defining the corporate identity,
- describing green institutional logics

7 Conclusion

The integration of the GHG Protocol as an environmental activity in Veoneer Sweden was assessed and it can be concluded that the protocol implementation provides a company with a solid foundation for improving the environmental performance. Change agents, public and internal reporting are important factors for greening processes in a company, which can stress the urgency of collecting useful data to quantify all categories of the GHG Protocol. The potential utilisation of emission results can have accelerating effects on further environmental work. The three research questions are answered briefly in the next three paragraphs.

Internal and external communication should consist of hard facts supporting an initial understanding and on knowledge transfer enlighten the backgrounds and linkages to the current identity and institutional logics. Generally, it is essential to inform about the benefits of sustainability for the company.

Through the protocol's measurement characteristic, the GHG Protocol can act as a tool to aid a corporate transition towards sustainability through its quantification characteristic and the broad involvement it requires.

For most of the categories, sufficient data for initial emission estimations could be accessed which led to preliminary results roughly matching with the expectations from the industry.

An implementation of the GHG Protocol forces suppliers to consider environmental activities to stay attractive as a business partner. It also allows a purchasing organisation to compare suppliers using environmental impact as a criteria, leading to a more environmentally informed purchase.

Further conclusions are listed in the following.

The existing environmental work is driven by stakeholder expectations which result in compliance-driven and an accommodatively applied environmental ambition.

The responsive alignment process of Veoneer Sweden does not allow further ambition although some Swedish employees demand it.

Expecting future increases of restrictions and obligations, the environmental efforts of companies need to be anticipatory and adoptive. Additionally, incentives decoupled from direct stakeholder expectations could be identified while pointing on a potential top-down management directive.

Sustainability needs to be considered as an integrative part of the existing management system instead of an additive one.

The role of the environmental coordinator manages the spreading of sustainability and functions as an administrator.

Current compliance-driven efforts can be improved and pursued with more knowledge, more resources and more specificity in the existing environmental policy and EMS. But the essential outcome is the need for an identity change towards an inclusion of the environment.

Veoneer's current environmental performance shows that the consideration of sustainability in the core of the company's identity is not enough. Carbon neutrality requires a higher ambition which can be applied through the next, more ambitious steps, of the green logics and in the change management process.

The final conclusion sums up how a company can approach a greening transition with the support of the GHG Protocol. Plan, do, check and act is a well known quality management pattern and the GHG Protocol supports the check part. All steps towards a climate neutral operation cannot be done at once, but it is on Veoneer to plan and do environmental activities aligned with the climate crisis because there is more information already existing. It just needs to be identified as such.

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A Greenhouse Gas Protocol calculation guidelines

In the following, deeper explanations on applicable calculation methods are shown which can be used for a more thorough understanding of the GHG Protocol assessment in this report's method.

A.1 Scope 1

As visualised in table A.1, vehicle and fuel data can be used in combination with a fuel-specific emission factor in order to obtain the carbon emissions.

Table A.1: Scope 1 required data for quantification

Data type	Data required
Fuel type	Diesel/Gasoline/Electricity/Ethanol etc.
Distance	Kilometers driven
Vehicle information	Type of vehicle, average fuel consumption
Fuel-specific information	Emission factors

The corporate standard describes scope 1 calculation procedures in the following five steps (Greenhouse Gas Protocol, 2004b).

- Identify sources
- Select calculation approach
- Collect activity data and choose emission factors
- Apply Calculation Tools
- Roll-up Data to Corporate Level

Identify sources

Find the different sources of emissions applicable to scope 1 in the form of fuel combustion (Greenhouse Gas Protocol, 2004b).

Select calculation approach

There are three different methods of calculating scope 1 emissions. First, emissions and flow rate monitoring is directly measured. Another less common one is to measure mass balance in connection with a process. But the most widely used method is to apply fuel-specific emission factors to the emission causing fuel (Greenhouse Gas Protocol, 2004b).

Collect activity data and choose emission factors

The reporting company should collect information connected to scope 1 combustion, typically quantities of fuel and its respective type. The protocol provides freely available cross-sector emission factors for a plethora of fuels although supplier-specific factors are preferred, if available (Greenhouse Gas Protocol, 2004b).

Apply Calculation Tools

The protocols regularly updated emission factors are peer-reviewed and recommended to use if the reporting company chooses to quantify emissions through emission factors. However, it is allowed to use factors originating from other sources, provided that they are at least as accurate as the ones being directly available from the GHG Protocol.

The corporate standard describes two categories of calculation tools. One is considering cross-industry, while the second is industry specific. The latter focus on industries such as aluminium production, semiconductor manufacturing or steel production. If a company is in one of the industry specific markets, it is common to use both dedicated tools for one's industry in addition to the cross-sector tools, as some aspects of the emissions would not originate from the specific industry. An example would be to use steel manufacturing tools for the production in such a company, and cross-sector tools to account for facility cooling emissions.

Roll-up Data to Corporate Level

After a company has selected a collection strategy, calculation tools and emission factors, it has to ensure consistency across facilities. In large companies, where the inventory has several contributors, the organisation must assure that the calculations are conducted similarly. That can include the creation of standardised spreadsheets, informing employees on where and how to store data. The roll-up step revolves around integrating reporting procedures within the company.

A.2 Scope 2

Calculations for emissions related to energy consumption's under scope 2 are categorised in two different. The market-based method is applied when emission reports by energy supplier or provider are available while the other, location-based, method is applicable when consumption quantities are available (table A.2). Since the emission reports do not require any further calculation efforts, the location based method start with collection of following data.

- Energy consumption quantities
- Emission factor per functional energy unit

While the energy consumption for scope 2 related activities should be available at the company sites, the emission factors need usually be collected from external sources. Location-based method indicates emission factors described desirably as close to the actual purchased process as available. The standardised dependence in unit should match with the one from the energy consumption quantification.

Table A.2: Calculation methods suggested by the GHG Protocol (Mary Sotos (2015)&Innovation Center for U.S. Dairy (2019))

	Market based method	Location based method
Definition:	Quantification of emissions based on contracts with energy supplier	Emission quantification based on average energy generation emission factors
How method allocates emissions:	Emission factors can be derived from the GHG emission rate provided in the contract or by the supplier	Emission factors gained through average data bases describing emission rates for required location and time frame
Where method applies:	To any operations in markets providing consumer choices of differentiated energy products and supplying held in contracts	To any electricity grids
Most useful for showing:	<ul style="list-style-type: none"> - Corporate procurement actions - Opportunities to influence energy suppliers - Risk/opportunities by contractual relationships 	<ul style="list-style-type: none"> - GHG intensity of grids where operations occur - Aggregated GHG performance of energy intensive sectors - Risks/opportunities aligned with local grid resources and emissions
What the method's results omit:	Average emissions in the location where electricity use occurs	Emissions from differentiated electricity purchases or supplier offerings, or other contracts

A.3 Scope 3

A.3.1 Category 1 - Goods and Services

The protocol standard suggests four different pathways on how to approach calculations to result in emissions for the goods and services purchased by the reporting company (Greenhouse Gas Protocol, 2004b). Two methods require specific data by the supplier, while the other two calculation methods are based on external average databases and internal company knowledge about the information of purchased products.

The so-called "Supplier-specific method" (WRI & wbcSD, 2013) advises to collect emission data inventories from all regarded suppliers of goods or services. That includes the mass of the purchased products and the normalized emission factor which is delivered by the supplier (table A.3).

In case of a lack of an emission factor for the supplied good or service, the hybrid method provides a manual calculation covering all cradle-to-gate processes which are necessary for the production of the service or product. Instead of manual calculation, the average data method suggests the usage of emission factors provided by life cycle databases or industry associations (WRI & wbcSD, 2013).

A. Greenhouse Gas Protocol calculation guidelines

The spend date data method covers the case when the quantities of the purchased goods or services are difficult to get, since the alternative could be the allocation through the monetary value spend. But then, the emission factor needs to be depending on per value instead of the quantity like before.

Table A.3: Category 1 - Purchased goods & services: Data requirements for different calculation methods according to WRI & wbcSD (2013)

Required information for CO ₂ equivalent	Supplier-specific	Hybrid	Average data	Spend based data
quantity of service or product (functional unit)	x	x	x	
value of good or service				x
emission factor for good or service	x		x	x
\sum scope 1 & 2 emissions of supplier		x		
cradle-to-gate emission factor of good or service		x		
distance material inputs to supplier		x		
mass/volume of materials		x		
cradle to gate emission factor of vehicle		x		
\sum waste of supplier		x		
emission factor for waste activity		x		

In case products and services are purchased in large quantities and variations like for instance, within a globally operating company, the initiative of applying the four different methods requires guidance what to target first. The recommendations in the standard plead for a monetary value assessment to regard on what goods or services, the most money is spent on (Greenhouse Gas Protocol, 2004b). Besides the monetary aspect, the absolute quantities could also guide into a ranking about the amounts purchased for each service or good during the regarded time frame. Depending on the amount of differentiation and fuzziness, it is recommended to identify category areas to combine similar goods or services in one group. The different ranking application about prioritising different goods or services can be done after categorising.

A third option of how to identify goods or services to initiate the GHG emissions calculation with could be the study of already existing literature and experiences what kind of emissions may be expected for each category. With this kind of pre-hot-spot labelling, the areas which are expected to weight heavier regarding their environmental impact can be assessed before areas with minor potential of being an emission hot-spot.

A.3.2 Category 2 - Capital goods

Since capital goods are also goods in a sense, the GHG Protocol's suggestion of calculating the CO₂ equivalent is similar to the already presented methods for the Category 1 emissions. Supplier-specific-, hybrid-, averages data- and spend-based method function analogously to how it is introduced in table A.3. The suggestion of categorising and how to identify with what it's more useful to start with can be copied from category 1 as well (Mary Sotos, 2015).

Tables A.4 and A.5 present the average emission factors which can be applied for calculating emissions from spend-based information about capital goods.

A.3.3 Category 3 - Fuel and Energy related activities (not already included in Scope 1 and 2)

The information required for calculating emissions caused by activities as described in table 2.4 should be approached similarly to the already described methods. Either the usage of public available average industry data or life cycle data basis or approaching supplying companies for information to calculating own life cycle emissions or for emission reports already including desired life cycle data (WRI & wbcSD, 2013).

A.3.4 Category 4 - Upstream Transportation and Distribution

Required data is similar to the upstream transportation emissions discussed in category A.3.8. Hence, the calculations can be conducted the same way as it is presented in table A.6.

There are three different ways to approach emissions caused by transportation. The fuel-based method aims for an as detailed and hence, as transparent calculation as possible. Sufficient first results could be gotten without having information about fuel efficiency, cost of fuels, volume/mass transported and information about refrigerated shipments, but intending towards the highest level of accuracy, it is recommended to collect also these optional data points. Cost of fuels could be beneficial if the quantities of spend fuel are difficult to find and the total amount spend on fuels is known (WRI & wbcSD, 2013).

The distance-based calculation method can be applied instead if barely information about the shipments is available. Using data known by the reporting company and available emission factors which are needed to be normalized per unit of distance a rough estimation about the emissions caused by transportation can be prepared. Important is here to identify different and real shipped distances for each mode of transport. An applicable scenario could be a ranking approach for a first assessment of environmental performance within a company, so that a quick estimation on the transportation emissions could be used in a further rather corporate assessment process of identifying environmental hot-spots (WRI & wbcSD, 2013).

Table A.4: Applied spend based emission factors derived from HM Government Department for Environment and Affairs (2019) (1/2)

Emission factor	Value
Accounting, bookkeeping and auditing services; tax consulting services	0.010 kg CO ₂ eq/SEK
Advertising and market research services	0.017 kg CO ₂ eq/SEK
Architectural and engineering services; technical testing and analysis services	0.015 kg CO ₂ eq/SEK
Basic pharmaceutical Products and pharmaceutical preparations	0.029 kg CO ₂ eq/SEK
Computer programming, consultancy and related services	0.015 kg CO ₂ eq/SEK
Computer, electronic and optical products	0.034 kg CO ₂ eq/SEK
Construction	0.031 kg CO ₂ eq/SEK
Education services	0.014 kg CO ₂ eq/SEK
Electrical equipment	0.051 kg CO ₂ eq/SEK
Fabricated metal products, excl. machinery equipment and weapons/ammunition	0.047 kg CO ₂ eq/SEK
Financial services, except Insurance and pension funding	0.012 kg CO ₂ eq/SEK
Furniture	0.053 kg CO ₂ eq/SEK
Gas distribution	0.167 kg CO ₂ eq/SEK
Industrial gases, inorganic and fertilisers (all inorganic Chemicals)	0.060 kg CO ₂ eq/SEK
Information services	0.015 kg CO ₂ eq/SEK
Insurance, Reinsurance and pension funding services, except compulsory social security & pensions	0.015 kg CO ₂ eq/SEK
Legal services	0.008 kg CO ₂ eq/SEK
Machinery and equipment	0.046 kg CO ₂ eq/SEK
Motion Picture, video, TV & music producing, publishing & broadcasting services	0.018 kg CO ₂ eq/SEK
Motor vehicles, trailers and semi-trailers	0.051 kg CO ₂ eq/SEK
Natural water; water treatment and supply services	0.047 kg CO ₂ eq/SEK
Other basic metals and casting	0.129 kg CO ₂ eq/SEK
Other chemical products	0.130 kg CO ₂ eq/SEK
Other food products	0.079 kg CO ₂ eq/SEK
Other manufactured goods	0.037 kg CO ₂ eq/SEK
Other mining and quarrying products	0.067 kg CO ₂ eq/SEK
Other personal services	0.022 kg CO ₂ eq/SEK
Other professional, scientific and technical services	0.013 kg CO ₂ eq/SEK
Other transport equipment	0.040 kg CO ₂ eq/SEK
Paints and paper products	0.098 kg CO ₂ eq/SEK
Petrochemicals	0.057 kg CO ₂ eq/SEK
Printing and recording services	0.048 kg CO ₂ eq/SEK
Real estate services on a fee or contract basis	0.007 kg CO ₂ eq/SEK

Table A.5: Relevant spend-based emission factors derived from HM Government Department for Environment and Affairs (2019) (2/2)

Emission factor	Value
Repair services of computers; personal; household goods	0.018 kg CO ₂ eq/SEK
Rest of repair; Installation	0.034 kg CO ₂ eq/SEK
Retail trade services, except of motor vehicles and motorcycles	0.025 kg CO ₂ eq/SEK
Rubber and plastic products	0.079 kg CO ₂ eq/SEK
Scientific research and development services	0.020 kg CO ₂ eq/SEK
Services of head offices; management consulting services	0.014 kg CO ₂ eq/SEK
Services of Buildings and landscape	0.020 kg CO ₂ eq/SEK
Soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations	0.119 kg CO ₂ eq/SEK
Telecommunication services	0.026 kg CO ₂ eq/SEK
Textiles	0.080 kg CO ₂ eq/SEK
Warehousing and support services for transportation	0.023 kg CO ₂ eq/SEK
Waste Collection, treatment and disposal services; material recovery services	0.113 kg CO ₂ eq/SEK
Water transport	0.157 kg CO ₂ eq/SEK

Same reasoning can be applied for the third method, which is calculating with economic information. With sourcing internal company information about the shipped goods and products, the difference to the distance-based method consists of the usage of the emission factor normalized per economic value. Additionally, in case of putting larger time frames together, inflation data needs to be collected for being able to adjust occurred costs (WRI & wbcscd, 2013).

Category 5 - Waste Generated in Operations

It doesn't surprise anymore that for the application of emission calculating caused by waste generating through the company's operation, the effort to achieve more accuracy depends on the expected fraction of the outcome from the total sum of emissions. Picking up the two methods, supplier-specific and average-data and modifying the life-cycle data method to the in the protocol called "waste-type specific" (WRI & wbcscd, 2013), similarities to the previous methodological approaches can be seen and the required data is roughly surveyed in following table A.7. The supplier-specific data method is recommended to use if waste is already detected as significant contributor to scope 3 emissions. Otherwise, it makes sense to initiate with one of the other two methods depending on whether the waste treating company can provide the reporting company with sufficient information about waste stream differentiation (waste-type-specific) or not (average data).

While for the supplier-specific method the data stream needs to come directly and without any alternatives from the waste treatment company, the waste-type-specific method just requires information about different treatment types and according

Table A.6: Category 4 & 9: Methods how to approach emissions caused by up-stream and downstream transportation recommended from WRI & wbcSD (2013)

Required information for CO₂ equivalent	Fuel based	Distance based	Spend based
Quantities of fuel	x		
Amount spend on fuels	x		
Amount spend on shipment by mode on transport			x
Quantities of fugitive emissions	x		
Distance shipped	x	x	x
Average fuel efficiency for used mode of transport	(x)		
Cost of fuels	(x)		
Volume/mass of transported goods	(x)	x	
Information if refrigerated or not	(x)		
Fuel emission factor	x (per volume of fuel)	x (per distance)	
Electricity emission factor (if electric vehicle is used)	x (per amount of electricity used)	x (per distance)	
Fugitive emission factor (if refrigerated)	x		
Emission factor by the mode of transport			x (per economic value)
Inflation data			x

emission factors from the waste treatment company. All other emission factors are optional to be received from the treatment company or from life-cycle databases, industry associations, national inventories or through the use of IPCC (Intergovernmental Panel on Climate Change) guidelines (WRI & wbcSD, 2013).

A.3.5 Category 6 - Business Travel

For covering all emissions which can be tracked down to travel for business purposes from the reporting company, the already from the transportation category known three methods fuel-based, distance-based and spend-based can be applied for this category as well. Through screening or with detection of already reported information in the company, it can be estimated how large the share of the relative contribution

Table A.7: Category 5: Calculation methods how to get emission data for waste produced by the reporting company according to (WRI & wbcSD, 2013)

Required information for CO ₂ equivalent	Supplier-specific	Average data	Waste-type-specific
Scope 1 & 2 emissions of waste treatment company	x		
Quantities of waste produced		x	x
Type of waste			x
Waste treatment type for each type of waste		x (proportional)	x
Waste type specific emission factor			x
Waste treatment specific emission factor		x	x

to the total emissions counted in scope 3 might be. Since it is more promising to use the fuel-based method to achieve higher accuracy, although it usually takes more effort in comparison to the other two methods, the GHG Protocol’s recommendation heads only towards the fuel-based method for business travel emissions, if it has been identified as major hot-spot. The general procedure doesn’t differ much from the already introduced way of applying fuel-based and spend-based emission calculation in category 4, upstream transportation and distribution (WRI & wbcSD, 2013).

The difference in the distance-based method consists of the more general level of calculating the emissions with a factor related specifically to the mode of transport and not to fuel anymore (table A.8). It is still in relation to the travelled distance and takes the location into account since the emission factor for travel apparently differ from country to country (WRI & wbcSD, 2013).

Common data sources could be a tracking system which depends on the different modes of transport or surveys among the employees, but data acquisition via the travel agencies and their ordered operating companies pledges for the highest accuracy. Emission factors and fuel-consumption data as it is mentioned already in some other categories might be found in life cycle databases or other similar inventories as also in some calculation tools provided explicitly for the GHG Protocol.

A.3.6 Category 7 - Employee Commuting

Considering a similar appearance of GHG emissions for employee commuting as for already described transportation in category 4 and for the previously explained business travel, the recommended methods are fuel-based, distance-based. Since commuting is usually not owned by companies, the third method targets average-data. The procedure for fuel based calculations is only applicable when information about the amount of fuel bought or the value of the employees’ purchases for fuel are available and in that case the proceeding follows closely the fuel-based one in category 4 & 6 (WRI & wbcSD, 2013).

Table A.8: Category 6: Different calculation methods for resulting in the emissions caused by business related travel from the reporting company (developed from WRI & wbcSD (2013))

Required information for CO₂ equivalent	Fuel based	Distance based	Spend based
Quantities of fuel	x		
Amount spend on fuels	x		
Amount spend on travel by mode of transport			x
Distance travelled	x	x	x
Average fuel efficiency for used mode of transport	(x)		
Cost of fuels	(x)		
Fuel emission factor	x (per volume of fuel)		
Electricity emission factor (if electric vehicle is used)	x (per amount of electricity used)		
Mode of transport		x	x
Emission factor by mode of transport		x (per distance)	x (per economic value)
Countries of travel		x	
Inflation data			x

Regarding the procedure to get required data and due to its ownership by the employees, it is a strong recommendation to collect this information via surveys, which should be conducted on a regular basis according to the predefined time frames for reporting towards the GHG Protocol (WRI & wbcSD (2013) & Greenhouse Gas Protocol (2004b)). In case of incomplete coverage of all employees especially in large international corporations, extrapolation of the gained information is necessary. Using the tool of surveys could also have some cross benefits, since it can be functioning partly as education and partly as a communication strategy for increasing environmental awareness. Further advantages could be gained through employees' answers about potential changes for impacting individual commuting habits.

A.3.7 Category 8 - Upstream leased assets

Applying the known calculation methods on leased assets, the life-cycle data approach can be compared with the asset-specific method. The lessor-specific calculation is according to supplier survey guiding and the EEIO method is represented through the usage of average data as determining part of one calculation suggestion. Especially for the asset-specific method, a lot of detailed information about the as-

Table A.9: Category 7: Data which is needed for different methods to calculate emissions caused by employee commuting (following suggestion from WRI & wbcscd (2013))

Required information for CO₂ equivalent	Fuel based (like in C4 &6)	Distance based	Average data
Quantities of fuel	x		
Amount spend on fuels	x		
Number of employees			x
Number of working days per year			x (average)
Number of commuting days per week and mode of transport	x	x	
Mode of transport		x	x (average)
Commuting distances	x (total in passenger km)	x (total in passenger km)	x (average)
Average fuel efficiency for used mode of transport	(x)		
Cost of fuels	(x)		
Fuel emission factor	x (per volume of fuel)		
Electricity emission factor (if electric vehicle is used)	x (per amount of electricity used)		
Emission factor by mode of transport		x (per distance)	x (per distance)
Energy uptake in case of teleworking	(x)	(x)	

set's specification is needed and it is recommended to find such information through utility bills, records of purchases or internal IT, while the emission factors of each emitting point can be found as usual in life cycle databases, industry associations, in GHG Protocol calculation tools or from already developed data in previous categories or scopes. Lessor-specific implies data gathering about the lessor and the whole leased facility to allocate the total emissions according to the area, volume or quantities depending what data is available (WRI & wbcscd, 2013).

Table A.10: Category 8: Different methods to calculate GHG emissions for assets leased by the reporting company (WRI & wbcSD, 2013)

Required information for CO ₂ equivalent	Asset-specific	Lessor-specific	Average data
Quantities of fuel	x	x	
Quantities of electricity	x	x	
Quantities of steam	x		
Quantities of heating	x		
Quantities of cooling	x		
Emissions from industrial processes	x	x	
Fugitive emissions	x	x	
Emission factors per unit of energy usage	x	x	
Emission factors of industrial processes	x	x	
Emission factor of fugitive emissions	x	x	
Emission factor per leased asset			x
Area, volume or quantity of lessors' assets		x	
Area, volume or quantity of reporting company's leased assets		x	x

A.3.8 Category 9 - Upstream transportation & distribution

A short recap from Category 4, transportation which is not paid by the reporting company can generally be counted as downstream transportation and distribution. Since the calculation procedure is the same as for the upstream transportation and distribution as it is introduced in Category 4, the advice in this section refers straightly to the presented methods in figure A.6 (WRI & wbcSD, 2013).

A.3.9 Category 10 - Processing of sold products

Concerning the complexity of further processing of products, the demands for methods are broad and diversified as it can be spotted in table A.11. The site-specific method which comes along with a life cycle data approach targets to quantify the energy consumption of the processing facilities as well as waste-related emissions and by extension, emissions in industrial processes which are not related to any combustion or fugitive emissions. The data for the emission factors of all mentioned activities could be gotten in first hand from the processing companies in case they have already developed own factors. Otherwise, as already known, factors from industry associations, GHG Protocol related data inventories or own calculations evolved by the reporting company from collecting information through bills

or purchasing receipts could supply with applicable reliability. But because of the mentioned large variety of potential processing characteristics, the quality of calculated emissions needs to be treated even more carefully (WRI & wbcSD, 2013). The average data method includes the potential of conducting an economic allocation, but generally, earmarks each process stage to find possible categories for which already average emission factors are available.

Table A.11: Category 10: Two different methods how to calculate emissions from further processions of a product by the reporting company (WRI & wbcSD, 2013)

Required information for CO ₂ equivalent	Site-specific	Average data
Quantities of fuel	x	
Quantities of electricity	x	
Emission data related to fugitive emissions	x	
Emission data related to industrial processes	x	
Quantities of waste	x	
Emission factor for fuels	x	
Emission factor for electricity	x	
Emission factor for waste output	x	
Emission factor related to fugitive emissions	x	
Emission factors related to industrial processes	x	
Processes involved		x
Mass or economic value		x
Emission factor of each process stage (per functional unit of product)		x (average)

A.3.10 Category 11 - Use of Sold Products

As presented in table A.12, the data requirements are dependent on the type of product. For all different product types, the mentioned data is a recommendation in what direction data gathering processes can head to since even within the categorized product types, the variety of application is still extensive.

Since the break down of emission causing procedures to direct or indirect linkages to the products' use, the three by now well known methodological approaches can be utilised for this use-phase purposes as well. The control of the producing and reporting company is limited to product usage, so that the ownership of directly related data may be also limited. Therefore, the application of the EEIO method includes assumptions which are based on the performance data from the reporting company's products. The emission factors could be extracted either out of own research and testing results or from the common life cycle data bases.

Table A.12: The two different kinds of environmental impacts caused by the use of the sold products of the reporting company (WRI & wbcSD, 2013)

Type of emissions	Product type	Required data
Direct use-phase emissions (required)	Products that directly consume energy (electricity, fuel etc.)	Total expected lifetime
		Quantities of sold products
		Fuel used per use of product
		Electricity consumed per use of product
		Refrigerant leakage per use of product
		Fuel life cycle emission factor
		Electricity life cycle emission factor
		Refrigerant leakage per use of product
	Fuels and feedstocks	Total quantities of fuels/feedstocks sold
		Combustion emission factors of fuel/feedstock
	GHG or products which contain a form of GHG that are emitted during use	Total quantities of products sold
		Quantities of GHGs contained per product
		Percentage of GHGs released throughout the lifetime of the product
		GWP of GHGs
Indirect use-phase emissions (optional)	Products that consume indirectly energy (electricity, fuel etc.)	Average number of uses over lifetime of product
		Average use scenarios
		Fuel consumed in use scenarios
		Electricity consumed in use scenarios
		Refrigerant leakage in use scenarios
		GHGs emitted indirectly in use scenarios
		Fuel emission factor
		Electricity emission factor

The supplier survey approach leads to a rather user-oriented gathering of performance data, which could be also simulated by the reporting company. However, in case of simulations, the evaluation of the testing quality likely includes performance data surveys derived from user experiences, which are close to the pure idea of this method to demand specific data from the users. Similar estimations but more thoroughly can follow the life-cycle data method which suggests very specific data acquisition closest to the real case usage of the sold products (WRI & wbcSD, 2013).

A.3.11 Category 12 - End-of-life treatment of sold products

Following items are derived from WRI & wbcSD (2013) and show the requirements on data related to end-of-life treatments.

- total mass of sold products
- total mass of packaging (since the sell from consumer to end-of-life handler)
- each proportion of applied waste treatment methods
- average waste treatment specific emission factor

Data is likely to be assessed according to the EEIO method and could be gathered via own information about sale quantities and via approaching users and waste treatment companies. The level of detail could be developed towards more life-cycle data about potential disassembling and applications related to more circular waste streams (WRI & wbcSD, 2013).

A.3.12 Category 13 - Downstream leased assets

Since the criteria for down- and upstream leased assets are not any different, table A.10 is as determining for required data as it is in described category 8. Hence, the recommendations for what calculation method to chose are the same (WRI & wbcSD, 2013).

A.3.13 Category 14 - Franchises

Since the control is not by the reporting company, the franchise-specific method can be applied according to the supplier survey method which focuses on an approach of the franchisee to request emission-related data and information about energy consumption like it is described in table A.13. Scope 3 emissions of the franchise are optional because of the not mandatory reporting regulations by the GHG Protocol and the upstream emission factor is essential in case of a relatively significant contribution to the total emissions by purchased goods and services (WRI & wbcSD, 2013). Besides of the franchisee, the information could be gained through own internal saved data about the franchise and its processes, through utility bills, purchasing records and through publicly available data inventories.

The average data calculation method should only be applied if it is not possible to gain any more information about the franchise than it is stored by the franchiser. It can be broken down to the kind of building and each site-specific floor space to use average industry numbers out of administrative databases from industry bodies or governmental statistic files.

Table A.13: Required information for the two suggested methods how to approach emission calculation caused by franchises in the GHG Protocol (WRI & wbcSD, 2013)

Required information for CO ₂ equivalent	Franchise specific	Average-data
Scope 1 emissions from franchise	x	
Scope 2 emissions from franchise	x	
Scope 3 emissions from franchise	x (optional)	
Site specific electricity use	x	
Site specific fuel use	x	
Site specific process activity data	x	
Site specific fugitive emissions activity data	x	
Site- or regionally specific energy emission factors per unit of consumption	x	
Floor space of each franchise		x
Number of franchises by building type		x
Number of franchise assets with GHG emissions		x
Emission factor for process emissions	x	
Emission. factor for fugitive emissions	x	
Upstream emission factor	x	
Average emission factor by floor space		x
Average emission factor by building type		x
Average emission factor by asset type		x

A.3.14 Category 15 - Investments

Depending on the emissions' significance in comparison to other categories, the type of investment and what data is available from the investment, two different calculation methods are available to choose (figure A.1).

Figure A.14 provides an overview of the data which should be collected according to what method to pick. Important notice is to consider the project-based calculation method only if the investment is based on a project-like approach. Therefore, the investment-and project-specific method is meeting the same purpose in following supplier surveys.

While applying the average-data method, the investment in a project is the only scenario where the project costs are required. The emission factors can be extracted like it is known from other EEIO data from life cycle databases or other sector and industry-related inventories.

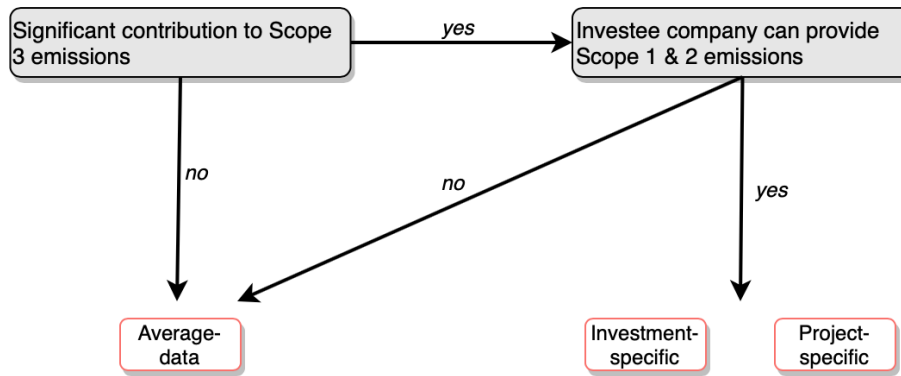


Figure A.1: Decision tree for approaching different kinds of investments for what calculation method to choose (WRI & wbcSD, 2011)

Table A.14: Methods how to calculate emissions from investments done by the reporting company derived from the GHG Protocol (WRI & wbcSD, 2013)

Required information for CO ₂ equivalent from equity investments	Investment specific	Project-specific	Average-data
Scope 1 emissions of investee company	x	x	
Scope 2 emissions of investee company	x	x	
Scope 3 emissions of investee company	x (optional, if significant)	x (optional, if significant)	
Investor’s proportional share	x	x	x
Sectors the investee operates in			x
Revenue of the invested company/ project			x
Project costs in the reporting year			(x)
EEIO emission factors of the sector			x

B Evaluation of the GHG Protocol assessment for Veoneer Sweden

This part of the appendix intensifies the analysis and partly the evaluation of GHG Protocol assessment's results.

B.1 Scope 1

Mobile combustion, the biggest share of the scope 1 emissions, is almost exclusively made up of cars, as most other identified mobile transportation units are electrical. Thus, the responsibility for total scope 1 emissions is significantly higher than it is for stationary combustion. Naturally, the ability to influence emissions regarding mobile combustion is high. Especially for company-owned vehicles, since the theoretical change for selecting less environmentally impacting vehicles is highly influenced by the company. Except for company cars, the fuel usage and hence emissions had to be extrapolated from available data. Sufficient collection measures were not in place for the full year of 2019. In some cases, driving distance and average fuel consumption are the only data available. The emission calculations' accuracy could improve if the company collects the amounts of fuel purchased instead (Greenhouse Gas Protocol, 2004b). A possible conduction which needs to be assessed further could be continuous documentation of fuel type and volume, perhaps from receipts. In Veoneer Sweden, when assessing other used cars within the organisation, driven distances for some of the cars are extractable from integrated GPS units. To complete data collection for all cars belonging to the category, GPS equipment of all cars would be recommended. An alternative way of achieving mobile combustion data could be realised with fuel information. But both ways require a deeper and further assessment.

The share of stationary combustion emissions of Veoneer Sweden is very low in comparison to the mobile caused ones, which might be a result of the highly electrified production. Thus, the responsibility for the total of scope 1 emissions is relatively low. The company's ability to influence emissions positively is similarly high as for the mobile combustion processes, since it is owned and situated at the reporting company. Thus, the feasibility of replacing the left stationary combustion causing assets could be part of a further assessment.

B.2 Scope 2

Data availability for electricity consumption is commonly high, as energy companies charge for the consumption and thus, have a financial incentive to have high accuracy in how much has been consumed. Should a company only be interested in retrieving an environmental footprint allocated to the electricity consumption, extracting activity data and energy type from electricity providers would be sufficient. However, there are benefits to measuring more detailed information inside the company facilities as it can help to identify inefficiencies, hot spots or other abnormalities.

Regarding emissions related to purchased heat for the facilities where a landlord supplies it, the company could request more detailed information about consumption, type and emissions from landlords who have information of activity data to charge for it.

B.3 Scope 3

Regarding the expected distribution of the shares of all categories in scope 3 like it is shown in Alexander Farsan (WWF) (2018), the calculated emissions seem to match roughly with the average distribution of scope 3 emissions in the automobile & components sector.

Use of sold products as the largest contribution to the total emissions in this thesis' estimation covers almost the corresponding fraction in figure B.1. Also, the emission estimations for EOL treatment matches roughly with the average industry share. Not possible is the comparison with purchased products and services and downstream transportation, which apparently take up significant shares of scope 3 emissions.

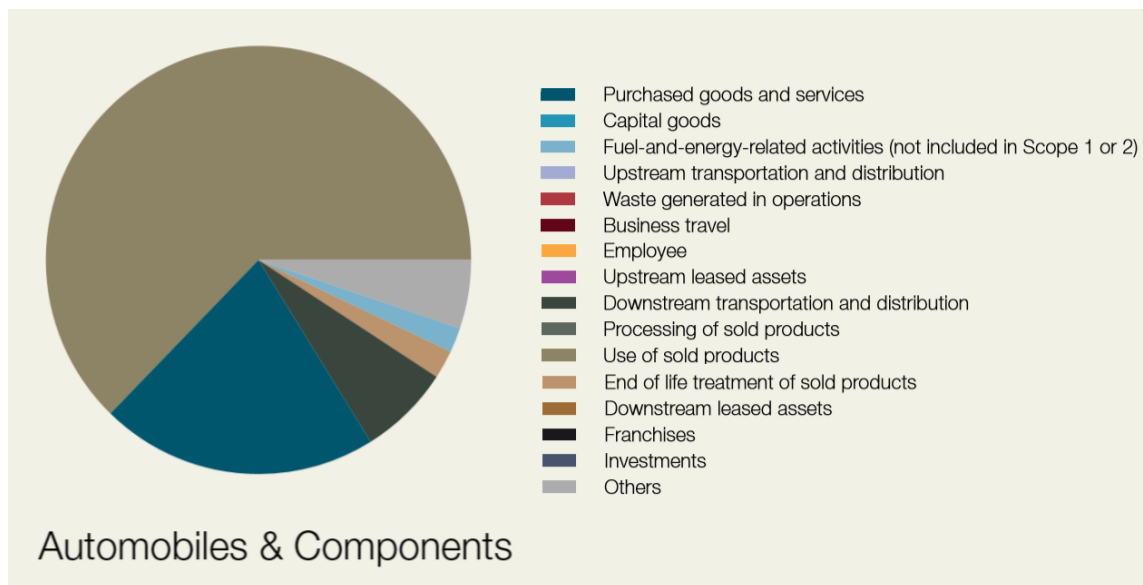


Figure B.1: Average share of scope 3 emissions for the automobile industry developed by Alexander Farsan (WWF) (2018)

B.3.1 Category 1 - Purchased goods and services

Data collection in category 1 can be a complex task to undertake. Should a company choose to use a supplier-specific method, requesting and collecting emission information from potentially thousands of suppliers might be required. That is the reason why an average data method was chosen. Hence, purchasing records and mass could be used to estimate emissions. Although supplier-specific information may give more accurate emission quantification, it is likely to be a slow process as there are many suppliers. Thus, an average data method may be good to use in the absence of supplier-specific information.

It is likely that relevant information is internally available in sufficient quantities for the approach of an initial estimation. Further assessments should consider communication strategies for spreading more convincing knowledge and involving also employees who could have needed understanding.

B.3.2 Category 2 - Capital goods

The coverage of all capital goods, which include some services in Veoneer, is complete. Although the categorisation allows simplification and thus requires average emission factors for each category. Through the DECC provided emission factors, which were developed for such initial estimation efforts in the UK, the only identified barrier hindering from emission estimations is the lack of spend information for the categories for capital goods. Because of the different way of categorising capital goods at the finance department, the required information is likely to receive from the indirect purchasing department of Veoneer in Sweden. But the availability of quantity and quality needs to be assessed further.

Considering the fact of the average emission factors for sub-categories stemming from the UK leads to the conclusion of assessing more opportunities to identify Sweden based emission factors. Regarding potential life cycle emission calculations, the effort in targeting the high variety of products and services in this category and thus, large diversity in suppliers needs to balance the gained higher accuracy in emission results. A potential pathway which needs to be assessed more detailed could consist of including policies in supplier contract delivering life cycle assessment alike information.

The finalisation of the started approach in estimating this category's impact through average emission factors could support further decisions in evaluating the relative responsibility of capital goods to the total scope 3 emissions and hence, the necessity or non-necessity of more accurate emission calculations.

B.3.3 Category 3 - Fuel and Energy related activities

The third category addresses upstream emissions that can be allocated to purchases of fuel and energy and are, as a consequence, dependant on the completeness of a scope 1 and 2 inventory. Activity data is required in combination with upstream emission factors to quantify a category 3 inventory. An emission factor for district

heating in Sweden was estimated through extrapolation of Swedish and British electricity emission factors (DECC, 2012). For an estimation which is likely to be more accurate, the company could approach the heating provider and request a factor specifically for the upstream emissions stemming from the plant that generates heat to the facility or obtain a general district heating emission factor for Sweden. Although Veoneer's responsibility for the upstream emissions of the fuel and energy purchased is limited and difficult to influence, as Veoneer is a much smaller organisation than most power providers, it can influence its emissions through its choice of energy type and fuel.

B.3.4 Category 4 - Upstream Transportation and Distribution

The emission reports retrieved from freight forwarders used by Veoneer varied in transparency and pricing. To get an overview and comparability between different companies, the calculation method needs to be similar and transparent. Several companies calculated emissions according to the EN 16258 standard, which is a method developed specifically for quantification of freight (SIS, 2012). Insisting that the reports should adhere to the same standard would be a way to ensure a more comprehensive emission inventory. Should all reports be generated using the standard, extracting emission data from forwarders could be of high accuracy as they would have more data such as fuel consumption, route and filling rate. Veoneer has both high responsibility for, and ability to influence, the emissions generated in the category, as it chooses both the type of vehicle and the company that should be used for the transportation.

B.3.5 Category 5 - Waste Generated in Operations

Data available was very varied between the different facilities. For one out of five facilities waste quantities according to Veoneer's share of the total building area could be allocated. According to the landlord, several similar requests were already received and the possibility to implement waste pickup per office is currently assessed in order to supply tenants with the requested data. That approach could perhaps be a way forward to extract data from the landlords of the offices where no data could be made available.

The biggest challenge consisted of unclear responsibilities between the facility owner and waste treatment company, since both parties avoided taking the initiative in requesting needed data from the other one. Additionally, it got apparent that waste treatment companies have difficulties in providing with emission-related data.

Further assessments need to include a constant request to waste treatment companies as well as to landlords to signalise the urgency. Perhaps, official requests by Veoneer employees out of the project of this thesis could be more promising in transmitting expectations. As already introduced previously, policies about emission reporting in contracts with waste treatment companies could be an option for future negotiations.

B.3.6 Category 6 - Business Travel

Usually, flights are booked via a travel agency and all other travel is conducted through receipt hand-ins. The HR department is responsible for the receipt management and the storage in the ERP system does not allow an extraction of fuel-related information. But potentially, a centralised system as the ERP is very attractive for extracting automatically required activity data. Further assessment is recommended to identify such possibilities.

Received emission reports by the travel agency supply sufficiently with aggregated emission factors. Throughout the communication, it got apparent that the reporting is an established service which can be modified depending on the customers' desires. An integration of emission reports as policy in future contracts is recommended, especially since it seems that the recent agency merges with another.

B.3.7 Category 7 - Employee Commuting

Category 7's emission calculations are based on a survey conducted within the logistics department at Veoneer in Vårgårda. The protocol recommends a larger sample size for a company the size of Veoneer. Hence, a representative sample for a large share of the organisation, involving every facility and office needs to be conducted. As the different facilities vary in size, proximity to the closest city centre and public transport availability, the share of car users may be lower as well as the frequency of commuting, distance to the office and other parameters that heavily impact the results. Although Veoneer has responsibilities for the emissions, it has a low ability to influence. As private individuals own the vehicles, the company cannot change cars to more efficient ones or force employees to reduce driving. Veoneer could encourage public transportation or carpooling through subsidies for tickets and assisting through facilitating carpool groups. For remote locations, closer collaboration with the local public transport company could lead to request more frequent or quicker routes between the facilities and popular junctions.

B.3.8 Category 8 - Upstream leased assets

Emissions that should be allocated to the eighth category were not calculated due to assumptions about financial and operating control of the facilities. Hence, they are allocated in scope 1 and 2. To gain certainty, contracts between landlords and Veoneer should be scrutinized to verify the assumed leasing agreements.

B.3.9 Category 9 - Downstream Transportation and Distribution

The GHG Protocol recognises the difficulty of data collection in category 9, as it contains emissions from facilities and activities that the reporting company does not pay for. That means there is no financial incentive for another company to comply with the request of emission data as there is no business relationship that would be damaged. To estimate emissions that should be allocated to category 9, Veoneer

could use the tool EcoTransIT, which is described in section 4.5.3. Required data could perhaps be collected at the time of dispatch by Veoneer and thus, avoiding requesting emission reports from transporters whom the company cannot influence.

B.3.10 Category 10 - Processing of sold products

The applied average data calculation method covers all product emissions with a mass-allocation approach, using LCA data about average vehicles. The result size in relation to other categories fits roughly with the figure B.1. However, eliminating simplifications related to the products could increase accuracy.

The chosen calculation method could potentially be improved with further data collection consisting of more customer-specific data. Since the contribution to the total scope 3 emissions is significant, further studies about the impact of Veoneer's products needs to be conducted. An alternative method could consist of approaching each customer individually while requesting emission reports.

Regarding the qualification's aim to result in an initial emission estimation, the applied method can be used for further estimations.

B.3.11 Category 11 - Use of Sold Products

Use of sold products is, for automotive component producers, commonly the category with the highest emission contribution (Persson, 2019). Considering the estimated weight impact, Veoneer can influence through more light-weight product design. As the vehicles equipped with Veoneer's products differ in fuel- and energy efficiency, characteristics of more customer-related vehicles could potentially lead to more accurate emission numbers.

The average data method is sufficient to screen the category's impact but as it makes up such a large share of emissions, efforts for more accuracy would be justified. With higher accuracy and more knowledge about the environmental footprint of the full life cycle of the products, Veoneer would also have the possibility to measure the environmental performance of the car industry. Such information could be collected by conducting life cycle assessments on their products.

B.3.12 Category 12 - End-of-life treatment of sold products

The identified available data covers the whole scope of emissions caused by the EOL treatment of Veoneer's products. The usage of internal performance and sales data in combination with emission factors from already conducted LCAs for vehicles can be declared as functioning way resulting in emission numbers for this category.

Through achieving all product performance information, a more accurate result could be possible. Considering the significant contribution to total scope 3 emissions, the responsibility for the total emissions is relatively high. Regarding the product design done by Veoneer, the company has the ability to influence emission reductions. Veoneer could calculate the impact of each product's EOL impact to gain a more accurate inventory. Knowledge about individual products' EOL phase gives prerequisites for improvements such as increased circularity.

As Veoneer is the company designing the product, it can influence the ease of recycling or reuse. Disassembly processes could be considered to provide a prerequisite for potential reuse. However, as their products are components, the entire car must be handled responsibly in its EOL-phase. Similar counts for the consumer who is responsible for a proper EOL handover.

It can be assumed that many different options for reuse are available but all require further assessment regarding practicability and feasibility.

B.3.13 Category 13 - Downstream leased assets

The person responsible for collecting environmental activity data in the lessor's organisation was contacted, and it got apparent that the emissions which should be allocated to this category are based on an estimation of the performance of the other facilities. Data was requested and approved to be supplied. Since the report could not be supplied in time for this report, further assessment needs to deal with an insistent additional request and with the possibility to establish a regular reporting channel.

C Additional background knowledge

C.1 Development of a methodological framework

The application of the theory is channelled with a concept developed out of the cross-level model for institutional logics from Thornton et al. (2012) which the already presented concept in figure 2.2 from Corbett et al. (2018) is also based on.

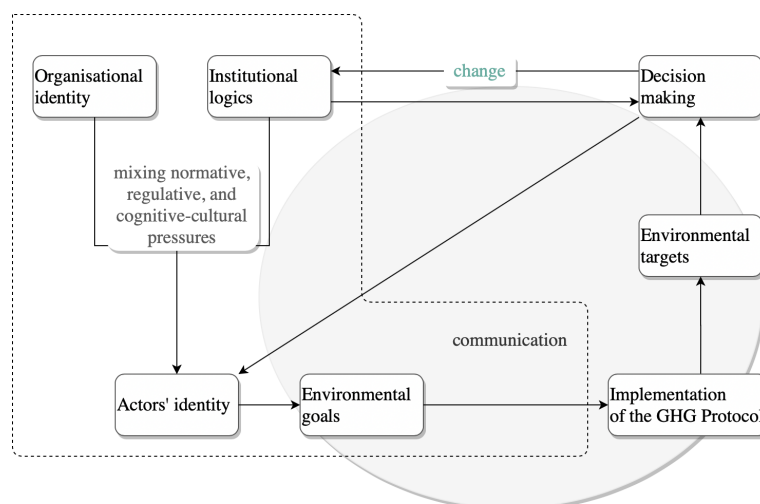


Figure C.1: Developed concept from Thornton et al. (2012) & Corbett et al. (2018)

The modification of the Thornton et al. (2012) model as it can be seen in figure C.1, pictures the methodological framework how the macro-level corporation impacts each actors identity and how the individual's influence can contribute towards change. The dashed area covers the scope of the thesis project and since communication is relevant for all processes from an actor's identity until the decision making, it is visualised as a guiding method in the background. In particular, the micro-level communication among defined key actors (section 3.1.3 & 3.2.5) in the process from environmental goals to the implementation of the Protocol is in focus but is also not negligible and deciding regarding the following steps towards the change causing decisions.

The biggest differentiation in comparison with Corbett et al. (2018)'s interpretation consists of a reflection back to the original model of Thornton et al. (2012) splitting the Corbett et al. (2018)'s actor's identity.

C.1.1 Embedding the concept into Kotter's change management methodology

The eight steps of Kotter et al. (1995) transition a corporation are already introduced (section 2.2.1) and so, the conceptual linkage towards how the GHG Protocol can be used as driving part for an impact to the transitioning of a company out of the automotive industry providing upcoming and out of the scope of this thesis leading proceedings including suggestions how to continue achieving a thorough and value-adding transition.

While Kotter et al. (1995) targets mainly decreasing costs and higher efficiency, the protocol targets in first hand just the assessment of emissions without applying any further conclusions. Therefore, this project targets to embed the activities leading to an application of the GHG Protocol into the phases of change management like the creation of a sense of urgency, the building of a guiding coalition, formation of a strategic vision and initiatives, enlisting of a volunteer army and concluding with a provision how to enable action by removing barriers. While the first stage in establishing a sense of urgency (Kotter et al., 1995) is defined with the identification of the main decision determining drivers both internal and external, the methodological approach targets a collection of information to enable an assessment and identification of the company's organizational identity and institutional logics in relation to the environment which both can be found in the concept in figure C.1. Additionally, the sense of urgency concerns the macro-level which is planned to formulate through an analysis of channelling the macro-level identities along the three categories normative, regulative and cultural-cognitive which are defined by Corbett et al. (2018). It is only planned to assess and not to build a guiding coalition the application of the GHG Protocol already includes the second step of forming a coalition, since the widespread data approaches automatically involve a formation of a network of people who at least need to report to each other regularly. Since it is essential to encourage employees to form opinion-leading coalitions, communication is identified beside the data acquisition and application as a core column of this project.

D Newsletter

D.1 Newsletter 1



What is the Greenhouse Gas Protocol for companies?

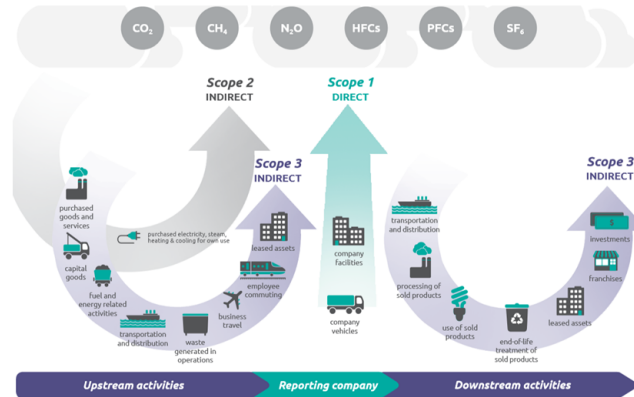
Corporate Accounting and Reporting Standard

- A joint initiative from the World Resource Institute (WRI) and the World Business Council for Sustainable Development (WBCSD)
- The most widely used emission reporting standard among large corporations, used by 92% of Fortune 500 companies.
- An all-encompassing standard for accurate and reliable environmental reporting, used by investors to determine performance.
- An effective way to gain more information about the facilities and enables hotspot identification for efficient mitigation efforts.

Three categories Referred to as "Scopes"

Emissions type	Scope	Definition	Examples
Direct emissions	Scope 1	Emissions from operations that are owned or controlled by the reporting company	Emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment
	Scope 2	Emissions from the generation of purchased or acquired electricity, steam, heating, or cooling consumed by the reporting company	Use of purchased electricity, steam, heating, or cooling
Indirect emissions	Scope 3	All indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions	Production of purchased products, transportation of purchased products, or use of sold products

A visualization of the different scopes



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The thesis – How to integrate environmental activities

The goal

- How to integrate environmental activities to business and everyday life
- Assessment of internal green logics
- Strategic steps for identifying internal incentives
- GHGP
 - Assessment of currently available data
 - Data evaluation
 - Guideline regarding how to access and integrate relevant data
 - Reporting draft of emission calculations
- Concluding in motivations for a proactive role

Completed

- Understanding the function and general requirements of the GHGP
- Data inventory sheet in Excel
- Targeting key stakeholders for interviews
- Determining thesis expectations

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What is currently being explored

Short term targets

- Invite key employees to interviews
- Extract emission data from shipping companies
- Determine general premium freight emissions
- Determine what data is missing in order to get complete Scope 1, 2 & 3 numbers
- Stakeholder analysis

Mid term targets

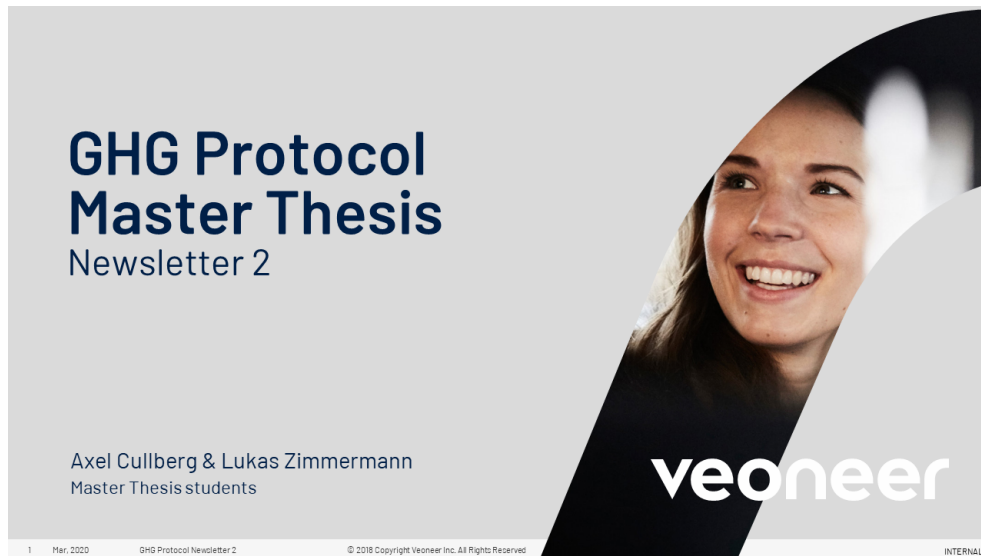
- Identify softwares for continuous data gathering
- Arranging interviews
 - Internal views and understanding of sustainability (expectations, visions)
 - Potential integration of GHGP reporting procedures
 - External and internal drivers
- Determine Scope 1 & 2 emissions

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D.2 Newsletter 2



What is the Greenhouse Gas Protocol for companies?

Corporate Accounting and Reporting Standard

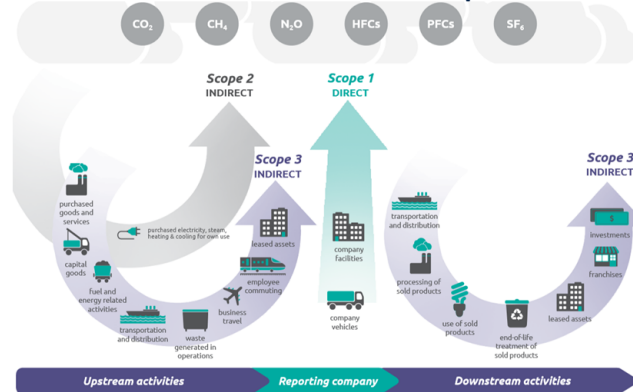
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Three categories

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Greenhouse Gas Protocol – different scopes



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The thesis – How to integrate environmental activities

What is currently being explored

Scope 3

- Transportation & Distribution
- Educating key personnel on data acquisition outside of the organizational boundaries
- Obtain employee commuting data
- Learn about ESO capital goods as well as investments
- Identifying missing data

Mid term targets

- Determining life cycle emission data
- Determining end-of-life emissions
- Finalize interviews
- Suggest how to obtain missing data in the future

Completed

- Rough Scope 1 impact
- Created a poll study in order to obtain employee commuting data
- Collected waste management data for all sites except SGO
- Scope 2 impact
- Interviewed a handful of employees
- Developed a tool for reporting vehicle usage on a monthly basis
- Scope 3 education

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What is currently being explored

Short term targets

- Scope 3:
 - Transportation & Distribution
 - Educating key personnel on data acquisition outside of the organizational boundaries
 - Obtain employee commuting data
 - Learn about ESO capital goods as well as investments
 - Structure all data that is missing

Mid term targets

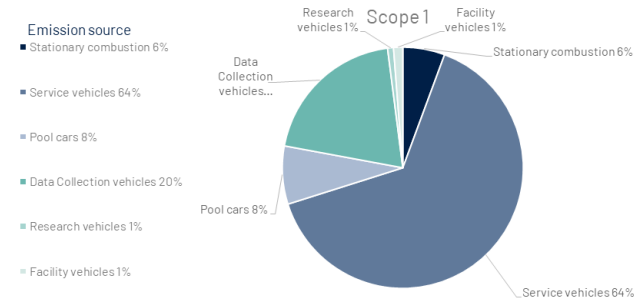
- Determining life cycle emission data
- Determining end-of-life emissions
- Finalize interviews
- Suggest how to obtain missing data in the future

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Scope 1

Distribution of scope 1 emission sources

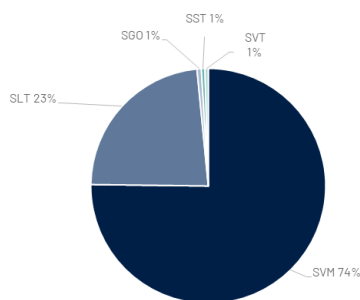


Note that the chart is based on the combustion that there is data about. Some of the categories is based on estimations and average data.

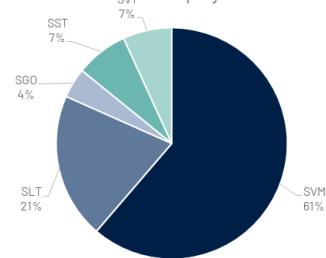
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Scope 2

Emissions caused by electricity consumption 2019



Distribution according to number of employees



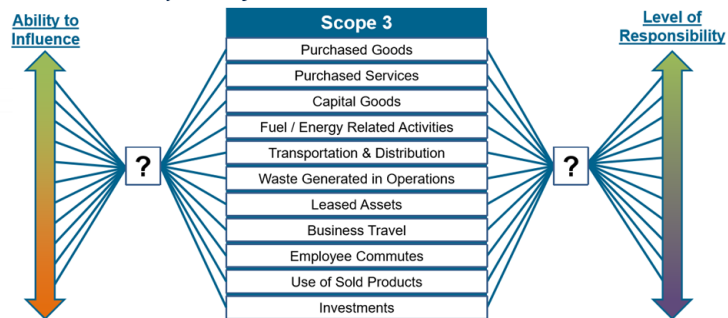
- SST & SVT not complete
- Swedish average electricity mix (0.0133 kg CO2eq/kWh)

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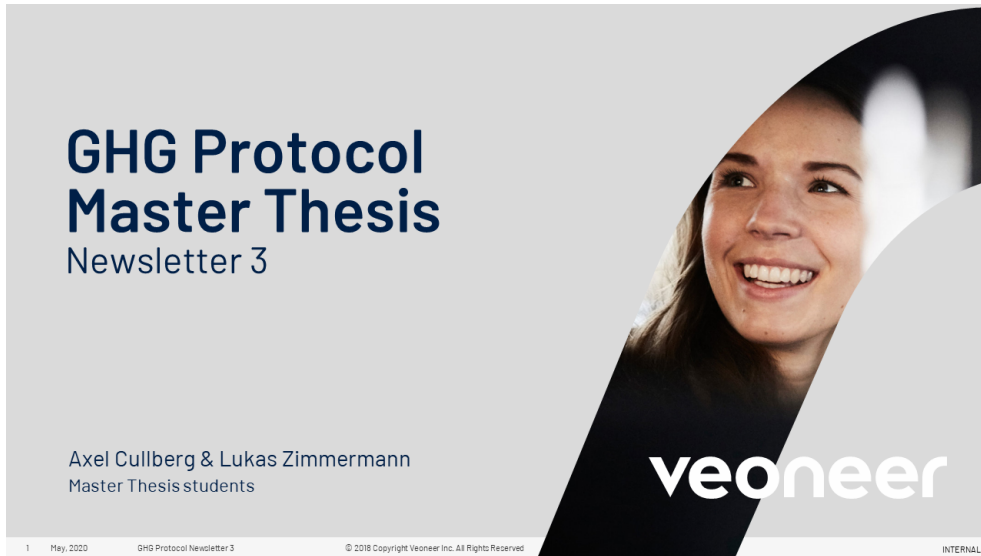
Next step for scope 3

What emission categories to address?

What procedures are already existing?



D.3 Newsletter 3



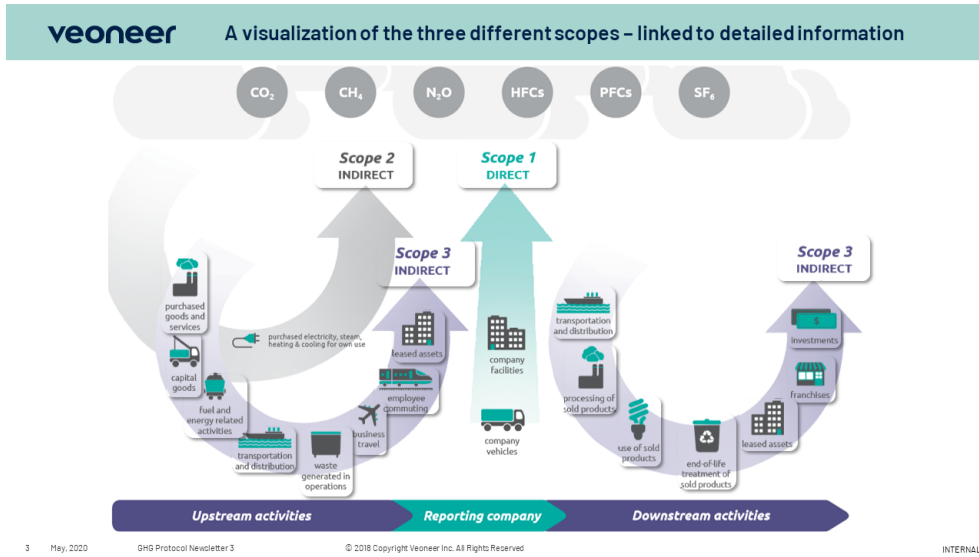
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Three scopes

Emissions type	Scope	Definition	Examples
Direct emissions	Scope 1	Emissions from operations that are owned or controlled by the reporting company	Emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment
	Scope 2	Emissions from the generation of purchased or acquired electricity, steam, heating, or cooling consumed by the reporting company	Use of purchased electricity, steam, heating, or cooling
Indirect emissions	Scope 3	All indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions	Production of purchased products, transportation of purchased products, or use of sold products



veoneer **Scope 1** [Back to overview](#)

Stationary combustion:

- Combustion of solid, liquid or gaseous fuel, generally for the purposes of producing electricity, generating steam or heat for dairy processing purposes

Mobile combustion:

- direct GHG emissions from owned or leased mobile sources (both on-road and non-road vehicles) that are within the company's inventory boundaries

Fugitive emissions

- Emissions from refrigeration and air conditioning resulting out of leakages and service operation over the lifetime
- Low priority and hence, not part of the current assessment stage

Collected data

- Stationary combustion 2019: Fuel consumption of two diesel generators (2xSVM)
- Mobile combustion 2019: Fuel consumption of Company cars(all sites), Pool cars(all sites), Data collection vehicles (based in SLT), Research vehicles (SVM, SLT), Facility vehicles (SVM)

Company cars 64.49%	Pool cars 7.79%	Data collection vehicles 20.06%	Research vehicles 0.79%	Facility vehicles 1.24%	Stationary combustion 5.64%
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Scope 2 - Calculation methods

Market based, which means contractual emission reports by the energy supplier | **Location-based, which means own calculations using energy consumption and location based emission factors**

Planned approach

- Assessing site specific energy consumptions
- Estimating environmental impact with average emission factors

Data collected

- Electricity consumption for 2019 and all Swedish sites
- Swedish average electricity emission factor (0.0133 kg CO2eq/kWh)

Data left to include

- District heating
- SST & SVT electricity consumption for 2019/11 & 2019/12

SVM 75.2%

- SGO 0.6%
- SVT 0.45%
- SST 0.5%
- SLT 23.26%

• SST & SVT not complete

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veoneer **Scope 3 – general calculation methods** [Back to overview](#)

Environmentally-extended input output (EEIO) data	Supplier surveys	Life cycle data
<ul style="list-style-type: none"> • Usage of average industry emission factors • Useful for screening purposes and initiative assessments 	<ul style="list-style-type: none"> • Data gathering through emission reports from suppliers • Initiative method to receive life cycle data not owned by the reporting company 	<ul style="list-style-type: none"> • Assessment of specific process related data from raw material extraction until end of life treatment of used products • Thorough assessment recommended to apply for produced products and identified emission hotspots
+	+	+
<ul style="list-style-type: none"> • Comprehensive coverage of the whole industry • Simplicity in method and application 	<ul style="list-style-type: none"> • Efficiency in time and results 	<ul style="list-style-type: none"> • Transparency and reliability of data and calculation methods • Accuracy of results
-	-	-
<ul style="list-style-type: none"> • Lacks of specificity and accuracy • Emission reductions are more difficult to measure • EEIO databases not always for all sites applicable 	<ul style="list-style-type: none"> • Lacks of transparency and reliability • Large variation in data quantity and quality 	<ul style="list-style-type: none"> • Usually time and cost extensive • Impractical application, due to complexity of products and supply chains

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Scope 3: Category 1 – Purchased goods & services

Extraction, production, and transportation of goods and services purchased or acquired by the reporting company in the reporting year

All upstream (cradle-to-gate) emissions of purchased goods and services

Planned approach	Required data
<ul style="list-style-type: none"> • Categorizing of all goods & services • Usage of average and general emission factors • Rough estimation on each category's impact • Identifying hot spots to prioritize categories • Motivating for a deep diving life cycle assessment 	<ul style="list-style-type: none"> • Economic value spend on per purchased good & service • Quantity or mass per good • Emission factors <ul style="list-style-type: none"> • Average industry numbers • From similar and comparable good or service

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Scope 3: Category 2 – Capital goods

Extraction, production, and transportation of capital goods purchased or acquired by the reporting company in the reporting year

All upstream (cradle-to-gate) emissions of purchased capital goods

Planned approach	Required data
<ul style="list-style-type: none"> • Categorizing of all capital goods • Usage of average and general emission factors • Rough estimation on each category's impact • Identifying hot spots to prioritize categories • Motivating for a deep diving life cycle assessment 	<ul style="list-style-type: none"> • Economic value spend on per capital good (category) • Quantity or mass per good/category • Emission factors <ul style="list-style-type: none"> • Average industry numbers • From similar and comparable or exemplary category dominant goods

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Scope 3: Category 3 – Fuel & energy related activities

Activity	Description	For whom to apply	How it is applied in Veoneer Sweden
Upstream emissions of purchased fuels	Extraction, production, and transportation of fuels consumed by the reporting company	End users of fuel	Well to tank emissions of counted fuels in Scope 1 (stationary & mobile combustion)
Upstream emissions of purchased electricity	Extraction, production, and transportation of fuels consumed in the generation of electricity, steam, heating and cooling that is consumed by the reporting company	End users of electricity, steam, heating, and cooling	Well to tank emissions of counted electricity in Scope 2 (Scope 1 & 2 emissions from electricity producers & providers)
Transmission and distribution losses	Generation (upstream activities and combustion) of electricity, steam, heating, and cooling that is consumed (i.e., lost) in a T&D system –reported by end user	End users of electricity, steam, heating, and cooling	Transmission & distribution losses of counted electricity in Scope 2
Generation of purchased electricity that is sold to end users	Generation (upstream activities and combustion) of electricity, steam, heating, and cooling that is purchased by the reporting company and sold to end users – reported by utility company or energy retailer	Utility companies and energy retailers	Not applicable

Required data:

- Differentiation between Well to Tank and Well to Wheel emissions for fuel and electricity production
- Energy mix of consumed electricity
- Information about transmission & distribution losses

Scope 3: Category 4 – Upstream transportation & distribution

Transportation and distribution of products purchased by the reporting company in the reporting year between a company's tier 1 suppliers and its own operations (in vehicles and facilities not owned or controlled by the reporting company)

Transportation and distribution services purchased by the reporting company in the reporting year, including inbound logistics, outbound logistics (e.g., of sold products), and transportation and distribution between a company's own facilities (in vehicles and facilities not owned or controlled by the reporting company)

The scope 1 and scope 2 emissions of transportation and distribution providers that occur during use of vehicles and facilities (e.g., from energy use)
Optional: The life cycle emissions associated with manufacturing vehicles, facilities, or infrastructure

Planned approach	Required data
<ul style="list-style-type: none"> • Approaching all used forwarders to receive emission reports • Estimating total environmental impact • Assessing internally stored transportation data • Developing requirements on future emission reports 	<ul style="list-style-type: none"> • For each single shipment: <ul style="list-style-type: none"> • Kind of good (quantity & mass) • Used mode of transports • Distance <ul style="list-style-type: none"> • Origin • Destination • Well-to-Wheel & Well-to-Tank emissions • Own calculations • Emission reports

Scope 3: Category 5 – Waste generated in operations

Disposal and treatment of waste generated in the reporting company's operations in the reporting year (in facilities not owned or controlled by the reporting company)

The scope 1 and scope 2 emissions of waste management suppliers that occur during disposal or treatment
Optional: Emissions from transportation of waste

Planned approach	Required data
<ul style="list-style-type: none"> • Approaching facility managers • Approaching waste management and treatment companies used by Veoneer Sweden • Estimating the environmental impact with the usage of emission factors provided by the GHG Protocol 	<ul style="list-style-type: none"> • Quantities of waste disposed in 2019 <ul style="list-style-type: none"> • Type of waste • Waste treatment method (incineration, landfill etc.) • Each proportion of treatment method • Waste treatment-specific emission factors

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Scope 3: Category 6 – Business travel

Transportation of employees for business-related activities during the reporting year (in vehicles not owned or operated by the reporting company)

The scope 1 and scope 2 emissions of transportation carriers that occur during use of vehicles (e.g., from energy use)
Optional: The life cycle emissions associated with manufacturing vehicles or infrastructure

Planned approach	Required data
<ul style="list-style-type: none"> Approaching travel agencies to receive emission reports Assessing internally stored information 	<ul style="list-style-type: none"> For each single trip: <ul style="list-style-type: none"> Used mode of transports Distance <ul style="list-style-type: none"> Origin Destination Fuel consumption Fuel emission factor Emission reports with a list of single trips

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Scope 3: Category 7 – Employee commuting

Transportation of employees between their homes and their worksites during the reporting year (in vehicles not owned or operated by the reporting company)

The scope 1 and scope 2 emissions of employees and transportation providers that occur during use of vehicles (e.g., from energy use)
Optional: Emissions from employee teleworking

Planned approach	Required data
<ul style="list-style-type: none"> Conducting a survey among employees <ul style="list-style-type: none"> Logistics department in Vårgårda is the trial target Assessing quality of results Developing survey which is applicable to all employees 	<ul style="list-style-type: none"> Number of commuting days Mode of transport Commuting distance Fuel efficiency Emission factor <ul style="list-style-type: none"> Electricity Fuel

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Scope 3: Category 8 – Upstream leased assets

Operation of assets leased by the reporting company (lessee) in the reporting year and not included in scope 1 and scope 2 – reported by lessee

The scope 1 and scope 2 emissions of lessors that occur during the reporting company's operation of leased assets (e.g., from energy use)
Optional: The life cycle emissions associated with manufacturing or constructing leased assets

Planned approach	Required data
<ul style="list-style-type: none"> Approaching several internal departments Assessing lease characteristics including ownership and financial control Approaching facility responsible for receiving information about energy use and possible combustion Estimating environmental impact Assessing possibilities to receive emission reports including an entire coverage of Scope 1 & 2 emissions 	<ul style="list-style-type: none"> Electricity consumption Quantities of fuel combustion <ul style="list-style-type: none"> Stationary Mobile Average industry emission factors

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Scope 3: Category 9 – Downstream transportation & distribution

Transportation and distribution of products sold by the reporting company in the reporting year between the reporting company's operations and the end consumer (if not paid for by the reporting company), including retail and storage (in vehicles and facilities not owned or controlled by the reporting company)

The scope 1 and scope 2 emissions of transportation providers, distributors, and retailers that occur during use of vehicles and facilities (e.g., from energy use)

Optional: The life cycle emissions associated with manufacturing vehicles, facilities, or infrastructure

Planned approach	Required data
<ul style="list-style-type: none"> Approaching all used forwarders to receive emission reports Estimating total environmental impact Assessing internally stored transportation data Developing requirements on future emission reports 	<ul style="list-style-type: none"> For each single shipment: <ul style="list-style-type: none"> Kind of good (quantity & mass) Used mode of transports Distance <ul style="list-style-type: none"> Origin Destination Well-to-Wheel & Well-to-Tank emissions Own calculations Emission reports

Scope 3: Category 10 – Processing of sold products

Processing of intermediate products sold in the reporting year by downstream companies (e.g., manufacturers)

The scope 1 and scope 2 emissions of downstream companies that occur during processing (e.g., from energy use)

Planned approach	Required data
<ul style="list-style-type: none"> Assessing process steps conducted at the customers sites Combining it with the quantities of sold products Developing suggestions how to introduce regulatory scope 1 & 2 emission reporting Estimating the environmental impact with average industry numbers for identified process steps 	<ul style="list-style-type: none"> Processes involved Mass or quantity of products Emission factor per process stage

Scope 3: Category 11 – Use of sold products

End use of goods and services sold by the reporting company in the reporting year

The direct use-phase emissions of sold products over their expected lifetime (i.e., the scope 1 and scope 2 emissions of end users that occur from the use of: products that directly consume energy (fuels or electricity) during use; fuels and feedstocks; and GHGs and products that contain or form GHGs that are emitted during use)

Optional: The indirect use-phase emissions of sold products over their expected lifetime (i.e., emissions from the use of products that indirectly consume energy (fuels or electricity) during use)

Planned approach	Required data
<ul style="list-style-type: none"> Assessing direct use phase impacts <ul style="list-style-type: none"> energy consumption of the products Assessing indirect use phase impacts <ul style="list-style-type: none"> Identifying weight impact on energy consumption Identifying average car characteristics Estimating environmental impact of electricity consumption Estimating environmental impact of products' weight with mass allocation 	<ul style="list-style-type: none"> Quantities of sold products (including mass) Electricity consumption per product and use Electricity life cycle emission factor Average car performance data <ul style="list-style-type: none"> Mass Fuel efficiency Electricity consumption

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Scope 3: Category 12 – End-of-life treatment of sold products

Waste disposal and treatment of products sold by the reporting company (in the reporting year) at the end of their life

The scope 1 and scope 2 emissions of waste management companies that occur during disposal or treatment of sold products

Planned approach	Required data
<ul style="list-style-type: none"> Assessing average car disposal treatments Estimating environmental impacts for each treatment Estimating environmental impact of products with mass allocation Identifying motivations for circularity within the production but also for reusing or refurbishing used products 	<ul style="list-style-type: none"> Quantities of sold products (including mass) Proportion of applied waste treatment methods Waste treatment specific emission factor

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Scope 3: Category 13 – Downstream leased assets

Operation of assets owned by the reporting company (lessor) and leased to other entities in the reporting year, not included in scope 1 and scope 2 – reported by lessor

The scope 1 and scope 2 emissions of lessees that occur during operation of leased assets (e.g., from energy use).
Optional: The life cycle emissions associated with manufacturing or constructing leased assets

Planned approach	Required data
<ul style="list-style-type: none"> Approaching several internal departments Assessing lease characteristics including ownership and financial control Approaching facility responsible for receiving information about energy use and possible combustion Estimating environmental impact Assessing possibilities to receive emission reports including an entire coverage of Scope 1 & 2 emissions 	<ul style="list-style-type: none"> Electricity consumption Quantities of fuel combustion <ul style="list-style-type: none"> Stationary Mobile Average industry emission factors

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Scope 3: Category 14 – Franchises (not applicable for Veoneer Sweden AB)

Operation of franchises in the reporting year, not included in scope 1 and scope 2 – reported by franchisor

The scope 1 and scope 2 emissions of franchisees that occur during operation of franchises (e.g., from energy use)
Optional: The life cycle emissions associated with manufacturing or constructing franchises

Planned approach	Required data
<ul style="list-style-type: none"> Approaching financial departments to verify that Veoneer Sweden AB has no franchises Therefore, no data acquisition planned 	<p>Theoretically needed data for following the average data calculation method:</p> <ul style="list-style-type: none"> Floor space of each franchise Number of franchises by building type Number of franchises assets with GHG emissions Average emission factors <ul style="list-style-type: none"> By floor space By building type By asset type

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Scope 3: Category 15 – Investments (not applicable for Veoneer Sweden AB)

Operation of investments (including equity and debt investments and project finance) in the reporting year, not included in scope 1 or scope 2

Planned approach

- Approaching financial departments to verify that Veoneer Sweden AB owns no investments
- Therefore, no data acquisition planned

Required data

- Theoretically needed data for following the average data calculation method:
- Investor's proportional share
 - Sectors the investee operates in
 - Revenue of the invested company
 - Average emission factors by sector

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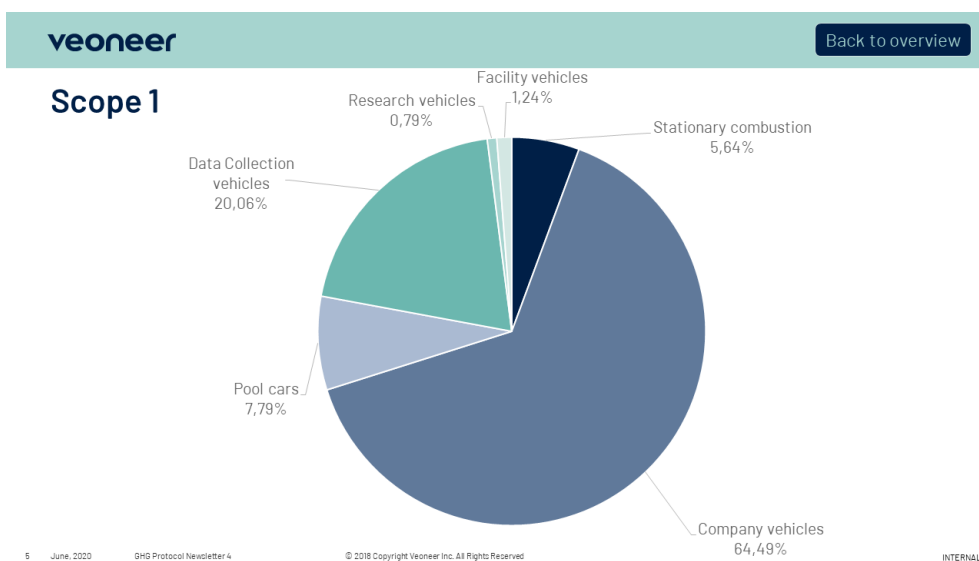
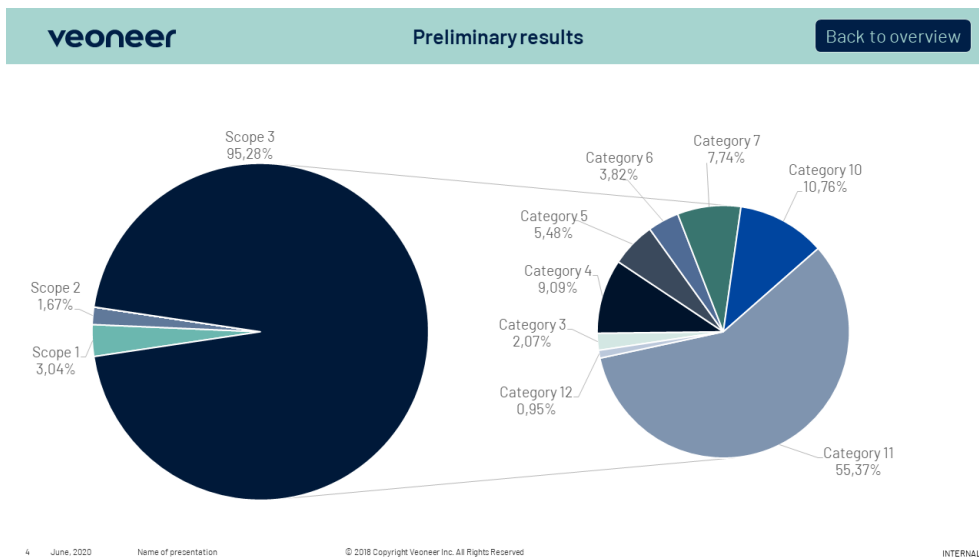
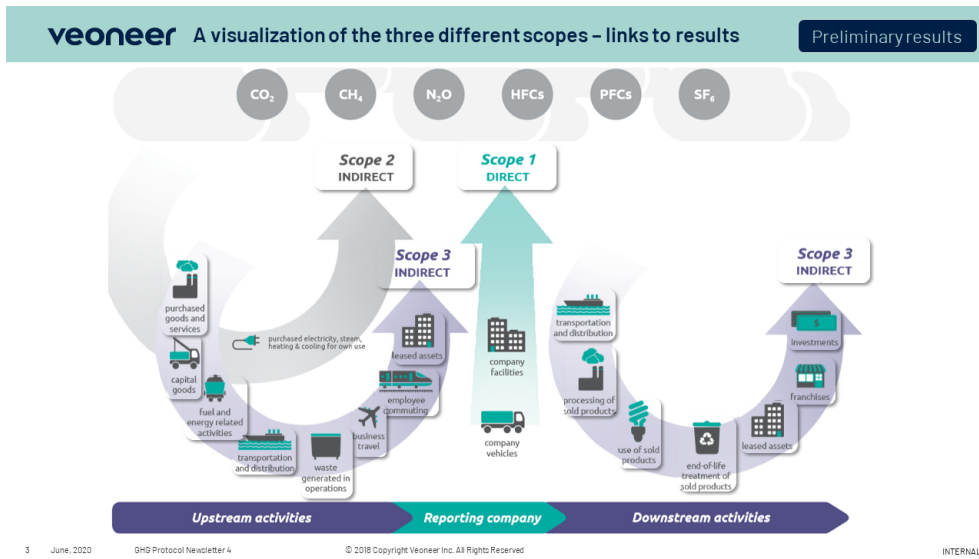
What is the Greenhouse Gas Protocol for companies?

Corporate Accounting and Reporting Standard

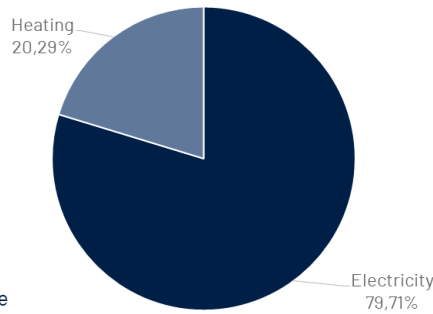
- A joint initiative from the World Resource Institute (WRI) and the World Business Council for Sustainable Development (WBCSD)
- The most widely used emission reporting standard among large corporations, used by 92% of Fortune 500 companies.
- An all-encompassing standard for accurate and reliable environmental reporting, used by investors to determine performance.
- An effective way to gain more information about the facilities and enables hotspot identification for efficient mitigation efforts.

Three scopes

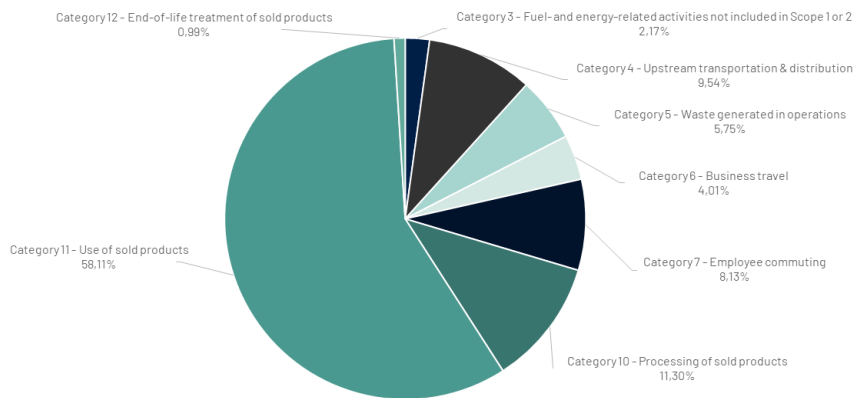
Emissions type	Scope	Definition	Examples
Direct emissions	Scope 1	Emissions from operations that are owned or controlled by the reporting company	Emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc.; emissions from chemical production in owned or controlled process equipment
	Scope 2	Emissions from the generation of purchased or acquired electricity, steam, heating, or cooling consumed by the reporting company	Use of purchased electricity, steam, heating, or cooling
Indirect emissions	Scope 3	All indirect emissions (not included in scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions	Production of purchased products, transportation of purchased products, or use of sold products



Scope 2



- Electricity: SST & SVT not complete
- Heat: only Vårgårda
- Swedish average electricity mix(0.0133 kg CO2eq/kWh)



Scope 3 - Categories	Relative share of scope 3	Comments
Purchased goods & services	-	not sufficient data collected
Capital goods	-	not sufficient data collected
Fuel- and energy related activities not included in Scope 1 or 2	2.17%	
Upstream transportation and distribution	9.54%	not complete
Waste generated in operations	5.75%	not complete
Business travel	4.01%	not complete
Employee commuting	8.13%	
Upstream leased assets	-	Scope 1 & 2
Downstream transportation and distribution	-	not sufficient data collected
Processing of sold products	11.30%	
Use of sold products	58.11%	not complete
End-of-life treatment of sold products	0.99%	
Downstream leased assets	-	not sufficient data collected
Franchises	-	not applicable
Investments	-	not applicable

Scope 3: Category 1 – Purchased goods & services

Required data

- List of purchased product categories
- Quantity of purchased products and services
- Mass of purchased products and services

Collected information

- Spend-based emission factors for average product and service categories

Challenges

- Collected data is not sufficient to enable in emission quantification
- Availability of required data is likely within Veoneer

Future path

- An insistent approach towards the direct purchasing department to access required data

Scope 3: Category 2 – Capital goods

Accessed data

- Category master of indirect purchasing
- Categories from finance for all capital goods
- Spend-based information for each finance category
- Spend-based emission factors for average product and service categories

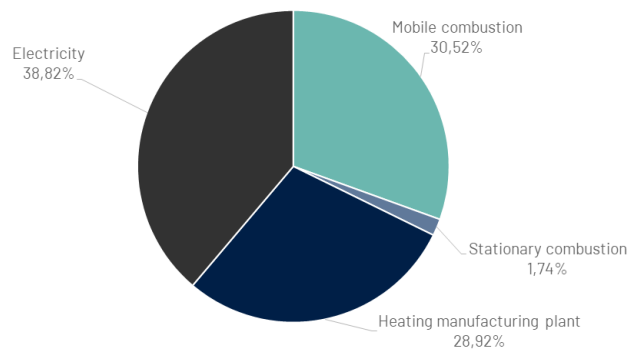
Challenges

- Emission factors cover 94.18% of the subcategories of the category master from indirect purchasing
- Categories from finance and indirect purchasing do not match

Future path

- Insistent approach of indirect purchasing department for accessing spend based data related to the category master

Scope 3: Category 3 – Fuel & energy related activities



Scope 3: Category 4 – Upstream transportation & distribution

Accessed data

- Seven out of eleven identified forwarders supplied the project with emission reports
- One more is available in return for a compensation

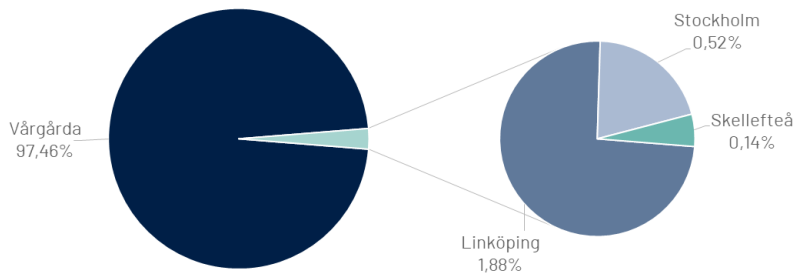
Challenges

- Emission reports vary quite largely in included quantities and transparency
- Emissions are calculated according to EN 16258
- Quality couldn't be verified

Future path

- Inclusion of policies related to emission reportings in contracts with forwarders
- Desired: contribution to industry standards about quality of emission reports

Scope 3: Category 5 – Waste generated in operations

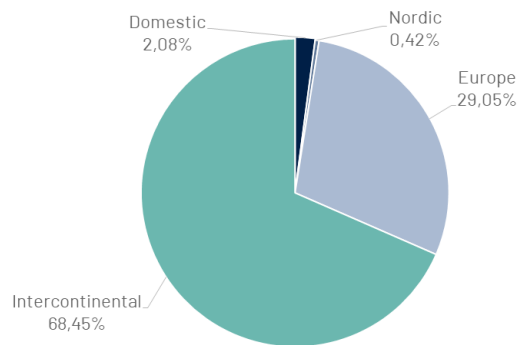


Scope 3: Category 6 – Business travel

- Emissions just from air travel
 - 2019
 - Veoneer Sweden AB

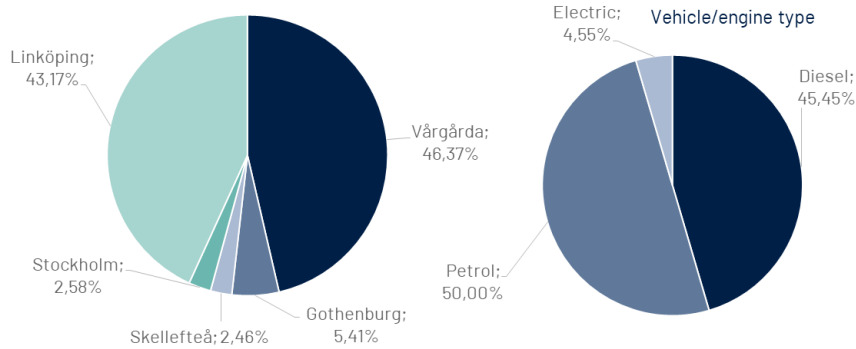
Total amount of flights

- Domestic: 126
- Nordic: 16
- Europe: 2170
- Intercontinental: 894



Scope 3: Category 7 – Employee commuting

Estimated employee commuting emissions



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June, 2020

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Scope 3: Category 8 – Upstream leased assets

Financial and operating control of the leased facilities were assumed

- Emissions are included in scope 1 & 2

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Scope 3: Category 9 – Downstream transportation & distribution

Required data

- Shipment number, customer, shipment address, quantity of shipped products and mass
- EcoTransIT as calculation tool

Challenges

- Required data is not owned by Veoneer
- Used mode of transport and mass couldn't be accessed

Future path

- As assessed so far, Movex contains sufficient data per shipment for the simplified EcoTransIT calculations
- LCA studies by customers partly contain emissions from the transportation of Veoneer's products
- Both pathways needs further assessment

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Scope 3: Category 10 – Processing of sold products

Accessed data

- Total sales 2019
- Product performance data
- Identified assembly steps

Challenges

- Performance data was not accessed for all products
- No detailed information about energy consumption at the customers' sites
- Large variations in applied life cycle assessments
- Vehicle market needed simplifications

Future path

- Customers could be approached to supply emission reports
- Due to the significant contribution to total emissions, more detailed LCA-like studies are recommended

Scope 3: Category 11 – Use of sold products

Accessed data

- Identified impact areas: electricity consumption & weight
- Total sales 2019
- Product performance data

Challenges

- Performance data was not accessed for all products
- Barriers to determine emission factors for the electricity consumption in the vehicles
- Large variations in applied life cycle assessments
- Vehicle market and product lifetimes needed simplifications

Future path

- Electricity impact needs to be assessed
- Due to the significant contribution to total emissions, more detailed LCA-like studies are recommended

Scope 3: Category 12 – End-of-life treatment of sold products

Accessed data

- Total sales 2019
- End-of-life emission factor

Challenges

- Large variations in applied life cycle assessments
- Vehicle market needed simplification

Future path

- Due to the significant contribution to total emissions, more detailed LCA-like studies are recommended
- Consideration of potential benefits through reutilisation efforts

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Scope 3: Category 13 – Downstream leased assets

Autoliv Vårgårda was identified as lessee

- Emission report was requested
- Communication in progress

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Scope 3: Category 14 – Franchises

No franchises owned by the Swedish organisation

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