

# The Influence of Corporate Social Responsibility on the Valuation of Greenhouse Gases

*An exploratory study*

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## Abstract

Prior research has extensively researched several relationships regarding Corporate Social Responsibility, but no research has been done on the relation between Corporate Social Responsibility and the valuation of greenhouse gases. This study sought to find the relationship using case studies and additional interviews. Based on the case studies and the interviews, an assessment of the corporate social responsibility level was made. This was compared to the value given to carbon dioxide and methane. The findings of this study suggest that differences in the focus on the social aspect of CSR and the involvement of public authorities in organizations has a big impact on the valuation assigned. Also, external incentives, such as regulation, can change the valuation assigned. Future research should investigate the determinants of the valuation in a quantitative manner and further distinguish the determinants within the different dimensions of CSR.



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## 1. Introduction

We live in an era where the climate is changing: the average ocean and surface temperature increased by 0.85 degrees Celsius. Besides, ice sheets have been losing mass and sea levels are increasing (IPCC, 2014). These effects of climate change are due to Greenhouse Gases (GHGs) in the atmosphere, such as carbon dioxide ( $CO_2$ ), methane ( $CH_4$ ) and nitrous oxide ( $N_2O$ ).

According to Evans, industries can help to lower the climate change using the following initiatives: Measuring carbon footprint; Carbon capping; Reducing energy use; Rewarding green commutes; Stand up against coal, tar sands and fossil fuels; Investing in renewables; Learning to adapt to climate change (Evans, 2016).

Water boards are part of the industry-section. The tasks of water boards consist of making sure that there is enough surface- and groundwater of good enough quality. Also, they must make sure that dikes will remain intact and that floods won't take place. To make sure that the quality of surface- and groundwater is compliant with the regulations, the boards have so-called Wastewater Treatment Plants (WWTPs). Here, the wastewater is treated to get rid of the substances that harm society and the environment, such as carbon gases, acids and fertilizers. For example, wastewater contains lots of organic materials. Those organic materials are converted into nutrients such as ammonium ( $NH_4$ ) and phosphate (P), which is heavily oxygen-demanding. Because of these nutrients, plants will grow in these waters. When these plants die, these organic materials are converted as well. All the oxygen that is needed for the conversion of organic materials into nutrients, is out of the water. Water animals in the water have less oxygen and will die as well. The treatment of wastewater is needed, but have a very high energy consumption. Water boards can help to enhance the society and the environment by lowering the energy consumption and lowering the emissions of GHGs; harvesting the fertilizing substances, such as phosphate; using the biogas that is formed with the digestion of the sludge, extracted from the waste water. In this thesis, I will focus on the GHGs.

As a result of the changing climate, regulations are changed by governments. There are limitations on the amount of nutrients that may be disposed on the surface waters. Nitrogen may contain 10 milligrams per litre water, where this is 1 mg/l for phosphorus (Bloch, 2005). Other regulation changes as a result of the climate change are the maximum emission amounts of carbon dioxide ( $CO_2$ ), sulfur dioxide ( $SO_2$ ), nitrogen oxides ( $NO_x$ ), non-methane volatile organic compounds (NMVOC) and ammonia ( $NH_3$ ) (Bruyn et al., 2010). Currently, there are no limits for methane ( $CH_4$ ) and nitrous oxide ( $N_2O$ ), even though these gases are more harmful per kilogram in comparison to carbon dioxide. Gases are often compared using the so-called  $CO_2$ -equivalents. Methane has a  $CO_2$ -equivalent of 28, where nitrous oxide has an equivalent of 265 (IPCC, 2014).

The limits on  $CO_2$ -equivalents are often expressed in the Emission Trading System. Here, one emission right represents the right to emission one ton of  $CO_2$ -equivalents (Nederlandse Emissieautoriteit, 2015). So, with one right, an organization is “allowed” to emission around 35 kilograms of methane or 3.7 kilograms of nitrous oxide, when the emissions of methane and nitrous oxide would be regulated.

Since, there is no regulation on the maximum emission amount of methane, organizations are not obliged to report their emission performance regarding this gas. They can voluntarily disclose their emissions. A possible reason to do so could be the fact that a certain firm has a high corporate social responsibility (CSR). CSR can be defined as corporations taking responsibility for their impact on society (European Commission, 2017).

No research is done on whether the valuation of (unregulated) greenhouse gases depends on the social responsibility. This valuation can incorporate the monetary costs of greenhouse gases, but also the social costs. In this study, the valuation of carbon dioxide and methane will be assessed. The valuation of carbon dioxide is assessed because of its use as a benchmark to value other greenhouse gases. Special attention will be given to methane, since the emission of this greenhouse gas is not regulated; the gas on its own is a strong GHG, but it also produces ozone ( $O_3$ ), which pollutes the air quality (Fiore, Horowitz, Dlugokencky, & West, 2006; Hansen, Sato, Ruedy, Lacis, & Oinas, 2000). Nitrous oxide is ignored because of the fact that these emissions are very dependent on which water treatment plant is used. At some plants, nitrous oxide does have a strong effect, whereas it is negligible at other plants (Law, Ye, Pan, & Yuan, 2012).

This study examines the following research question: How does the corporate social responsibility impact the valuation of greenhouse gases? This question will be answered using case studies and additional interviews. The case studies, one at a groundwater treatment facility, another at a water chain organisation, and the last one at an industrial water treatment facility will be conducted using the internship at the faculty of science at the Radboud University, where I am a student-assistant. In this internship, the simultaneous oxidation of ammonium and methane at low temperatures is investigated. These three facilities are part of the research and therefore, access is already granted.

Since the greenhouse gas emissions are a social problem and I can access these facilities for additional information through the internship, a case study is the right research method. In depth information on the three forms of social responsibility regarding these facilities can be conducted, which can change the perception on the social costs of pollution gases heavily. The interviews will help to investigate the different aspects of the four forms of corporate social responsibility. Questions regarding the profitability, quality of the effluent and strategy will be answered. The goal of this research is to give insight in the effect of social responsibility on decision-making. By using multiple case studies, no generalization can be given, but a starting point for further quantitative research can be set.

## 2. Theoretical background

In this chapter, extant literature on corporate social responsibility, the valuation of social goods, and the relation between corporate social responsibility and the valuation of social goods will be discussed.

### 2.1. Corporate social responsibility

Corporate social responsibility (CSR) is a thing since Bowen published his book “Social Responsibilities of Businessmen” (Bowen, 1953). Bowen defined CSR as *“to pursue those policies, to make those decisions or to follow those lines of action which are desirable in terms of the objectives and values of society”* (Bowen, 1953, p.6). Even though it was already a thing, CSR became heavily debated since Milton Friedman gave his opinion with the very well-known words (Carrigan & Attalla, 2001; Epstein-Reeves, 2010; Maignan, 2001): *“there is one and only one social responsibility of business—to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud”* (Friedman, 1970). Friedman refers to Adam Smith’s “Invisible hand” by stating that free competition is needed: human beings serve society’s interest by seeking self-interest, in a world where free competition is a thing. Because of the competition, entrepreneurs will produce products with the best price to quality ratio. When a product is cheaper at entrepreneur A than at B, while the quality of the products is the same, we will buy the product at A. Because of this phenomenon, where governments do not intervene and the highest social profit possible is obtained, this phenomenon is called the “Invisible Hand” (Smith, 1976).

A report of Dailey (2016), based on two surveys, stated that global consumers are willing to make personal sacrifices to address environmental issues (Dailey, 2016). Also, by incorporating corporate social responsibility into the firm, perceptions of consumers of the firms’ goods and the firms in general will ameliorate (Raza Naqvi, Ishtiaq, Kanwal, Ali, & Inderyas, 2013).

This is exactly the point that McWilliams and Siegel (2001) make. They define CSR as “actions that appear to further some social good, beyond the interests of the firm and that what is required by the law” (McWilliams & Siegel, 2001, p.117)

Where Friedman stated that only profitability was the goal of businesses; McWilliams and Siegel stated that there is some social good, beyond the economic interests and legal obligations of the firm, Carroll (1991) states that profitability is the fundament of being socially responsible, also compliance on legal obligations is needed. After that, there is some social good in the form of ethical and philanthropic components of being socially responsible. These components of CSR are not equally weighted, but can be seen as sort of a pyramid:



**Figure 1: Carroll's Pyramid of CSR**

Source: (Carroll, 2016)

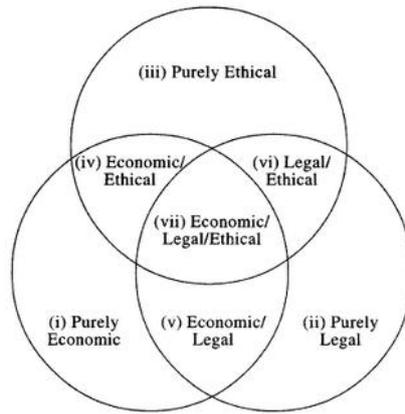
The economic responsibility flows from the business entities that are in place right now. In the past, these entities were formed to provide goods and services. Profit was the main reason why societal members chose to be entrepreneur. Over time, profit became maximum profit. Since profit was the fundamental reason to become entrepreneur, this is the first layer of the pyramid, even before the legal responsibilities. Statements surrounding the economic responsibilities are “It is important to be committed to being as profitable as possible.” and “It is important to maintain a strong competitive position.” (Carroll, 1991 p.40) Economic responsibilities restrict to minimalist public policies, by intertwining with public policies such as subsidies, protection rights and so on, the invisible hand cannot work properly anymore. Therefore, the market will be inefficient and maximum profit cannot be reached (Windsor, 2006).

Businesses are expected to get their profit within the boundaries that are set by regulations and laws, which can be regional, national and international. This is called the legal responsibility. Regulations can be seen as codified ethics since these regulations are general accepted moral views, that they became institutions. Examples of legal responsibilities are “it is important to perform in a manner consistent with expectations of government and law” and “it is important that a successful firm be defined as one that fulfills its legal obligations” (Carroll, 1991).

Besides the economical and legal responsibilities, societies expect firms to operate ethically. Even when there are no written laws, firms are expected to behave fairly while conducting business. These moralities, as they are called too, protect stakeholder’s moral rights. The difference between legal and ethical responsibilities can be hard to distinguish. Legal responsibilities are the written moralities whereas the ethical responsibilities aren’t (Carroll, 2016).

Examples of ethical responsibilities are “it is important to recognize and respect new or evolving ethical/moral norms adopted by society” and “it is important to recognize that corporate integrity and ethical behavior go beyond mere compliance with laws and regulations” (Carroll, 1991, 2016).

Philanthropy is about being a good corporate citizen. This is exactly what is meant with philanthropic responsibilities, voluntarily enhancing society by, for example, engaging in programs to higher social welfare. The difference with ethical responsibilities is about the voluntary part. With ethical responsibilities, society expects you to do something. When you don’t donate to charity, society won’t despise you, a philanthropic responsibility (Carroll, 2016; Porter & Kramer, 2002).



**Figure 2: Three-Domain Model of Corporate Social Responsibility**

Source: (Schwartz & Carroll, 2003)

Philanthropic responsibilities can be vague (Martin, 1994). Schwartz and Carroll (2003) thought so too, they even can be unnecessary. Therefore, Schwartz and Carroll created a new framework, which differs from the traditional one in two ways: First, the philanthropic component of CSR has been left out. Second, in this framework there is overlap between the different components. Economical, legal, and ethical responsibilities still refer to the responsibilities as described by Carroll (1991).

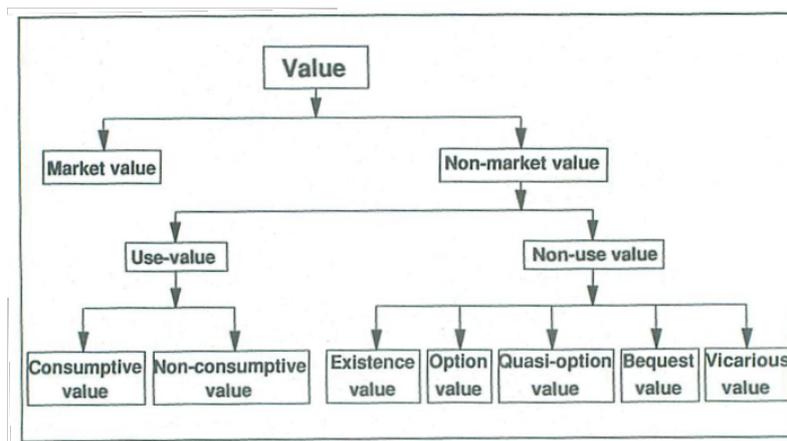
Another way of measuring CSR is using the Triple Bottom Line, founded by Elkington (2001). He stated that firms need to focus on economic, environmental and social value. This definition of CSR is also known as the 3P formulation: People, Planet and Profits.

In this study, the Triple Bottom Line (TBL) will be used to establish the social responsibility of corporations. This is because the interview questions can easily be divided into economic, environmental and social categories. Since the philanthropic requirements of Carroll's pyramid are vague, questions can hardly be categorized as philanthropic. Also, Schwartz and Carroll's model incorporates the legal responsibilities. Every organization will state that they obey the regulations. Therefore, the legal aspect of CSR is a difficult measure.

Beside the TBL, political connectedness is measured, using questions regarding influences from governments and politics. Prior research found that political preference and connectedness are correlated with CSR (Di Giuli & Kostovetsky, 2014; Huang & Zhao, 2016). Huang and Zhao even established a positive relation between the political connectedness and society-oriented responsibilities.

## 2.2. The valuation of social goods

Within economics, a distinction can be made between two types of values, namely market values and non-market values. The first category consists of values that are formed using demand and supply (Sarker & McKenney, 1992). Since social goods are non-exhaustive, demand and supply are not applicable for the valuation of social goods. Non-market values are needed to place a value on a social good.



**Figure 3: Subdivision of value categories**

Source: (Sarker & McKenney, 1992)

Non-market values consist of use-values, which are preferences for participating in an activity, and non-use values. The use-values are consumptive, these involve an environmental resource, such as fishing, or non-consumptive in nature (Sarker & McKenney, 1992). Five categories of non-use values can be distinguished, of which existence value is one. This type of value can be defined as the value placed on a good or service even though you are not using it (Krutilla, 1967; Rosenthal & Nelson, 1992; Sarker & McKenney, 1992). In Krutilla's article Conservation reconsidered, the following example is given: *"There are many persons who obtain satisfaction from mere knowledge that part of wilderness North America remains even though they would be appalled by the prospect of being exposed to it."* (Krutilla, 1967, p.781).

Option value, on the other hand, is the maximum amount people are willing to pay, to have the option to have a certain good or service available in the future (Bishop, 1982; Weisbrod, 1964). Sarker and McKenny (1992) notice that risk aversion is needed to get a positive option value. Option values are constantly used in cost-benefit analysis. Since option values only can be assigned when the decision made is irreversible, and the future benefits of the decision are unknown, people need to make the consideration what to do all the time (Dixit & Pindyck, 1994; Pindyck, 1991).

Even though the terminology is quite similar, option values are very much different from the next value category: quasi-option values. Where option values are based on individual choices, quasi-option values are based on the public sector (Sarker & McKenney, 1992). Also, reality in period 1 affects the expectations for the outcomes of period 2. A possible irreversibility comes into play. As shown by Arrow and Fisher, quasi-option values are not dependent on the risk aversion (Arrow & Fisher, 1974). The quasi-option value can be defined as the difference in expected value of the outcome in period 1, without new information, and the expected value of the outcome in period 2, when new information is incorporated, that is, the value assigned to delaying an irreversible decision (Arrow & Fisher, 1974; Fisher & Hanemann, 1987; Ha-Duong, 1998). As one considers whether a decision needs to be made right now, or in the future, one can state that assigning quasi-option values is sort of a cost-benefit analysis (Freeman, 1984).

Bequest value is the willingness to pay for the possibility of future generations to have that certain good or service within reach (Czarnezki & Zahner, 2005; Greenley, Walsh, & Young, 1981; Walsh, Loomis, & Gillman, 1984). The last value that is distinguished by Sarker & McKenney is the vicarious value, this value is the value you assign to the knowledge that something exists and others can enjoy this phenomenon (Czarnezki & Zahner, 2005; Dlamini, 2012). The bequest value is the most applicable value for this study, since firms might be willing to pay for the next generations to enjoy the earth in full glory.

Another method for valuing the social goods is the travel cost method, developed by Clawson and Knetsch (1966). The rationale behind this theory is the assumption that travelling is costly, the costs of travelling increase when the distance increases and the costs of visitation or recreation increases as well (Randall, 1994). With this valuation method, access to the use of a good or service is bought. Poor and Smith (2004) show this by using the travel cost method to evaluate the willingness to pay to recreate at Saint Mary's City. By doing so, a demand curve, and the consumer surplus as well, can be extracted from the valuation. This valuation method is inapplicable for this study, since this method assumes the usage of territory for camping, or at least visitation.

The last valuation theorem is the contingent valuation method. This valuation method is largely used in environmental cost benefit analysis (Venkatachalam, 2004). The idea is founded by Ciriacy-Wantrup in 1947, when he stated that the prevention of soil erosion had some additional market benefits. Since these benefits were public in nature, they could only be valued using the willingness-to-pay principle (Ciriacy-Wantrup, 1947).

Davis (1963) was the first one to put this theorem into empirical research, by performing a survey among goose-hunters on the benefits of goose hunting. In the discussions surrounding this research, the option value and existence value were acknowledged as part of the total economic value (Venkatachalam, 2004). Where the travel cost method couldn't measure non-use values, the contingent valuation method could, using surveys. The downside of the Contingent Valuation Method is the fact that subjectivity comes into play since opinions are asked in the surveys. Three different problems with the Contingent Valuation Method can be identified: the hypothetical response bias, where respondents assign values that are too high because they know that the situation is hypothetical; there are large differences between the willingness to pay and the willingness to accept; lastly, the preferences of the respondents are often not well-established (Hausman, 2012; Kling, Phaneuf, & Zhao, 2012). The outcomes of the contingent valuation are incorporated into a cost-benefit analysis. It needs to be stated that decisions made in other parts of the cost-benefit analysis do in fact influence the outcomes of the contingent valuation (Báez & Herrero, 2012; Whitehead & Blomquist, 2006).

The method used in this research is partly comparable to the Contingent Valuation Method, since interviews, instead of surveys, are conducted. I'm aware of the shortcomings of this research method, but it can be seen as the best in breed.

### 2.3. The relation between CSR and the valuation of social goods

Using the different social responsibility dimensions (social, environmental and economical), the relation between these CSR dimensions and the valuation of social goods will be investigated.

Firms that are highly socially responsible on the social component of CSR are in particular focussed on the amelioration of working conditions of human beings. Also, inclusiveness is a term that these firms feel strongly about. Werner (2009) showed in her research that initiatives to reduce the social exclusion of minorities in Bangladesh worked out. She pleads for more Corporate Social Responsibility initiatives. Another part of the social component, as shown by DESUR (2009), is the job creation. By creating new jobs, the employment level will rise, which in turn will make people happier, thereby the social happiness level as well (Ohtake, 2012). Training and development can also be seen as an important factor in the social component of CSR. High values are attached to the amelioration of the capabilities of employees, when firms are heavily involved in being social responsible (Cavazotte & Chang, 2016).

On the economic aspect of CSR, it can be stated that subjects like quality standards, information providing, and responsible purchasing are of importance. Firms that are economically socially responsible are likely to invest in providing better information towards stakeholders and the other way around (Morsing & Schultz, 2006). Standards are of importance at all time, because of regulations. But, when a firm is focussing on the economic aspect of social responsibility, they are likely to specify the standards set even further, or make them even stricter for themselves (Gouldson, 2006). Responsible purchasing is very important as well, as shown by (Carter & Carter, 1998; Carter & Jennings, 2004).

The last component of Corporate Social Responsibility can be described as the environmental component. Here, indirect emissions, that are the emissions not directly linked to the production process of the firm in question but further up or down the supply chain, are of importance (Benjaafar, Li, & Daskin, 2013; Kolk, Levy, & Pinkse, 2008; Sundarakani, De Souza, Goh, Wagner, & Manikandan, 2010). Another factor is the efficiency (Bianco, Cucchiatti, & Griffa, 2007; Peattie & Crane, 2005). However, this can be seen as a short-term profit (Eichholtz, Kok, & Quigley, 2009). The last main aspect within the environmental component of Corporate Social Responsibility can be defined as recycling. Firms that invest in the environmental dimension of CSR are very likely to recycle waste and convert them into resources (Maloni & Brown, 2006; McWilliams, Siegel, & Wright, 2006).

The valuation of the greenhouse gases can be subdivided into the environmental dimension of CSR. Therefore, I assume that firms that are well-performing on this environmental dimension, are likely to assign high values to the reduce of greenhouse gas emissions.

### 3. Methods

I conducted a study on the influence of CSR on the valuation of greenhouse gases. This study consisted of two components, namely interviews with representatives of the different firms and research of documents regarding performance and Corporate Social Responsibility.

Those two parts are woven into each other since the information gathered from the documents was used to construct the questions of the semi-structured interviews.

To set-up the interviews, contact information gathered from my job on the side was used. "Waterweb" is the only firm that was not directly accessed because of the job on the side. I've accessed "Waterweb" because the "Energie- en grondstoffenfabriek", which was an initial contact referred me to them. The interviews were semi-structured of nature. In order to let the interviewees, speak freely, anonymity has been guaranteed. Also, the interviews were conducted in Dutch to avoid misunderstanding and incapability of expressing what they were willing to say, since English is not our native language. When quotes are used in this paper, the original Dutch answers are translated as good as possible into English. The responses were recorded using a mobile phone and transcribed afterwards. All respondents<sup>1</sup> were fine with the recording of the interview, as long as anonymity has been guaranteed. The interview questions used can be found in Appendix 2. These questions can be seen as a guide line throughout the entire interview. Additional questions were asked when clarification was needed. An example of that in the interview with "Waterweb". Here, the question asked was about the determinants of an investment decision. "Waterweb" responded with the words: *"All investments start with a necessity."* After the interviewee finished his answer on the original question, an additional question regarding what can be defined as this necessity was asked. The interview questions can be subdivided into five categories: first, general questions to get a feeling of the interviewee and the firm; second, questions regarding the involvement of governments in the firm; third, some questions about the social component of CSR; fourth, questions on the economical aspect of CSR and last, questions about the environmental component of CSR are being asked. The subdivision of interview questions can be found in figure 4 as well, where the interview questions used are attached in appendix 2. The distinctions in questions is made, to get a clear view of the differences between organizations in various categories of CSR.

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<sup>1</sup> A list of interviewees can be found in Appendix 1.

General questions	6 questions
Political involvement	7 questions
Social aspect	5 questions
Economic aspect	4 questions
Environmental aspect	6 or 7 questions, depending on whether social cost is used

**Figure 4: Subdivision of interview questions and amount of questions**

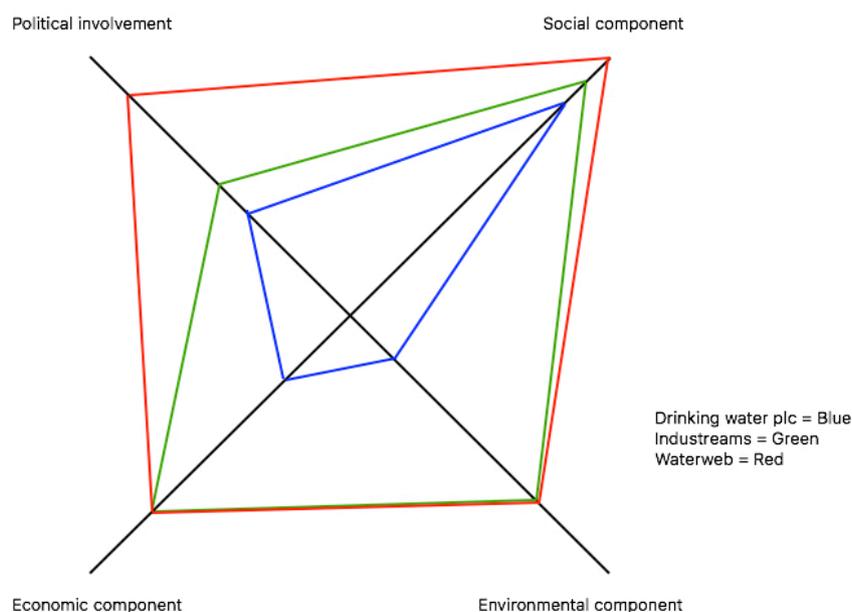
First of all, the answers were analysed using binary coding to get a clear view of the CSR-profile that can be assigned to these different organisations. Each different category within CSR itself is made clear as well. A firm could be more socially responsible overall, while the social responsibility in the economic aspect is lower than another firm, for example. A clear CSR-profile is needed to possibly understand different outcomes regarding the valuation of greenhouse gases better. When the answer on a question showed social responsibility, such as *“we have... solar panels on our headquarters in Zwolle”* (Interviewee “Drinking water plc.”, personal communication, June 2, 2017) and *“what we do all the time, and we’ll keep doing that, is motivating and stimulating our employees to keep learning. But they must take initiative, they must want it themselves as well”* (Interviewee “Industreams”, personal communication, June 13, 2017), a 1 was noted as answer, when there was no sign of social responsibility in the answer on a certain question, a 0 was noted. All 1-coded answers were added up and divided by the amount of questions on that certain category. This output was multiplied by ten to find the centimetres from origin. Later on, the answers are discussed extensively to motivate the figure drafted, and to make differences between organisations even more clear. The documents used for constructing the interviews were mostly publicly available. These included yearly reports, sustainability reports and minutes of interviews gathered for the job on the side.

## 4. Results

In this chapter, the results of the research will be discussed. First, the social responsibility of the different firms will be discussed using a figure that indicates the political involvement, the social, economic and environmental component of CSR. Then, the results regarding the valuation of the greenhouse gases carbon dioxide and methane will be discussed.

### 4.1. Social responsibility of the different firms

In this section, all parameters of social responsibility will be discussed extensively. The political connectedness of the firms is also discussed. Since “Drinking water plc.” is the least social responsible and least political involved as well, they are used as a “benchmark”. Per parameter, “Drinking water plc.” situation is sketched as a reference point, in order to make the differences between companies clear.



**Figure 5: Indication on political involvement and social responsibility of the firms**

Source: (Interviewee “Drinking water plc.”, Personal Communication, June 2, 2017; Interviewee “Industreams”, Personal Communication, June 13, 2017; Interviewee “Waterweb”, Personal Communication, June 29, 2017)

#### 4.1.1. Political involvement

Regarding the political involvement, the connection between this parameter and the corporate social responsibility, as found by Di Giuli & Kostovetsky (2014) and Huang & Zhao (2016) can also be determined in this study.

On the subject of political involvement, "Drinking water plc." stated that the financial resources needed, to do business, are gathered by the drinking water fares that are paid by customers. When it turns out that this input is not enough, additional money is gathered by getting loans in the market. By not using subsidies as a source of money, the political involvement on this point is low, to not at all. Regarding the stakeholders, governments can be established as a stakeholder for "Drinking water plc.". Governments influence the policy set by "Drinking water plc." in the form of the Precario tax, which is a tax for the tubes that are placed in municipalities' ground, that needs to be paid. Also, water extraction licenses can only be granted by provinces. Gathering such a license can take up to ten years. Therefore, political involvement on this point is quite substantial. On the other hand, "Drinking water plc." cannot influence the governments, for example by recommendations on policy. Besides all regulations and government interventions, "Drinking water plc." has their own thresholds and benchmarks that need to be taken into account. An example is the hardness of the drinking water that is supplied to all inhabitants connected to "Drinking water plc.". The regulatory boundary is 2.5 millimol per liter, but "Drinking water plc." softens the water when it becomes higher than 2 millimol per liter. This is done to help customers: *"Above 2 millimol, we would like to soften the water... There's been lots of discussions on our thresholds and benchmarks. Lots of stuff has an impact... What was very important for customers, was the fact that a water boiler and a coffee machine break down more often, when the water is harder."* (Interviewee "Drinking water plc.", personal communication, June 2, 2017) Since these thresholds and benchmarks are set by "Drinking water plc." self, politics are not that much involved here.

For "Industreams", the political involvement is somewhat higher: Where "Drinking water plc." gets their financial resources only from consumers' fees for drinking water and the financial market, when the fees are insufficient, "Industreams" also gathers some finances from partners and subsidies. Also, since "Industreams" treats the wastewater of a potato factory, they have an influence in the policy that is maintained.

Partners of “Industreams” also have a say in the policy used. Another factor that stands out is that “Industreams” is nudged towards more sustainable investments by provinces. Besides these differences, “Industreams” and “Drinking water plc.” are very much alike. Therefore, the political involvement is just a little higher for “Industreams”.

“Waterweb”, on the other hand, is very independent of political financial resources, such as subsidies. They gather their resources from all water-related taxes, such as the drinking water tariff, the water board tax and the effluent charge.

The interviewee of “Waterweb” did state that politics influence the policy maintained: municipalities are nudging the firms towards a more sustainable policy, certain demands are made on this topic. Since “Waterweb” is a governmental agency, they can influence politics as well. As with “Drinking water plc.”, “Waterweb” also has their own thresholds and benchmarks to even further enhance the sustainability maintained by the firms.

#### 4.1.2. Social component

The first thing that stands out is the fact that “Drinking water plc.” is willing to help consumers, that are in debt restructuring, to pay their invoices. Of course, this can also be explained as egocentric, hence the fact that consumers that are able to pay invoices, can pay “Drinking water plc.” as well. But still, there are lots of organisations that don’t take the effort to help the ones that are in the need of help. Also, “Drinking water plc.” makes use of employment agencies. Regarding innovation, “Drinking water plc.” can be described as specialist-based, and oriented towards the future. Short-term innovations are not used. Investing in employees is also very specialist-based, fitting courses for every team are in place. An example of the specialist course: One of the interviewees at “Drinking water plc.” stated that, due to the improving lab technologies, more and more is known about the substances in the drinking water. To know what to do, courses can be followed by technicians. Regarding the gender distribution, it can be said that “Drinking water plc.” employees 75% men and 25% women. This figure is not evenly split because of the technical background.

For “Industreams”, sustainability lies in the fact that we need to make the world a better place, together. This can be seen in the fact that “Industreams” had some residual heat which couldn’t be used in a profitable way. They could just open the door and destroy this heat, but they found a way to supply the nearby swimming pool of this residual heat, who used it to warm the water. “Industreams” didn’t become more durable, but the world did. Also, some initiatives are taken to help the Third World: *“Via a partner, we’ve made some test batches of a certain fertilizer for Solidaridad... We’ve made the fertilizers for cotton, corn and soya in Mozambique.”* (Interviewee “Industreams”, personal communication, June 13, 2017).

Again, making the world as a whole a more durable place. “Industreams” can be described as very progressive and risk-taking regarding innovations.

An example is the reclamation of phosphate from wastewater. This phosphate is sold a fertilizer. “Industreams” was one of the first to use this technology. Employees do have the chance to enhance their skills, but own initiative is very important. Employment agencies are used as well and the gender distribution is 90% men compared to 10% women. This is, just like “Drinking water plc.”, due to the fact that the business is very technical.

Regarding the social component for “Waterweb”, it can be stated that “Waterweb” has initiatives as well, to make the world overall a better place. They even have their own organisation, called Wereld “Waterweb”, where organisations are encouraged to cooperate with other organisations and start projects anywhere in the world. Within “Waterweb”, job circulation is a thing. Employees have a budget that they can spend on training and courses. It could be that a person had a job at the office at first, and afterwards is active in the technological part of “Waterweb”. Besides the investments in employees’ capabilities, “Waterweb” is also very progressive regarding innovation. “Waterweb” feels strongly on the subject of sustainability. This is possible because of the social background of the firm. On the subject of gender distribution, it can be said that the percentage women employed is quite high, relatively to the other drinking water companies.

#### 4.1.3. Economical component

The question regarding the accumulation of financial resources is part of the political involvement category and the economic category as well. Obviously, the answers are completely the same, so I won't get into this component here.

The achievements of "Drinking water plc." are evaluated based on the benchmarks that are set by the firm itself. These benchmarks are set on the water quality, operating costs, customer service, the buying policy that is maintained, cost efficiency. With the benchmarks, all drinking water companies of the Netherlands are evaluated. So, the performance of "Drinking water plc." is compared to the other companies. When an investment is made, "Drinking water plc." first checks whether the business case is profitable. If that is the case, the environmental, health and safety standards come into play.

For "Industreams" a check-up is performed based on the estimates made for that year. Most of the time, performance is discussed in a meeting with the supervisory board. The performance measures are about the amount of water that is treated in that period, the amount of biogas generated, how many working hours were counted and so on. "Industreams" considers the possible profitability of a business case when debating whether an investment needs to be done or not. Other factors, that are kept in mind, are the environmental impact and the safety implications.

The achievements of "Waterweb" are evaluated using the thresholds and benchmarks set in the entire drinking water sector. They also made benchmarks for the other water sectors, such as the wastewater industry and the sewage industry. The two most prominent categories in these benchmarks are the environmental aspect and sustainability. Besides, the costs of projects are evaluated as well. Regarding the environmental impact of products used, "Waterweb" incorporates the direct environmental impact, as well as the indirect. When certain products are bought, questions are raised on the origins and the mode of production used. They are very strict and fierce on these measures. When the interviewee was confronted with the fact that firms state that they want to be as green as possible, but they don't incorporate the social costs of the products used, the answer was: *"I think that is rubbish... You need to be as sustainable in every aspect that you can influence, so the procurement policy as well..."*

*When you don't have enough financial resources, you should organize a meeting with the entire sector, then you do have enough financial resources. So, yes, I think that is a very cowardly position to take.*" (Interviewee "Waterweb", personal communication, June 29, 2017). These social costs are of very high importance, as can be noticed from the quote.

#### 4.1.4. Environmental component

The main challenges regarding the environment, for "Drinking water plc.", is the fact that the surface water quality can change because of climate change. According to the interviewees, "Drinking water plc." won't experience major changes in the drinking water quality, since groundwater is used, which is hardly affected. Nonetheless, the changes in climate need to be observed and investments need to be made to cope with these changes, if needed. In order to reduce the climate change, "Drinking water plc." uses several methods to make their business "greener".

An example is the use of solar panels at the headquarter in Zwolle. Another way is the extraction of resources from wastewater. 99% of all residues is used durably. Examples are the use of humid acids and chalk for animal feed and in the glass industry. But, the core business is supplying high-quality drinking water to consumers, durable energy use comes second. Since it comes second, "Drinking water plc." doesn't consider the environmental impact of the products used. So, the CO<sub>2</sub>-footprint of the PVC tubes used is not considered. Also, "Drinking water plc." is not a member of the EU Emission Trading System, but is part of the so-called "meerjarenspraken 3". These agreements are experienced as quite hard, since the drinking water needs to be of high quality at a low cost for every consumer, since it is a basic need.

"Industreams" experiences the emission rights on all kinds of substances as the main environmental challenge. Also, changes in regulation can make a substantial impact on the policy. Durable initiatives are the usage of residual heat for the swimming pool nearby, the fabrication of fertilizers from residues and the tests with all other residues that are still not durably used. As with "Drinking water plc.", the environmental effects of the products used are not taken into account. "Industreams" makes use of the following resources from residues: biogas, struvite, nitrogen and tare. Where "Drinking water plc." is not a member of the EU Emission Trading System, "Industreams", is a member.

However, this doesn't change the policy that much, mainly because of the low equilibrium prices in the trading system.

Since "Waterweb" extracts water from the Rhine, and the water level could change drastically from a change in climate, this is seen as the main environmental challenge. Because of the climate change, extreme weather, as in drought or floods, can occur. As we, the Dutch, live below sea level in a big part of the country, this can also be seen as a huge environmental challenge. Peat dikes have collapsed earlier as well, because it was too dry (nu.nl, 2003). Regarding green energy, "Waterweb" is very progressive as well: *"We put a lot of solar panels in place. We aim for 100.000. We also generate wind power, we've got a very nice spot in the westerly harbour area, where six wind turbines we'll be put in place."* (Interviewee "Waterweb", personal communication, June 29, 2017) The recycling of residues is starting up; therefore, no percentages are known, but "Waterweb" does know what substances are in the water they treat. Their aim is to extract these substances and convert them into resources. Also, the used tubes that are replaced get a new purpose.

It is clear that "Drinking water plc." is the least social responsible in the environmental aspect. "Industreams" and "Waterweb" are equal on this component. Based on this information, the valuation of greenhouse gases, assigned by "Industreams" and "Waterweb" is likely to be higher than the one assigned by "Drinking water plc.".

#### 4.2. The valuation of carbon dioxide and methane

At "Drinking water plc.", CO<sub>2</sub> is not converted into monetary values. They didn't know that some firms do: *"Are there some companies who in fact convert these kinds of factors into Euros?"* (Interviewee "Drinking water plc.", personal communication, June 2, 2017). Even though no monetary value is assigned to carbon dioxide, and with that methane, "Drinking water plc." does check the environmental impact of CO<sub>2</sub>. But, this is only done when several investment choices are very much alike. Then, the impact of an investment on the environment can be taken into account.

“Industreams” is more progressive in this valuation. They stated that converting the emission of greenhouse gases into Euros would be very useful. Right now, the equilibrium is €4.94 for one emission right (Bloomberg L.P., 2017). “Industreams” stated that this price is way too low to have any impact on the policy that is being maintained by companies: *“But I do know... when it is worth six euros right now, and in a little while it becomes thirty-, thirty-five euros... then you will see some changes. Then, companies will adapt to that.”* (Interviewee “Industreams”, personal communication, June 13, 2017). With a higher price for emitting greenhouse gases, such as carbon dioxide, companies will get nudged towards sustainable investments. When the price of carbon dioxide would rise towards €35, the cost of emitting a ton of methane would be €850. According to “Industreams”, this would be a fair price, but right now, it is not realistic.

“Waterweb” has the very fierce opinion that the CO<sub>2</sub>-emission trading system is not working. This is the main result of the free allocation of emission rights in the first two phases of the EU ETS. This whole system should be brought down and rebuilt into a new system where the market mechanism does in fact work. As stated, “Waterweb” does incorporate direct and indirect social costs of the products used. According to “Waterweb”, and the municipality, the social costs of carbon dioxide emissions are much higher than the equilibrium price in the emission trading system. They incorporate a social cost of €60 per ton CO<sub>2</sub> emitted. The faction GroenLinks in Amsterdam even stated that the social costs are around €80 till €100. Because of the social background of “Waterweb”, they can use these kinds of prices to investigate the social benefits of reducing greenhouse gas emissions. All investments are profitable because of that. Methane is also considered. “Waterweb” investigates the possibilities of methane in premium uses. They use CO<sub>2</sub>-equivalents to frame the social costs of other greenhouse gases. Using these CO<sub>2</sub>-equivalents, “Waterweb” maintains social costs of €1500 per ton methane emitted.

#### 4.3. The relation between CSR and the valuation of social cost of carbon

As shown in paragraph 4.1, “Waterweb” is the most social responsible firm, in general terms, then comes “Industreams”, and “Drinking water plc.” is the least social responsible of these three, which is remarkable in the first place. “Drinking water plc.” is a drinking water company that, you would assume, has social interests. Drinking water is priority number one, so profitability would come at the second place.

When Corporate Social Responsibility is separated into the social, economic and environmental aspect, “Drinking water plc.” is the least social responsible on all three components. “Industreams” and “Waterweb” are very similar: only on the social aspect, “Industreams” is a little less social responsible. When the political involvement is taken into account, “Waterweb” can be seen as the most political involved, “Drinking water plc.” the least, and “Industreams” steers a middle course.

The results on the incorporation of social costs of carbon, and the valuation of these costs, show that “Waterweb” is also the most progressive in using social costs and assign the highest monetary value. A monetary benefit of €60 is assigned to the reduce of the CO<sub>2</sub>-emission by one ton: *“Within the council, there was a discussion about the real price of CO<sub>2</sub>. Then you have on the lower boundary a price of sixty euros, up to one-hundred euros.”* (Interviewee “Waterweb”, personal communication, June 29, 2017). Using the CO<sub>2</sub>-equivalents, the monetary benefit of reducing methane emissions by one ton would be €1500. This high value is in line with the high environmental social responsibility figure, that is assigned to “Waterweb”. Another reason behind this value could be the organisational form of “Waterweb”. Since “Waterweb” is a non-profit foundation, with the municipality Amsterdam and Water Board Amsterdam, Gooi & Vecht as parent organisations, it could be the case that risks can more easily be taken, the government could warrant for “Waterweb”, if an investment of policy change turns out bad. As a subsidiary company, it is very likely that you have a policy very similar to the ones of the parent organisations: *“We use the principles of our parental companies. At the Water Board, we see some movement regarding the buying of electricity. They want the greenest energy possible. They find it absurd that the energy used by us, in any way can be linked to “non-sustainable”.* (Interviewee “Waterweb”, personal communication, June 29, 2017).

As the parent companies have a high impact on the policy maintained by “Waterweb”, it could be said that the political connectedness has an influence on the valuation of greenhouse gases. On the other hand, because of the high value assigned, all investments are deemed profitable. One could also state that this is not progressive at all, and being progressive at social responsibility must be defined as investing in social responsibility while low benefits of CO<sub>2</sub> reductions are assigned.

“Drinking water plc.” is the least social responsible. This is also depicted in the usage of social costs of carbon, which they hardly incorporate. Only when investment alternatives are very similar, the social cost of carbon could have an impact. This impact is not converted into euros whatsoever. They mainly focus on delivering drinking water of high quality, afterwards safety and sustainability are of importance. That they do not make use of the social cost of carbon is very clear from the interview, where cynical and condescending reactions were given when the social costs value of carbon according to Stanford University was stated: *“Then you are going to incorporate the flooding of the Maldives as well, very crudely stated haha.”* (Interviewee “Drinking water plc.”, personal communication, June 2, 2017). “Drinking water plc.” is focussing on their core business of supplying high-quality drinking water at a low price. This could be a reason why no attention is given to the social costs of carbon. When regulations are put in place by external parties, something will happen within the firm: *“We do have, I don’t know what that is now, that we wanted to save an amount of energy before 2020... But that is also related to the principles set by Brussels.”* (Interviewee “Drinking water plc.”, personal communication, June 2, 2017). External incentives need to be in place, in order to make companies more sustainable, and more aware of the damage done by climate change.

“Industreams” is the organisation that is positioned between these two extremes, both on the CSR level, and on the valuation of greenhouse gases. They also do not consider the environmental effects of the products used, as is the case at “Drinking water plc.”. “Industreams” does, however, state that the incorporation of monetary values for carbon dioxide emissions would help to make the world more sustainable.

Right now, with the equilibrium price of €5 per ton CO<sub>2</sub>, this is not possible. €30 per ton CO<sub>2</sub> would be a better depiction of the social costs. Consequently, a price per ton methane emitted of €850 would be “fair”, but this is not realistic. When these prices would be real, corporations will react to this price: *“I do know, when it is worth six euros now, and in the future, it will be thirty, thirty-five... then you will see some movements. Companies will react to that, that is going to help. Whether they have to pay it, or get it.”* (Interviewee “Industreams”, personal communication, June 13, 2017).

The difference in the valuation between “Industreams” and “Waterweb” could be due to the differences in the other components of CSR. On the economic and environmental aspect, both firms are similar. However, when we look at the social component, “Waterweb” is a little more responsible. One question in the social responsible sphere was about innovation. “Industreams” has a little less innovation, compared to “Waterweb”. The difference in the valuation of greenhouse gases could be liable for that. As stated before, when a high value is assigned, investments that reduce the emissions of greenhouse gases have more profitability than with the firms that assign lower values. Therefore, more innovative technology, that is costly in monetary values, can only be taken into action within the firm, when benefits are high. The reduce in emissions could be one of those benefits.

Another reason could be the political involvement. Because “Waterweb” needs to comply with the wishes of their parental companies, and have wider network to take resources from, it is very much possible that more innovative technologies can be profitable for “Waterweb” but not for “Industreams”, which has a much smaller network and is operating in an industrial sector, where the monetary value is the most important one.

## 5. Conclusion and discussion

This section starts with this study's findings, along with their managerial implications. Afterwards, the shortcomings of this study will be discussed and directions for future research are established.

This study tried to find a relationship between corporate social responsibility and the valuation of greenhouse gases. The likelihood that a firm would behave socially responsible was assessed on the basis of the political involvement in these firms, since this relationship is already established by Di Giuli & Kostovetsky (2014) and Huang & Zhao (2016). The corporate social responsibility level itself was assessed using questions on the three components of social responsibility: the social, economic and environmental components. Also, questions regarding the incorporation of the social costs of carbon were asked, to assess the valuation of greenhouse gases.

Intuitively, one could state that the more social responsible firms are more likely to assign higher values to the reduce of greenhouse gases. This is also found in this research. With the separation of the different components of Corporate Social Responsibility, several subjects within CSR that can be found important are distinguished. Within the social component, firms are willing to invest in the working conditions, inclusiveness of all societal groups, and the ability for employees to train and develop themselves. On the economical part, the focus is more on the standards set for the quality of the work done. Also, information providing and responsible purchasing are of importance. Within the last component, the environmental one, subjects like indirect emissions, efficiency and recycling are investment areas for social responsible firms. In this study, differences in valuation was mainly dependent on the social component of CSR, and the political involvement of firms. When public authorities are heavily involved in a company, as was the case with "Waterweb", the valuation of greenhouse gases will rise.

Where other relationships with CSR are investigated, the relationship between CSR and the valuation of greenhouse gases has not been investigated. This study can be seen as the starting point for research in this area. This study also made clear that the definition of being progressive in social responsibility needs to be defined. Being progressive in social responsibility can be interpreted in two ways right now. One could state that this is the assignment of high values to the reduce in carbon emissions. On the other hand, when one values this reduce in carbon emissions highly, all investments can be seen as profitable. Therefore, being progressive could also be defined as investing socially responsible, even though the monetary benefits of reducing carbon emissions are low. Within this study, differences regarding CSR are pointed out using the different dimensions of CSR. Future research could investigate the possibility that certain subjects within the dimensions are liable for the differences in valuation.

The fact that the involvement of public authorities influences the valuation of greenhouse gases implicates that firms need to think about their position in society. Do they feel strongly about sustainability because it is in the spirit of the firm, or because their connections to public authorities? Another implication for society is the fact that firms can think of using their networks to make the world more sustainable and being profitable at the same time. Right now, firms hide behind the argument that sustainable investing is not profitable at all times. This research, the case of “Waterweb” in particular, showed that sustainable investments can be made, when the right policy is, and networks are, in place. Also, the cases in this study stated that regulations on the maximum amount of emitting greenhouse gases will make organisations more sustainable. Coercion is the driving factor for a lot of organisations, since you must comply, whereas right now, firms do not care so much, because they are profitable and act within the boundaries of the law.

Even though this exploratory research's aim was not to find a statistical relationship between corporate social responsibility and the valuation of greenhouse gases, the generalizability of this study is hampered by using a multiple case study. Also, the sample size in this study is very small, due to a lack of time and accessibility. In addition, the binary coding used to form an image of the social responsibility brings in some subjectivity. When an answer found itself in the so-called "grey area", a decision on whether it would be seen as social responsible or not, needed to be made. Another problem with the binary coding is the relative importance of a question: the environmental component was measured using 7 questions, whereas the economic component was measured with 4 questions. It is stated that the figure is only used to find the relative social responsibility, but the figure can easily be interpreted as showcasing the statistical relative differences in social responsibility. Also, in the interviews conducted, I introduced the subject of the study. By doing so, the interviewees could give some political justifiable answers, since the goal of the study is known.

To make the comparison between Corporate Social Responsibility and the valuation of greenhouse gases, the focus of the firm on the different aspects of CSR needed to be made clear. This was done by investigating the answers given. For future research, it might be an idea to ask the companies themselves to state on which category their focus is. This can also help to make the research more quantitative.

Future research could use quantitative data to investigate the relation. In this research, only the sign of the relationship is established. Quantitative data could help to find strength of the correlation between corporate social responsibility and the valuation of greenhouse gases. Also, when different valuations are assigned to greenhouse gases, it is important to further investigate the differences between organisations. In this research, only the differences within corporate social responsibility are investigated. Characteristics within the different components of CSR and characteristics outside of CSR can obviously have an impact as well. Furthermore, experiments could be conducted to research the effects of different prices for the emissions of greenhouse gases on the sustainable investment behaviour of organisations.

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## Appendix 1. List of interviewees

<b>Company name</b>	<b>Function</b>
“Drinking water plc.”	Specialist Process Technology Planning
“Industreams”	Project Manager Analyst
“Waterweb”	Strategic Advisor

## Appendix 2. Interview questions per subject

Generally asked interview questions subdivided into categories				
General questions	Political involvement	Social component	Economical component	Environmental Component
Could you tell something about yourself and your position within the firm?	How does the firm get its financial resources?	How does 'equal opportunities for everyone' come forward in your organisation?	How does the firm get its financial resources?	Are there any challenges regarding the environment?
Could you tell something about the firm you work for?	What are the stakeholders?	What is the gender distribution in your organisation?	How are the achievements of the organisation evaluated?	Do you consider the environmental effects of the products you use?
What can be said about the strategy of the firm?	What kind of government do you have to deal with?	Does your organisation make use of employment agencies?	Are the social costs of carbon dioxide incorporated in an investment decision?	What do you think about energy from sun, wind and water?
Which trade-offs are made when making an investment decision?	How does government influence your policy?	How would you describe the organisation regarding innovation?	Of what importance are these social costs?	To what extent do you recycle the residues from the production process?
What can be seen as the biggest challenges for the organisation?	Do you influence the government?	Do employees have the ability to get training or follow courses?		What do you think of converting CO2 into Euros? What would be a fair price?
Do you have additional information or documents that could be of importance?	Which regulations are of importance for the organisation?			Are you member of the EU Emission Trading System? If yes/no, how does/could it change your policy?
	Besides government and regulations, what other aspects influence policy?			Using the CO2-equivalents drafted by CE Delft, methane would cost €850, is this fair?