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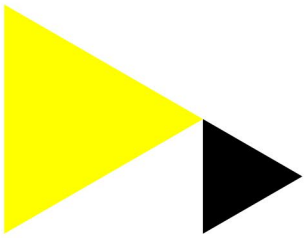

Corporate Reputation of Companies on Twitter seen from a Sustainability Perspective

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Abstract. Corporate reputation is becoming increasingly important for firms; social media platforms such as Twitter are used to convey their message. In this paper, corporate reputation will be assessed from a sustainability perspective. Using sentiment analysis, the top 100 brands of the Netherlands were scraped and analyzed. The companies were registered in the sustainable industry classification system (SICS) to perform the analysis on an industry level. A semantic search tool called Open Semantic Desktop Search was used to filter through the data to find keywords related to sustainability and corporate reputation. Findings show that companies that tweet more often about corporate reputation and sustainability receive overall a more positive sentiment from the public.

Keywords: Corporate Reputation, Sustainability, Semantic Search.

1 Introduction

In the current society, social media platforms are an extensive part of the communication strategy companies use to reach stakeholders (Dijkmans et al., 2015). Therefore, firms try to get engagement through these social media outlets since it benefits them (Burson-Marsteller, 2012). However, whether social media activities bring an actual benefit to corporate reputation (CR) has not been studied extensively (Dijkmans et al., 2015). Currently, a limited number of studies focus on disclosing CR (Suarez-Rico et al., 2018). This paper will focus on the link between social media activities and CR.

Research within CR communication is continuously growing within business research and practice (Pollach et al., 2012). CR is especially relevant since it can help a firm be perceived more positively (Chernev and Blair, 2015) and achieve competitive advantages (Porter and Kramer, 2006). Moreover, there is a scientific consensus that CR is a strategic indicator of expanding a company's value (Love and Kraatz, 2017). Companies that have accrued a good reputation are more likely to successfully introduce innovative products and reach stakeholders (Kwon and Lee., 2019).

According to Fombrun et al. (2015), multiple variables can be used to measure CR. One of these variables is citizenship which focuses on companies acting like good citizens and signaling that to their stakeholders. Citizenship derives from environmental sustainability and responsible behavior, which also influences CR (Fombrun et al.,

2015.) Friedman & Miles (2001) mention that sustainability is increasingly becoming a determinant of CR since firms are becoming aware of the need of managing a wider range of social and environmental concerns. In agreement, Bartikowski and Walsh (2011) explain that citizenship and sustainability directly positively affect reputation.

Orlilzky et al. (2003) affirm this notion that firms should focus on profit and how the profit is made, and whether it is done sustainably. While firms may invest in their social achievements, it is much more challenging to achieve a better social reputation without proper acknowledgment of this information (Hasseldine, Salama, and Toms, 2005). By communicating this information to the public, the company is trying to show that they act responsibly and sustainably, enhancing their value (Vitezić et al., 2012).

Social media, especially Facebook and Twitter are used to communicate this message by engaging with their followers (Dijkmans et al., 2015: Aurajo et al., 2012). Through social media, people have changed how they interact with firms (Hanna et al., 2011). Firms had to react to these changes and adapt their strategy. The most common use of social media is to improve a firm's trustworthiness, brand attitude, and customer commitment (Van Noort and Willemsen, 2011). A significant following that actively engages in the firm's activities is highly valuable (Dijkmans et al., 2015). Firms are involved in social media because this form of communication is approximately twenty times more advantageous than marketing campaigns and thirty times more advantageous than media appearances (Trusov et al., 2009). Firms recognize the importance of social media but often do not understand how their actions impact their CR (Pentina et al., 2013).

Twitter and Facebook are the most used by companies (Burson-Marsteller, 2012). Twitter is an interactive tool that enables users to interact with each other in real-time (Suarez-Rico et al., 2018), while Facebook has a friend-to-friend structure in which peers have to confirm relationships with each other (Brossetta, 2018). Among these two platforms, Twitter seems to have the highest engagement, which is a huge advantage for companies that want to spread a particular message (Rowe et al., 2014). However, Twitter limits the number of characters that each tweet can display, making it more difficult for companies and people to express themselves (Li et al., 2013). Nevertheless, Twitter supplies organizations with a reliable tool to distribute information and open dialogue with many stakeholders (Araujo and Neijens, 2012). The remainder of this paper will focus on Twitter engagement since it has a positive relationship with a CR (Li et al., 2013).

The purpose of our research is to give a sustainability perspective of CR on social media. Since most of the research about CR is traditionally done with surveys (Lewis, 2001), there is a need for engaging stakeholders through social media such as Twitter (Aurajo et al., 2018). CR is becoming a more popular topic within the academic literature since it is valuable in developing long-term relationships with customers (Mohammed and Rashid, 2016). Therefore, an algorithm-based analysis of Twitter conversations will be used to measure the influence of sustainability and its related CR constructs on stakeholders.

The **main research question (MRQ)** is as follows: To what extent are sustainability and CR related variables that are measurable on Twitter? The following **sub-**

questions will be of relevance: (A) Which sustainability traits are in general relevant to measure on Twitter? (B) Which sustainability traits are particularly important to CR? (C) How can sustainability traits best be measured on Twitter?

The structure of the paper is as follows. First, in section 2, we derive two sets of working hypotheses that are relevant to be tested according to the current academic literature. Thereafter, we discuss applicable methodology in section 3 and give results in section 4. Finally, in section 5, we discuss the work and give some directions for future work.

2 Literature Review

This section will give insight into the different theoretical views there are about CR. Next to that, a conceptual link between sustainability and CR will be established. Two sets of hypotheses will be used to give the paper structure: one for sustainability traits specific to CR and one for general sustainability traits.

According to Braun and Dacin (1997), understanding a firm's sustainability is suggested as one of the most prominent types of connections that a stakeholder can have with a company. The more ethical a customer perceives a firm to be, the more they will associate and relate with said firm from a social perspective (Moon et al., 2015). Firms that focus on active Twitter interaction about CR are expected to improve how customers perceive the company, generating a larger amount of trust and loyalty (Aurajo et al., 2018). Additionally, according to Wu and colleagues (2017), a company can influence a customer's behavior and their CR perception of a company. Following Wu, specific CR attributes such as civilization can significantly influence customer perception (Tsai et al., 2015). According to Frynas and Yamahki (2016), CR theory can be split into several categories that measure CR: stakeholder theory, institutional theory, legitimacy theory, and resource-based view. They also mention that the stakeholder theory, which focuses on groups that can either damage or help the firm, is one of the most prominent theories. Additionally, firms acting more socially responsible is becoming the norm in Western countries (Faucher, 2015).

A stakeholder can be defined as "any group or individual who can affect or is affected by the achievement of the organization's objectives." The stakeholder theory views the organization at the center of various communication with various stakeholders (Neville et al., 2015). Building upon this theory, consumers and customers are considered stakeholders concerned about the financial value of consumption and the implementation of CR initiatives (Oliver, 2014).

To measure citizenship, a company must act responsibly to protect the environment (Fombrun et al., 2015). A stakeholder will hold a firm in higher esteem and support it more if they participate in citizenship behavior (Bartikowski et al., 2011). This is also confirmed by Zelazna et al. (2020), who mentions that a company should not only focus on profit but also have a moral responsibility to consider the well-being of society. Furthermore, when a firm expresses good citizenship behavior, it possesses attributes that stakeholders may want to associate with (Bartikowski et al., 2011). Fombrun et al. (2015) have identified three main attributes that a company must con-

sider as a citizen. To measure these attributes, they use the Reptrak system. The Reptrak system is one of the world's most reliable sources when it comes to CR (Lee et al., 2018).

The following, first set of four hypotheses will be based on Fombrun et al.'s (2015) article, which distinguishes multiple attributes of citizenship. Fombrun et al.'s (2015) article will be used since they use the reptrak system, one of the world's most reliable sources for CR (Lee et al.,2018). First, we will state **Hypothesis 1** as follows: Citizenship related tweets receive greater sentiment than non-citizenship-related tweets.

Singh et al. mention a clear link between CR with regards to citizenship and sustainability, which has a strong positive effect on financial performance (Singh and Misra, 2021). Furthermore, two components apply to all companies when looking at CR: corporate citizenship and sustainability (Gonzales et al. l., 2017). This link between citizenship, sustainability, and CR is also confirmed by Cho et al. They mention that these three attributes have a positive relationship with each other (2012).

Additionally, sustainability is progressively becoming one of the determinants of CR since companies show that they are conscious of this need to manage environmental issues (Friedman et al., 2001). Companies that act in this manner often have a past of adhering to the obligation of multiple stakeholders, thus creating a reputational advantage (Miles and Covin, 2000). By using Fombrun et al. (2015) attributes, companies prioritize doing the right thing and nurture the goodness of society; this gives the most compelling theoretical insight to conceptualize CR (Singh and Misra, 2021).

Now that the link between citizenship and sustainability is established, further research within sustainability confirms the use of Fombrun attributes to measure civilization. Based on Rahman et al. (2019), a business that adopts procedures that reduce the counteractive effect on the environment, such as using eco-friendly packaging, recycling goods, conserving energy and water, and increasing pollution control, is considered to have a significant impact on citizenship and therefore CR. Additionally, within the corporate sustainability model of Formentinia et al. (2016), attributes such as corporate sustainability, which ensures the stakeholder's needs and the equity of future generations, seem to have contributed to the corporate gain. Also, the execution of sustainability and CR principles can somehow benefit business activities (Jančiauskaitė et al., 2019). Therefore, it is essential to know how customers perceive and value a firm's sustainable effort (Flores-Hernández et al., 2020). Furthermore, firms should actively attempt integrating environmental concerns into their day-to-day activities since this will help them in the long term (Rashid et al.,2013). Therefore, **Hypothesis 2** is stated as follows: Tweets related to protecting the environment receive a greater sentiment than tweets unrelated to protecting the environment.

Another attribute that measures citizenship is whether firms positively influence society (Fombrun et al., 2015). Backhaus et al. (2002) introduce the notion that a good and well-thought-out sustainability policy will significantly influence the company's attractiveness. Firms that are focused on social responsibility and that act toward environmental protection benefit from an improved CR (Salama, 2003). Additionally, companies are likely to implement an environmentally conscious strategy that positively influences society to boost their reputation (Tsoutsoura, 2004). Brammer and Milington et al. (2005) confirm this view, who researched that a positive

influence in society will lead to a more positive impression of the company. Therefore, **Hypothesis 3** is stated as follows: Tweets related to a positive influence on society receive a greater sentiment than tweets unrelated to a positive influence on society.

Finally, to measure citizenship, a firm must support good causes to be considered a citizen (Fombrun et al., 2015). Walsh et al. (2009) also use this scale to measure the social impact of corporate responsibility. This attribute consists of validity, dimensionality, and consistent reliability (Walsh and Beatty, 2007). Additionally, a company's reputation can be diminished by violating multiple regulations; however, the extent to which this might happen will be drastically reduced by supporting good causes (Williams et al., 2000)—corresponding with Fombrun, Chibuike et al. (2010) state that all the attributes mentioned by Fombrun are empirical to measure the social and environmental impact of a firm. Hence, **Hypothesis 4** is formulated as follows: Tweets related to supporting a good cause receive a greater sentiment than tweets unrelated to supporting a good cause

Firms nowadays have an increasing interest in sustainability, not only for financial gain but as an aspect of their business (Lee, 2012). Furthermore, CR goes hand in hand with sustainability (Duthler et al., 2018). Firms will engage in sustainability to improve social welfare to increase their CR (Sen et al., 2003). Firms that undertake sustainable activities want to reinforce their legitimacy and better their reputation (Carroll et al., 2010). According to Clarkson et al. (2008), there is a positive relationship between sustainable performance and the level of outspokenness and deducted that better performers are more open about their activities. However, this signal needs to be genuine; if a false signal is only once revealed, the effect is no longer potent (Watson et al., 2002). Moreover, a firm that currently has a bad reputation can utilize sustainability as a tool to increase trustworthiness and to improve its reputation (Hult et al., 2018).

Sustainability can be considered a communication tool for reputation management, affecting multiple stakeholders (Axjonow et al., 2018). When communicating about sustainability on Twitter, several different strategies can be applied (Etter, 2014). According to Etter (2014), there are three strategies how a firm can apply. Firstly, a company can choose to be very passive and not reply to any questions, which is a broadcasting strategy. Secondly, a company can actively react to questions but not actively approach members, called a reactive strategy. Lastly, a company can actively react to questions and actively approach Twitter users to apply an engagement strategy.

In agreement with Burton and Soboleva (2011), firms mainly use one-way communicating strategies such as the broadcasting strategy. To measure sustainability on Twitter, Suárez-Rico et al. (2018) have identified several attributes related to it. They mention that within sustainability, the following attributes must be available. A company must be consistent in posting, they must communicate about their sustainable activities, and it must be relevant in what they post; specifically, they must tell how it will affect the stakeholders' life. The combination of these attributes makes sustainability measurable. These attributes are also confirmed by Gangi et al. (2019); they use these attributes to measure the impact of sustainability. Therefore, the following, sec-

ond set of three hypotheses is constructed: **Hypothesis 5**---Companies that are more consistent in tweeting about sustainability will receive greater sentiment than companies that are not consistent; **Hypothesis 6**---Tweets related to sustainable activity will receive greater sentiment than tweets unrelated to sustainable activity; **Hypothesis 7**---Tweets that are relevant within sustainability will receive a greater sentiment than tweets that are not relevant within sustainability.

3 Methodology

We now will proceed with describing different measuring methods to show how variables that are relevant to sustainability can be quantified systematically from Twitter datastreams.

Sentiment analysis is currently expanding within the area of Natural Language Processing (Pang and Lee 2008). A user's opinion and sentiment on Twitter are considered an adequate representation of a company's reputation (Colleoni, 2011). O'Connor et al. (2010) argue that a sentiment detector based on Twitter data reproduces and accurately measures customers' trust within a particular company's reputation. Additionally, Lai (2011) shows a positive correlation between sentiment on Twitter and CR.

However, the informal language commonly used in Twitter sentiment analysis is difficult to execute (Kouloumpus et al., 2011). Therefore, the most accepted approaches to Twitter sentiment analysis are lexicon-based or machine learning-based (Pak et al., 2010). The lexicon approach determines the sentiment or polarity of a piece of text through a dictionary (Hu and Liu 2004) while the machine learning-based method trains a sentiment classifier using various features (Pang et al. 2002).

The downside of using sentiment analysis is that it does not explicitly target a user's opinion (Liu 2021). A sentence can have positive and negative words which sentiment analysis does not distinguish correctly (Liu 2021). On the other hand, an aspect-based sentiment analysis (ABSA) performs a finer-grained analysis (Feldman 2013). ABSA tries to identify different aspects of the sentence, and for each identified aspect, it estimates the different polarities (Brychcin et al., 2014). Using this method helps the analysis become more accurate than the methods described above (Bahrainian et al., 2013). However, the disadvantage of this method is that synonyms are not always considered (Pontiki et al., 2016). Generally, the best performing ABSA relies on manually labeling data, which can be a disadvantage if there is limited time available (Chen et al., 2017).

When using a lexicon-based approach, the user could use a semantic search to search for specific keywords to split a dataset. A semantic search is a technique in which keywords are matched with a text dataset (Robert, 2019). An approach taken by most semantic searches over Twitter data is to organize documents and search for keywords (Panasyuk et al., 2013). Apache's Lucene, Indri, and MG4J are some of the most common open-source semantic search engines available (Bast et al., 2016). With these tools, a user can use a dataset and filter through it using keywords. Once the user has established the filtered dataset, he/she can export this into a file to analyze it.

3.1 Sustainable Industry Classification System

To measure the effect citizenship and sustainability have on CR, an approach was chosen containing a comprehensive dataset because it considers the strengths of social listening (Westermann et al. 2020). A better brand may increase its visibility, thus improving its reputation (Melo et al., 2012). Since brand reputation affects CR (Fombrun and Van Riel, 2004), a list of the Dutch top 100 companies with the best-assessed reputation will be used that comes from MT/Sprout.

Each year MT/Sprout makes a list of the best companies within the Netherlands in collaboration with Corporate Financial Netherlands; these lists are based on thousands of surveys as well as average profit over 2019, percentage of change profit from 2015-2019, and return on invested capital over 2019 (Auping, 2020). MT/Sprout has over 40 years of experience knowing which company is currently performing the best (MT/Sprout n.d.). This list will use the sustainable industry classification system (SICS) from the Sustainability Accounting Standards Board (SASB). The SICS contains an industry-standard template that shows which industries have the most impact on sustainability; the purpose of the SASB is to give more guidance to these industries (SASB n.d.).

Firms worldwide have recognized SASB and their industry-standard as core components for their strategy in the future (SASB n.d.). By combining the top 100 brands and the SICS, a better overview will be given, which will show what industry has the most significant impact on sustainability. By making sure each industry given in the SICS contains several firms, the overall influence of sustainability is integrally considered at industrial level.

3.2 Data Collection and Processing

The dataset will be generated based on crawling the Twitter profiles of the top 100 brands within the Netherlands according to MT/Sprout. The top 100 was chosen since companies with a higher brand awareness are more likely to invest more measures into CR (Fisher et al., 2011). Next, the focus will lay on the main English version of the account. For example, "@Heineken," in this case, would be the Twitter account that tweets explicitly in the English language. This is done because sentiment analysis for the Dutch language is less validated than their English counterparts (Thelwall et al., 2010). This information will be collected using Twitter's python application programming interface (API) called Tweepy and stored in a database. The main advantage of the use of Tweepy is that it is an easy-to-use interface (Balaji et al., 2017). On the other side, Tweepy only allows for 3200 tweets per timeline to be scraped (Balaji et al., 2017).

Lexicon-based sentiment analysis will use the dictionary TextBlob to analyze the sentiment and polarity (Feldman 2013). TextBlob has been chosen as the main sentiment analysis since it provides better results and accuracy than other lexicon-based analyzers (Hasan et al., 2018). For each company profile, the scraper will collect in-

formation such as company name, description, location, and the number of followers. Next to that, the actual content of the tweet, language, date of the post, the status of a tweet, meaning whether it was a reply or a retweet, number of likes, and amount of retweets will be added to the dataset.

Once the dataset has been accumulated, the preprocessing and cleaning of the data will commence. First, aspects such as URL links will be removed since they do not carry much information (Jianqiang et al., 2017). Additionally, stop words such as "the" and "is" will also be removed from tweets. This is done because it is considered that these words play a negative role in the sentiment analysis (Pak, 2010). Finally, additional characters such as #'s will also be stripped from the tweets together with emojis and whitespaces (Ahmed et al., 2017).

Once the data has been preprocessed and cleaned of some sort, the tokenization process will begin. Within this part, the given text will be converted into several tokens. This will help with structuring the data and eliminating unwanted words (Mohan and Sunitha, 2020). Since tweets are usually presented inconveniently, with tokenization, these unwanted characters are separated in which the text will be much easier to read for the sentiment analysis (Azzouza et al., 2017). The python package word_tokenize from nltk did the tokenization. This package was used because it is an important base for python programs that work with human language data (Vijayarani et al., 2016). Additionally, nltk is ideally suited for linguistic-related research because of its extensive documentation (Bird, 2005).

In addition, question marks and hyperlinks were removed in the preprocessing since it will increase the accuracy. Next to that a subjectivity and polarity are given to each tweet. The subjectivity indicates whether the text has a positive or negative sentiment, while the polarity indicates how strong a particular opinion is, both using a scale of -1 (weak opinion/negative sentiment) to 1 (strong opinion/positive sentiment) (Nausheen et al., 2018).

After the dataset has been accumulated, a semantic search tool is needed to distinguish specific keywords in the dataset (Guha et al., 2003). Open Semantic Desktop Search (OSDS) will be used for this purpose. OSDS is an open-source semantic search tool based on apache's Lucene that allows users to explore large datasets (Open Semantic Search, n.d). OSDS is operated through a virtual machine based on Linux (Open Semantic Search, n.d). The user must first install the pre-configured virtual machine from the official OSDS website before the tool can be operated (Open Semantic Search, n.d). Once the virtual machine is installed, OSDS can be installed with a user-friendly interface that helps the user semantically search his/her dataset (Open Semantic Search, n.d).

The tool can perform semantic searches and find synonyms, hyponyms, and aliases when using any keywords (Open Semantic Search, n.d). A hyponym is a more specific word whose meaning is included in the meaning of another word. For example, when searching for the word 'dog,' hits related to animals would also show up if specified. In contrast, a synonym is broader and gives a word that has a similar meaning.

Additionally, OSDS is smart enough to search for different variations of the keyword. For example, the processed tweet, "We excited join RFA look forward contrib-

uting knowledge working alongside committed leading evolution sustainable renewable fuel industry", shows up in OSDS when searching for the keyword "sustainability." In the tweet, the word sustainability is not explicitly mentioned. However, OSDS knows that the keyword has multiple variations and gives sustainable back as a hit.

4 Analysis and Results

This section will answer and explain the most relevant subset of the hypotheses that have been stated here above. Using OSDS with explicit keyword search that is directed to the sub-questions and hypotheses that have been mentioned in sections 1 and 2, which thus includes synonyms and different word variations, multiple datasets were created. The systematic analysis of each dataset results in an overview of tweets that are related to a certain aspect that is relevant to sustainability (section 4.1) or citizenship (section 4.2). This will then be compared to an overview of non-related tweets in the same dataset in order to be able compare the sentiment and validate the respective hypothesis that is at play. The full dataset in which the comparison will be made contains in total 320.000 tweets in which the sentiment was divided over 40% positive, 40% neutral, and 20% negative sentiment. The comparison will be made on an industry level using the SICS framework.

4.1 Sustainability

The first hypothesis that was looked at was whether tweets related to sustainable activity receive greater sentiment than tweets unrelated to sustainable activity (hypothesis 6). The keywords chosen for sustainable activities were based on Kurapatskie et al. (2012), which identified three key activities. The activities that were searched for in OSDS were "Pollution prevention," "Clean technology," and "Community Focus." When combining the three outcomes into one dataset, it becomes apparent that about 10% of the entire dataset contains aspects about sustainable activities. Furthermore, there is an overall positive sentiment of the 10% sustainable activity-related tweets, with the average subjectivity being 0.63.

These sustainable activities range from events to mentions that a new product has been developed. Something noticeable is that the transportation industry in the SICS framework has expressed itself the most about sustainable activities while the healthcare industry expressed itself the least. On average, the sustainable activity-related tweets received a 30% more positive sentiment when compared to non-sustainable activity-related tweets. Therefore, hypothesis 6 has been accepted.

When zooming into the relevancy of sustainability-related tweets, every tweet serves a particular purpose. A company wants to either convey a certain message or make a certain announcement. When searching for sustainable-related tweets within OSDS, it returns about 16% of the hits. After analyzing the sustainability-related tweets, the following topics were given by OSDS: events, product development, and announcements. OSDS can tag and annotate tweets in order to categorize them based on their content. These topics contained the word sustainability but were not relevant to the concept of sustainability. For example, a tweet could contain the word "sustain-

abilityGroup" as an announcement of a group that would work together in the future. This tweet does contain the keyword sustainability but is not relevant to sustainability since it is just an announcement.

Additionally, when looking at the overall sentiment of these tweets, they did not have a more positive sentiment compared to the average sustainability-related tweets. On average, the relevant, sustainability-related tweets had a subjectivity of 0.45, meaning that most of the tweets had a neutral sentiment. In contrast, the non-relevant tweets had a subjectivity of 0.58.

According to Suárez-Rico et al. (2018), the final factor in measuring sustainability is the consistency with which firms tweet about it. As mentioned before, firms included in the transportation industry have tweeted most consistently about sustainability. When comparing this industry with other industries, the transportation industry has a more significant positive sentiment. This trend can also be seen in other industries. The second industry that tweets most consistently about sustainability is the renewable resource industry, and the second-worst industry is the finance industry. In this case, the renewable resource industry has a greater positive sentiment than the finance industry. In both cases, the industry that tweeted more consistently about sustainability has an overall more positive sentiment.

4.2 Citizenship

In order to measure citizenship, Fombrun et al. (2015) have identified the following attributes: (A) A company must act responsibly to protect the environment; (B) A company must have a positive influence on society; (C) Companies must support good causes to be considered a citizen. These attributes have been extracted from OSDS using the keywords 'protecting environment', 'positive influence society,' and 'good causes' because these keywords relate to the first set of hypotheses given in section 2. Again, once the different datasets have been assembled with the various keywords, they are subsequently compared to non-related tweets in the dataset to compare the sentiment and validate the hypotheses.

When searching for the keyword 'protecting environment,' OSDS returned about 12% of the hits. All of these had some mention of the environment and included synonyms. When comparing the overall sentiment with the respective non-protecting environment dataset, it becomes clear that tweets related to the environment have a more positive sentiment than the non-protecting environment-related tweets. On average, a tweet related to protecting the environment had a polarity of 0.5 and a subjectivity of 0.6, which means that the tweets had a medium strength of opinion but were majorly positive. When focusing on the industry level of the results, the renewable resources industry received the most positive sentiment out of all the industries.

Following this, the dataset was then tested using a t-test to determine if there is a statistical difference in the mean between the two datasets. When comparing this dataset to the respective non-protecting environment dataset, we found that with a 95% confidence amount, there is no significant difference (p-value=5.6) between the two means. Therefore, based on the results given above and the results of the t-test, the

hypothesis of whether protecting the environment-related tweets receive greater sentiment (hypothesis 2) is rejected.

The second attribute that a company must have to be considered a citizen is that the company must have a positive influence on society. Within OSDS, the results of using this variable as a keyword were about 7%, with most of the results having a positive sentiment. When comparing the results with non-positive influence-related tweets, it is apparent that there is an overall more positive sentiment. Of all the tweets that relate to a positive influence on society, 65% have given a positive sentiment, while the total non-positive influence on society-related tweets has a positive sentiment of 40%. The average subjectivity of the positive influence on society-related tweets was 0.7, while the non-positive influence on society had a subjectivity of 0.55. This means that hypothesis 3 should be accepted. On an industry level, the renewable resource industry tweeted the most about positively influencing society.

The last attribute that Fombrun et al. (2015) mention is that a company must support good causes to be considered a citizen. Using OSDS shows that about 9% of the results are related to supporting a good cause. Of these tweets, 70% have a positive sentiment. Comparing this with all the tweets that have been scraped, the good causes related tweets receive a more positive sentiment. This means that it is quite likely that hypothesis 4 should be accepted. Technology and Communication have the most positive sentiments out of the tweets that relate to supporting a good cause at the industry level. About 80% of all the tweets within Technology and Communication have a positive sentiment.

5 Discussion and Future Work

The increasing need for firms to communicate about their CR efforts has raised questions about its effects on their customers (Pollach et al., 2012). In this paper, we presented sentiment analysis that was performed on the Twitter posts of the top 100 brands of the Netherlands. Twitter's official API was used in order to scrape the tweets. OSDS was used to filter through this dataset to search for keywords that relate to citizenship and sustainability. The sentiment of the filtered tweets was then compared to their non-filtered counterpart to determine whether they have a more positive sentiment. The results provide insights into the critical aspects of citizenship and sustainability on Twitter. The importance of citizenship and the link between sustainability has been established in the literature review.

Suárez-Rico et al. (2018) have identified several attributes that measure sustainability in a social media environment. From these attributes, several hypotheses were constructed. The results show that tweets that contain sustainable activities did have a higher positive sentiment. The transportation industry tweeted the most about sustainable activities. This could be due to the industry starting to widely adopt social media to voice its sustainable operations (Singh, Shukla, and Mishra 2018). Within the study of Suárez-Rico et al. (2018), they found that companies that use non-sustainable activities such as mining and petroleum are more likely to have a negative sentiment. This aligns with the results of our study; both studies show that companies that men-

tion sustainable activities on social media are more likely to receive a positive sentiment.

However, tweets relevant to sustainability did not receive a positive majority sentiment within our study; most of these tweets were neutral. This is an interesting development since tweets that relate to sustainable activity do have a positive sentiment. This shows that companies should tweet more positively about the relatability of sustainability because these tweets contain values that are familiar and relevant for stakeholders (Kumar et al., 2014). Thus, tweeting about topics relevant to sustainability can add additional value to the brand (Reverte, 2012).

Another attribute that was looked at was whether companies that tweeted more consistently about sustainability received a more positive sentiment. This was done on an industry level in which the transportation industry tweeted the most consistent about this topic. This industry also received the highest amount of positive sentiment. 29% of the tweets of the transportation industry were about sustainability. This is probably because sustainability is becoming a critical criterion for companies within the transportation industry (van Hoek, 2010). Additionally, sustainability is becoming an increasingly fundamental topic because of the increasing demand for the transportation of goods (Lammgård, 2012).

We have found that four out of five industries that tweet most consistently about sustainability are polluters. Similarly, Kim et al. (2015) mention a robust positive relation between toxic emissions and being focal on their charitable contribution. This is also confirmed by Kunz et al. (2014), in which they mention that the industry a company operates in plays a massive role in the amount of online reporting they do of their sustainable activities. These findings also align with Suárez-Rico et al. (2018) who mention that the industry that pollutes more is more outspoken on their sustainable behaviors on social media to change the customers' perspective about them.

Fombrum et al. (2015) mention that a company must act as a citizen if they want to be corporately responsible. The three attributes were analyzed with the results described in section 4.2 (citizenship). Remarkable is that the renewable resources industry received the most positive sentiment when searching for the keyword related to protecting the environment. This is possibly due to society moving more towards the renewable resources industry for sustainable production methods (Panwar et al., 2011).

The second attribute that was looked at was whether companies that tweet about positively influencing society would have a higher sentiment than tweets that do not contain this topic. Of all the tweets that positively influenced society, 65% included a positive sentiment with an average subjectivity of 0.7. The non-positive influence on society tweets did not only have fewer positive tweets, which was 40%, but the average subjectivity of these tweets was about 0.55. Thus, the group with positive influence on society tweets has a higher subjectivity than the reciprocal group. The renewable resource industry tweeted the most about having a positive influence on society. This industry has become more vocal on social media in recent years (Vezmar et al., 2014). One potential explanation of this result might be that with the expansion of renewable resources, the media is becoming more vocal about its influence (Reetz Mira et al., 2019).

Finally, the attribute of supporting good causes was analyzed in which it became apparent that most of the tweets that contain this element have a positive sentiment. This is remarkable because the technology and communication industry has the most positive sentiment when filtering for supporting good causes. According to Porter et al. (2002), companies that support good causes improve their competitiveness and performance. Surprisingly, a considerable portion of companies do not disclose the acts of supporting good causes (Chalmeta et al., 2017).

This paper has made some important contributions to CR efforts on social media seen from a sustainable lens. Nonetheless, some limitations need to be considered. Firstly, this paper focuses on tweets from the top brands in the Netherlands, which have been exposed to several CR and sustainability-related attributes. Because of the sustainability aspect, the companies chosen were put in the SICS matrix. While these findings might be generalizable in different industries that are not present in the SICS matrix, future research should validate these assumptions. Secondly, the CR and sustainability-related tweets were compared to non-CR and non-sustainability tweets as a group. While this paper might help give a better understanding of the impact of tweeting about CR and sustainability, it only focuses on the attribute of citizenship. Future studies should further explore the remaining attributes that relate to CR and compare their sustainability messages.

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