

Master Thesis

Text Mining for Sustainability: Detecting Corporate Greenwashing with the Sustainable Development Goals

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*“It’s not always what you say
that matters, sometimes it’s
what you don’t say.”*

— EUGENE H. KRABS

Abstract

This thesis investigates the automated detection of greenwashing by companies on the level of the Sustainable Development Goals (SDGs) by looking for discrepancies between sustainability reports and news articles. Greenwashing is a practice that is considered both unethical and harmful for sustainable development. Despite the risk of reputational damage that a company can suffer, many companies continue greenwashing, as there currently is no simple way to detect it. The results of this thesis show that differences in attention for the SDGs and differences in sentiment per SDG between the two sources together form a good indicator of greenwashing. In addition, this thesis seeks to contribute to research in sustainability by evaluating two existing SDG-classifiers, Aurora and OSDG, and by making all the tools that were used in this research publicly available.

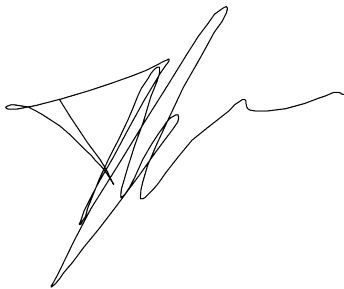
Declaration of Authorship

I, Dyon van der Ende, declare that this thesis, titled *Text Mining for Sustainability: Detecting Corporate Greenwashing with the Sustainable Development Goals* and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a Master's degree at this University.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
- Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

Date: June 25th 2021

Signed:

A handwritten signature in black ink, consisting of several overlapping loops and a long horizontal stroke extending to the right.

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Chapter 1

Introduction

In 2015 the United Nations introduced the Sustainable Development Goals (SDGs) as part of the 2030 Agenda for Sustainable Development (United Nations, 2015). The agenda aims to achieve sustainable economic, social and environmental development and to attain this 17 goals were formulated that cover these themes (United Nations, 2015). The goals are defined very broadly and each goal comes with specific targets, 169 in total, that should be achieved by 2030. In Table A.1 in Appendix A a short overview of the SDGs is given, while in Appendix B a complete description of the SDGs and their targets can be found.¹

As it requires a worldwide effort to successfully achieve the goals, the United Nations explicitly call upon the responsibility of the private sector to help contribute (United Nations, 2015). A 2019 report by Scott and McGill (2019) analysed over 1100 companies and found that 72% of those companies mentioned the SDGs in their reporting. Based on this fact alone it might seem as if the United Nations have succeeded in involving the private sector in the SDGs. The same report, however, also concluded that only 14% of the companies included the more specific targets and a mere 1% actually measured their performance against SDG targets (Scott and McGill, 2019). This raises the question whether companies actually contribute to the SDGs or if they just mention them for positive brand image, a practice known as greenwashing.

1.1 Motivation

Greenwashing is not only considered unethical, but can also be harmful for sustainable development. The most effective way to make companies stop greenwashing is by pointing it out, as this will hurt the company's reputation (de Jong et al., 2020) and will offer customers the choice to take their services from a company that is not a greenwasher. The problem with this is that it is often unclear when a company is guilty of greenwashing. The resources that are required to validate the sustainability claims that companies make, make it difficult to detect greenwashing, as not only financial resources, but also time and knowledge of the field of operations are required. This gives companies the chance to continue greenwashing without any consequences.

With my thesis I want to take the first steps in addressing these issues by investigating a way of detecting greenwashing that can be applied to a large amount of companies and organisations using techniques from the field of Text Mining. With that in mind, I have made all the tools that were created for this thesis available for further research.

¹For convenience the first time a specific SDG is mentioned on a page its name is also provided in brackets.

1.2 Research Question

To design a method that is able to detect greenwashing, the definition of greenwashing needs to be established first. Following the explanation of Siano et al. (2017), **greenwashing is a discrepancy between talk and action** by an organisation regarding sustainability. Siano et al. (2017) distinguish two types of greenwashing that have been described in the literature: *attention deflection* and *decoupling*. The first type is whenever an organisation deliberately draws away the attention from unsustainable practices; the latter describes behaviour that is contradictory to the sustainability claims that an organisation has made.

Thus, to detect greenwashing is to detect a discrepancy in talk and action. With the SDGs as representation of sustainability and with a company's sustainability report as *talk* and news articles as *action*, attention deflection can be described as a discrepancy in attention for the SDGs in the sustainability report compared to news articles. In the same way decoupling can be described as a discrepancy in sentiment per SDG in the sustainability report compared to news articles. Figure 1.1 visualises these descriptions of attention deflection and decoupling.

Combining all of the above steps leads to the following research question:

Can a difference in distribution of attention for the SDGs and a difference in sentiment per SDG between sustainability reports and news articles be used to detect greenwashing?



(a) Attention deflection: There is a difference in attention as SDG 15 is represented in the action, but not in the talk.



(b) Decoupling: Both talk and action mention the SDG, but the talk is positive about it and the action negative.

Figure 1.1: Examples of attention deflection and decoupling.

1.3 Thesis Outline

To answer the research question I will analyse data from sustainability reports and news articles with the help of SDG-classification and Sentiment Analysis. Chapter 2 provides background information on greenwashing and explains how SDG-classification and Sentiment Analysis

have been studied in the literature. In Chapter 3 I describe the steps that I took to collect data and the tools that I used to analyse the data. To determine the quality of the SDG-classifiers, I performed an evaluation task on the classifier, which can be found in Chapter 4. The results that are used to answer the research question are analysed in Chapter 5 and discussed in Chapter 6. This thesis ends with a conclusion and recommendation for future work in Chapter 7.

Chapter 2

Relevant Works

In this chapter I will give an overview of studies that are relevant to this thesis. Many publications on the topic of greenwashing have been published and in Section 2.1 the most important concepts for understanding the motivation behind this thesis are described. As SDG-classification and Sentiment Analysis play an important role in my research on detecting greenwashing, Section 2.2 and Section 2.3 explain general use cases, specific implementations and practical details of working with these tools.

2.1 Greenwashing

Research interest in what is known as *Corporate Social Responsibility* (CSR) has grown over the last few years and especially since 2015, which was also the year when the SDGs were introduced (Agudelo et al., 2019). CSR looks at the contribution of a company to society beyond financial performances, which includes sustainability. One reason for a company to participate in sustainable development is the positive effect that it can have on its brand image, which in turn can lead to higher profits (Aras and Crowther, 2011). However, if higher profits are the only motive of claiming to be sustainable without actually being sustainable and consumers are aware of this, it will negatively impact the brand's reputation (de Jong et al., 2020). Despite this risk, it is still a reality that many companies do not hold themselves to their green claims (van der Waal and Thijssens, 2020).

What allows companies to continue with their greenwashing practices, is that it can be very difficult for consumers to determine what part of a company's communication is true and what is not. This is partly due to the fact that the interpretation of sustainability can be different for each organisation. For example, protecting life below water (SDG 14) is not as relevant to a book publishing company as it is to a fishing company. The SDGs were introduced as guideline to sustainable development, but it has also allowed companies to use the SDGs to profile themselves as sustainable. This way, the SDGs became prone to greenwashing as a marketing instrument. Another complicating factor is the scale at which large companies operate, with many projects spread over many countries. Inspecting all these activities would require an amount of resources that is unrealistic for most people. Hence, relying on the communication from the company is the easiest way of finding information about its sustainability, but not the most reliable way.

Siano et al. (2017) looked into the different forms of greenwashing that are described in the literature and found that these can be divided into attention deflection and decoupling. Decoupling occurs when a company is expressing commitment to make changes for sustainability, without freeing up the resources that are required to actually make the changes. A form of this

is the practice of a company joining all kinds of voluntary programs that support sustainability, but seldom lead to real change (Delmas and Montes-Sancho, 2010). With attention deflection a company is making itself guilty of misleading communication. Some examples of these are making irrelevant claims, claims that are so vague that they are easily misinterpreted and making claims that can not be proofed (Dahl, 2010).

Once greenwashing comes out, the effects can reach far beyond reputational damage for the greenwashing company. The Volkswagen Dieselgate scandal in 2015 showed that reputational damage can extend to the whole branch that a company operates in, a phenomenon that is known as ‘guilty by association’ (Bouzzine and Lueg, 2020). The bad reputation on its turn then creates scepticism among green investors to invest in that branch, further complicating sustainable development in the sector (Pimonenko et al., 2020).

2.2 SDG-classification

In order to automatically detected which texts are specifically relevant to SDGs and which texts are not, SDG-classification can be used, which is part of the field of text classification. The goal of text classification is that given a set of documents $D = \{d_0, \dots, d_n\}$, each document $d_i \in D$ is assigned a label l_j from the set of labels $L = \{l_0, \dots, l_m\}$ (Allahtari et al., 2017). In the case of SDG-classification, the set of labels consist of the 17 SDGs and since a text can be relevant to multiple SDGs, the task is a multi-label classification task.

In the literature several approaches to SDG-classification have been investigated, one of the approaches being rule-based classification. With this approach a hand-crafted list of rules is used to determine which label should be assigned to a text. The Aurora Universities Network created such a rule-based system that uses expert-crafted queries to classify texts in the online Scopus library for scientific publications¹ (Vanderfeesten et al., 2020). The Aurora classifier is implemented on target level, which means that it can also be used to classify specific targets. Below is the first query of the classifier for target 1.1: *By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day*:

```
TITLE-ABS-KEY (( "poverty" ) W/3 ( "eradicat*" OR "reduc*"
OR "end" OR "ending" OR "alleviat*"))
```

Since the queries are written for the Scopus search tool, they specify in which data fields the terms have to occur, namely the title, abstract or keywords of a paper. Furthermore it includes windowing constraints so that certain words have to be within a specified range of each other. An advantage of this approach is that the decisions made by the classifier are easy to understand, but at the same time its simplicity can be a limiting factor in achieving high performances. Vanderfeesten et al. (2020) reported a precision of 0.61 and a recall of 0.15 for the Aurora classifier.

Then there is the supervised machine learning approach. Supervised machine learning requires a large amount of labelled input data which an algorithm uses to learn from until it can successfully perform the desired task. The lack of a corpus with enough labelled data is what complicates the use of supervised machine learning in the case of SDG-classification. Constructing a good corpus is a complicated and expensive task and the corpora that have been used thus far are small or homogeneous. If a corpus is too small, the algorithm has not enough examples to learn from; if a corpus is homogeneous, it means that the examples are all very similar and the classifier has a problem labelling input that comes from a different source.

¹<https://scopus.com>

Nonetheless, Pincet et al. (2019) built a classifier that assigns SDGs to OECD² aid transaction descriptions of governments. For this they used the SDG definitions and labelled OECD project descriptions to train the algorithm. How well this classifier performs is unknown as there was no test set available for an evaluation.

Sovrano et al. (2020) investigated a method that uses a Text Similarity Approach. By calculating how similar an input text is to a target text, this method can determine which SDGs are relevant to the input text. With this study the definitions of the SDGs were used as target text to label UN resolutions, the input texts. Again there are no evaluation scores of this method available for the same reason as with Pincet et al. (2019).

LaFleur (2019) used Topic Modelling to build an SDG-classifier. With this approach, 17 documents, one for each of the SDGs, are represented as a Bag-of-Words, a collection of words that ignores word order. An algorithm determines weights for each of the words that help it discriminate between the topics, i.e. the SDGs. This resulted in a list of relevant words with weights, which can be used to classify unseen documents. LaFleur (2019) labelled 267 publications from the Department of Economic and Social Affairs of the United Nations with this method. Also for this classifier no evaluation metrics are published.

Related to SDG-classification is the work of Duran-Silva et al. (2019) who created a list of key terms for the SDGs (except SDG 17 (Partnerships for the goals)). Starting with a small list of key words collected from literature around the SDGs, they searched for new documents which formed a reference corpus. A word embedding model is then trained and all words that are semantically close to the original key terms according to the embedding model are added to the list, as well as words that are related according to Wikipedia. The final list is manually revised and can be used to implement in a classifier as was done for the OSDG project.

OSDG combines the key words from Duran-Silva et al. (2019) and several other sources³ into a so-called integrated ontology (Pukelis et al., 2020). An ontology “defines a set of representational primitives with which to model a domain of knowledge or discourse (Liu and Özsu, 2009).” As this resulted in over 14 thousand key words, the key word lists are mapped to specific Fields-of-Study (FOS). For every input text, also the FOS is determined and the corresponding ontologies are used to label the text. In Figure 2.1 an overview of this process can be found. As the project is in beta at the time of writing, performance of the classifier is still unknown.

2.3 Sentiment Analysis

Sentiment Analysis is a well researched topic in Text Mining. Its goal is to classify documents with a label that indicates the sentiment of the input. Whereas with SDG-classification the task is a multi-label classification task, there are multiple implementations possible with Sentiment Analysis. The simplest form of Sentiment Analysis is binary classification, where the label is either *positive* or *negative* (Breck and Cardie, 2017). Sometimes, also a *neutral* label is added to this. Ordinal scales (e.g. 1, 2, 3, 4 or 5 stars) or regression (e.g. a score between -1 and +1) are also quite common (Breck and Cardie, 2017; Thelwall, 2013; Hutto and Gilbert, 2014). It is also possible to rate both the positive and the negative sentiment separately (Thelwall, 2013). As Sentiment Analysis has been well studied over the years, many high quality resources have been developed. This includes training corpora and benchmark data set to train and evaluate classifiers. Sentiment analysis is often used to determine the sentiment of online reviews. One

²The Organisation for Economic Co-operation and Development

³See https://github.com/osdg-ai/osdg-mapping/blob/master/OSDG_DATA_SOURCES.md for the most recent list of sources.

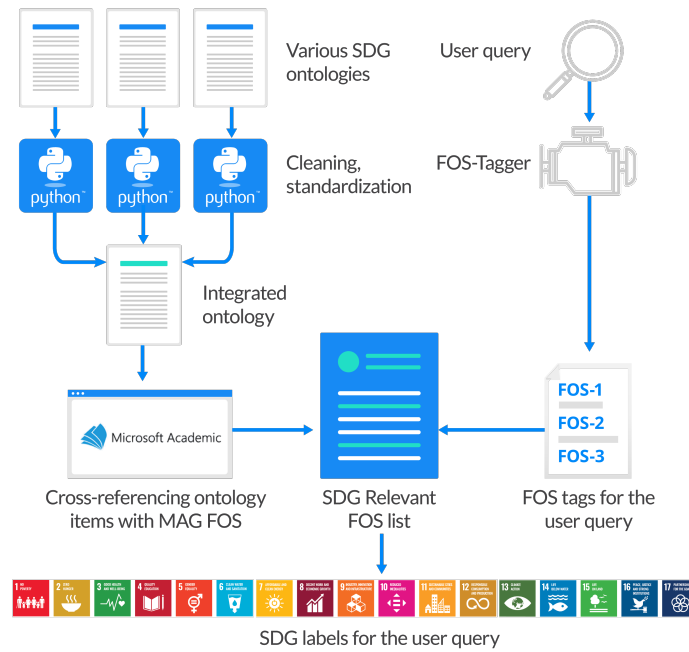


Figure 2.1: Schematic representation of the OSDG classification process (Pukelis et al., 2020).

of the most used benchmarks, The Stanford Sentiment Treebank (SST), is a data set that consists of sentences from movie reviews labelled with sentiment (Socher et al., 2013). The current state-of-the-art classifiers are neural networks that can achieve an accuracy of up to 97.5 on SST-2⁴ in the case of Jiang et al. (2020).

Rule-based sentiment analysers work with a sentiment lexicon and textual features such as negations, punctuation, capitalisation and emoticons. A sentiment lexicon is a list of words and for each word a sentiment value is attached. A positive word ('happy') has a positive value, while a negative word ('sad') a negative value. A word that is written with all letters capitalised, exclamation marks or booster words ('*extremely* happy') amplify the meaning of a word, while a negation inverts the meaning (Hutto and Gilbert, 2014). The final sentiment score for an input is determined by the ratio of positive and negative sentiment (Jurafsky and Martin, 2020). Performance of rule-based Sentiment Analysis can outperform human annotators in some cases, with Hutto and Gilbert (2014) reporting a precision of 0.99 for its VADER classifier compared to 0.95 for humans with the classification of social media texts.

⁴SST-2 is the binary classification task based on SST.

Chapter 3

Methods

To formulate an answer to the research question as posed in Chapter 1, data from sustainability reports and news articles of four different companies are analysed. This chapter walks through the steps of selecting the four companies, extracting text from the different sources and labelling the texts with SDGs and sentiment. Figure 3.1 shows a schematic representation of the steps in this chapter. All tools that were created during this process are made publicly available at <https://github.com/dyonende/SDG>.

3.1 Company selection

The selection of the four companies is a crucial first step for this research. To increase the chances of finding a greenwashing company two unsustainable companies are selected, following the intuition that unsustainable companies are more likely to greenwash. For comparison also two sustainable companies are analysed. But as there exists no complete list of how sustainable all companies are, I used multiple sources to come to a selection. For the set-up of the experiment to work, the selected companies should be of a scale large enough to generate enough news articles to analyse. A second criterion is that the companies need to have an English sustainability report available, as SDG-classifiers are not available in any other language.

I made two pairs of companies where each pair consists of a sustainable and an unsustainable company that are active in the same branch. For the first pair this branch is the energy sector for which I selected Ørsted as the sustainable company. Ørsted is the highest ranked energy company

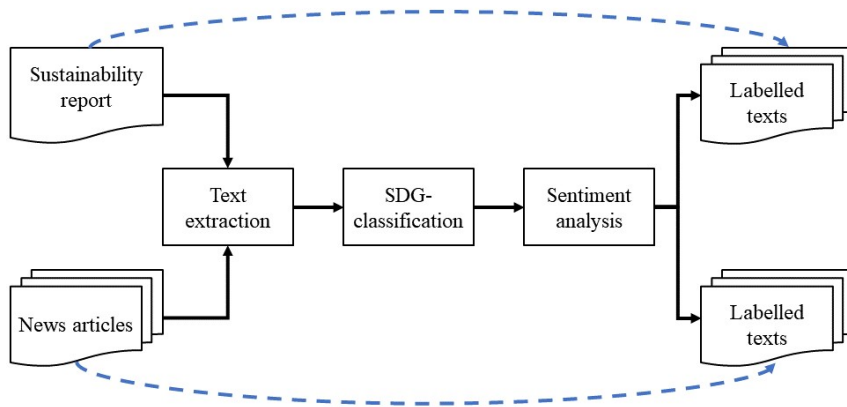


Figure 3.1: Schematic representation of the data collection and annotation process.

in the 2021 Corporate Knights top 100 index of the world's most sustainable corporations¹ and overall listed second. Shell was chosen as the unsustainable energy company, based on its position in the Combined Toxic 100 / Greenhouse 100 Indexes² and its bad reputation regarding sustainability (Kenner and Heede, 2021; Milieudefensie, 2021).

In the food & beverages industry Oxfam ranked the ten largest corporations on sustainability for its Behind the Brand campaign, focusing on seven themes that are comparable to some of the SDGs: transparency, women, workers, farmers, land, water and climate (Sahan, 2016). From this list I selected the highest and lowest ranked companies with a sustainability report. These are Nestlé (ranked second) and General Mills (ranked eighth).

3.2 Data Collection

The four companies all offered a sustainability report on their website, from which I took the most recent version available. See Table 3.1 for the chosen report per company. From the reports all paragraphs of text that contain at least 20 tokens are selected and texts that are shorter, including page numbers and headings, are filtered out.

Table 3.1: The reports used for each of the companies.

Company	Sector	Sustainability report
General Mills	Food & Beverages	General Mills (2021)
Nestlé	Food & Beverages	Nestlé (2021)
Ørsted	Energy	Ørsted (2021)
Shell	Energy	Royal Dutch Shell PLC (2021)

To collect news articles, I used the search tool from Google News, which allows to search for a specific company. After loading the page with news articles manually all the links to news articles were extracted from the HTML. The search results from Google News contain about 80 links to news articles, but as there might be duplicate articles and sites that have a cookie wall or pay wall, the final number of articles could eventually be lower. For each article, the text is split into paragraphs, while again keeping only the texts that contain at least 20 tokens. The data was collected on May 4th 2021.

The reason of keeping only paragraphs of text instead of whole PDF-pages or news articles is that the paragraphs are more fine-grained towards a specific topic and that all SDG-irrelevant parts of text are filtered out this way.

3.3 SDG Classification

The step after the collection of the data is the annotation of the data. For SDG-classification I chose to use both Aurora and OSDG, as these are the only classifiers that are publicly available. I decided to use two classifiers instead of one, because the reliability of OSDG and the specific version of Aurora that is used in this research are unknown. To determine the reliability of the classifiers an evaluation is performed where human annotators inspect the output of the classifiers, see Chapter 4. Based on the outcomes of the evaluation, it is determined whether or

¹<https://www.corporateknights.com/reports/2021-global-100/>

²<https://www.peri.umass.edu/combined-toxic-100-greenhouse-100-indexes-current>

not the classifiers are reliable enough to use for classification. Using both Aurora and OSDG reduces the risk of having no reliable results in case one of the classifiers has a low reliability. The Aurora classifier uses a list of queries were written such that they can be used for the search function in the Scopus library. For use outside of Scopus, I had to adapt the queries for Python. In this process I made the practical decision to drop the windowing constraints from the original queries. Rewriting the queries for Python is a time intensive work and not considering the windowing constraints sped up the process significantly. How this specific implementation of Aurora will perform is measured in the evaluation.

Classification of the text with OSDG was a straightforward process. OSDG runs out of the box through the available version on Docker. It takes a text as input and returns a list of relevant SDGs.

3.4 Sentiment Analysis

Many Sentiment Analysis tools have been developed that each have their own strengths and weaknesses. There are three specific requirements that a sentiment analyser should fulfil for use in this thesis. The first is that it should perform the sentiment analysis on document level (and not on sentence level). Secondly, the tool should be a regression algorithm, because this allows for more fine-grained analysis of the sentiment. Thirdly, the tool should work in English.

The tool that checks the requirements is VADER (Hutto and Gilbert, 2014). VADER scores an input text on positive, negative and neutral sentiment. It combines these scores into a compound score which is a number between -1 and +1, where a negative score indicates negative sentiment, while a positive score indicates positive sentiment. The performance of VADER heavily depends on the type of text that it is used for. For social media texts it can achieve a precision of 0.99, but for product reviews and movie reviews this number is between 0.7 and 0.8, while for New York Times editorials the precision is 0.69.

Chapter 4

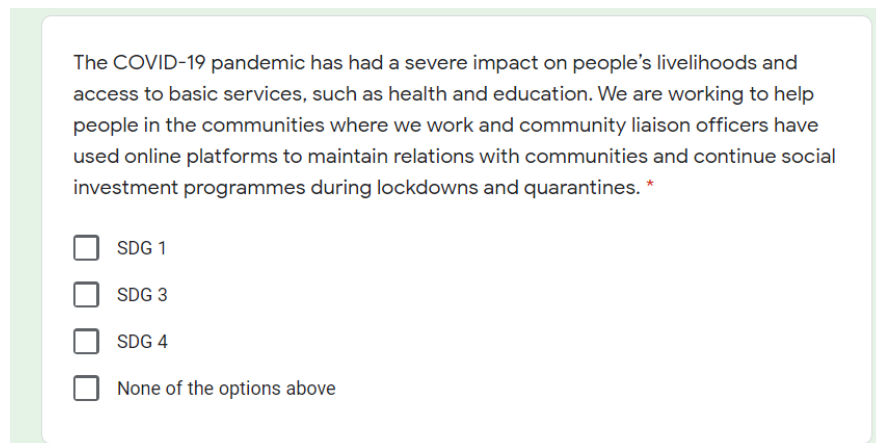
Classifier Evaluation

The objective of the annotation task is to validate the results of the adaption of the Aurora classifier and the OSDG classifier. The performance of both classifiers has not been evaluated, so their reliability needs to be verified before they can be used for research.

4.1 Annotation Task

From the labelled texts in the collected data a sample of size 50 will be annotated by human annotators. The annotators are asked to read the text fragment and select all the SDGs that they think are relevant to the text. They can choose from a list of SDGs that are the labels that the classifiers assigned to the text. A question looks like the one in Figure 4.1.

The setup of this annotation task is such that it can only detect true positives and false positives but no false negatives, i.e. SDGs that are relevant but that were not recognised by the classifier. This is by design, as the annotation task would have been much more difficult for the annotators if they had to choose from 17 different labels for each text.



The COVID-19 pandemic has had a severe impact on people's livelihoods and access to basic services, such as health and education. We are working to help people in the communities where we work and community liaison officers have used online platforms to maintain relations with communities and continue social investment programmes during lockdowns and quarantines. *

☐ SDG 1

☐ SDG 3

☐ SDG 4

☐ None of the options above

Figure 4.1: An example question for the annotation task. The annotators are asked to select all the SDGs that they think are applicable to the given text. Subsection A.3.3 provides an instruction on how to answer this specific example. Text taken from Royal Dutch Shell PLC (2021).

The task is performed by three annotators who were allowed to look up the SDGs during the task, but not any other information. They were provided with annotation guidelines which can

be found in Appendix A. One of the three annotators already had experience working with the SDGs, while the other two did not; their main source of knowledge came from the descriptions in the annotation guidelines.

As the task is expected to be quite difficult, the threshold for the inter-annotator agreement is set at Fleiss' $\kappa > 0.4$, meaning that the agreement of the annotators should be at least 40% above the expected agreement by chance (Artstein, 2017).

If this threshold is met then the majority vote of the annotators is used to measure the performance of the classifiers. Since only true and false positive are detected through this task, the precision is the evaluation metric to determine the reliability of the classifiers. The precision is a number between 0 and 1, with a higher precision being better and is defined as the number of true positives (TP) divided by the number of true positives and false positives (FP):

$$precision = \frac{TP}{TP + FP}$$

4.2 Results

After the annotators completed the task they communicated that they found the task quite difficult. The Fleiss' κ of 0.45 that was reached is therefore a good result and it means that the results are reliable enough to use for the evaluation of the classifiers. The fact that one of the annotators was already knowledgeable of the SDGs before the task, did not cause major differences in annotations, as the pair-wise agreement between the annotators was comparable for the three pairs at around 0.75.

Using the majority vote of the annotators, the precision of both classifiers was calculated. The adaption of Aurora achieved a precision of 0.51, while OSDG scored better with a precision of 0.61. This means that Aurora scored lower compared to the precision of 0.61 reported by Vanderfeesten et al. (2020).

By lack of any other reference metrics for the task of SDG-classification, it seems that a precision of above 0.5 currently is an acceptable score, especially given that the task is considered difficult. Together with the fact that OSDG is not very sensitive which would result in a very small amount of data to analyse (more details on this in Chapter 5), I decided to use both classifiers for the analysis of the data. The combination of classifiers used for the remainder of the thesis is the union of labels assigned by Aurora and OSDG. The precision of this combination is 0.53.

Chapter 5

Results

In the current chapter I examine the collected data in Section 5.1. Then in Section 5.2 and Section 5.3 I analyse the discrepancies in attention and sentiment. Finally in Section 5.4 I interpret the findings of the analyses to see if greenwashing was detected.

5.1 Data Description

The extraction of text paragraphs from the sustainability report resulted in quite a difference in number of texts for the four different companies that are listed in Table 5.1. For Shell this number is 881, while Nestlé only has 193 and General Mills and Ørsted are at around 319 and 318. The difference between these numbers can be explained by the fact that there is no standard format for sustainability reports, meaning the companies can use any form they like. Shell's report has the most pages (102) out of the four companies and contained mostly text, while Nestlé's report contained half the number of pages and used a lot of visual information such as tables and graphs.

With the texts that were extracted from the news articles, again for Shell this has yielded the most text and Nestlé the least, but the range is smaller from 451 to 749. The reason why the range for the news articles is smaller is because the number of results from Google News is the same for every search query.

Table 5.1: The number of text paragraphs that were collected per source.

Company	Sustainability report	News articles
General Mills	318	627
Nestlé	193	451
Ørsted	319	467
Shell	881	749

However, not all these texts are relevant as only the ones that are specifically relevant for the SDGs are needed. In Table 5.2 the number of texts that were labelled is shown. For the two classifiers combined the number of texts is around 100 to 170 for all companies and in both sustainability report and news articles, with the exception of sustainability report of Shell with 342 text paragraphs.

From the results in Table 5.2 it can be deducted that Aurora is more sensitive compared OSDG, as it always classified at least three times as many texts. The results also show that the numbers

of texts for the combined classifier are not much higher than for Aurora alone, meaning that there is a large intersection between the texts that the classifiers label.

Table 5.2: The number of text paragraphs that were labelled by the classifiers.

Company	Sustainability Report			News Articles		
	Aurora	OSDG	Combined	Aurora	OSDG	Combined
General Mills	109	29	117	87	23	99
Nestlé	88	15	94	101	31	115
Ørsted	160	30	168	105	32	124
Shell	311	80	342	121	24	132

A closer look at the distribution of the SDG labels in Figure 5.1 reveals that the number of texts are distributed very unevenly over the 17 SDGs. For SDG 1 (No poverty), SDG 5 (Gender equality) and SDG 10 (Reduced inequalities) there is not even one of the companies that has at least 10 labelled text paragraphs. The SDG that has the highest number of relevant text paragraphs, SDG 9 (Industry, innovation and infrastructure), is the same for all the companies. Another observation is that Shell exceeds the other companies in quantity for most SDGs, but this makes sense as Shell had more texts than the other three companies to begin with.

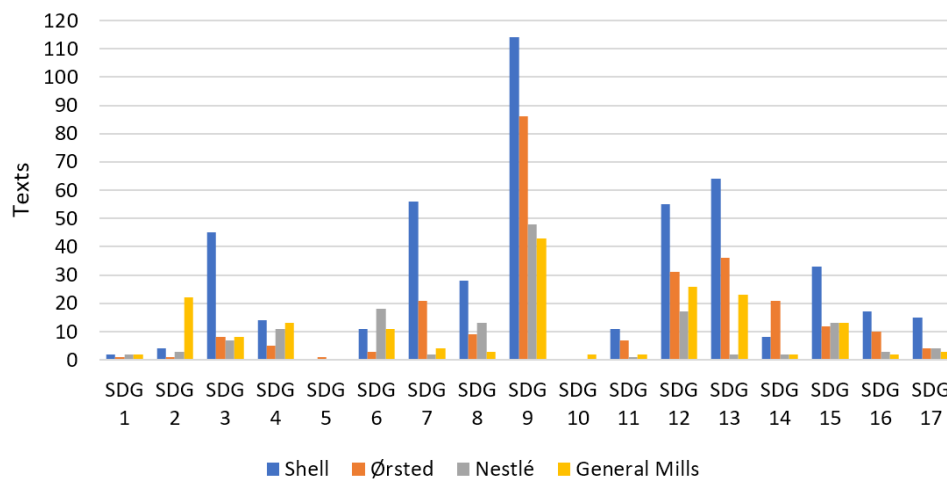


Figure 5.1: Overview of the number of labelled text paragraphs in the sustainability reports.

Roughly the same findings of the reports apply to the distribution of labelled texts in the news articles in Figure 5.2: SDG 9 is the most common, while SDG 1, 5 and 10 occur less than 10 times. Here, however, also SDG 11 (Sustainable cities and communities), SDG 16 (Peace, justice and strong institutions) and SDG 17 (Partnership for the goals) occur less than 10 times for all companies. Since the number of news articles texts for Shell was closer to those of the other companies, the observation of Shell exceeding the other companies in quantity does not apply here.

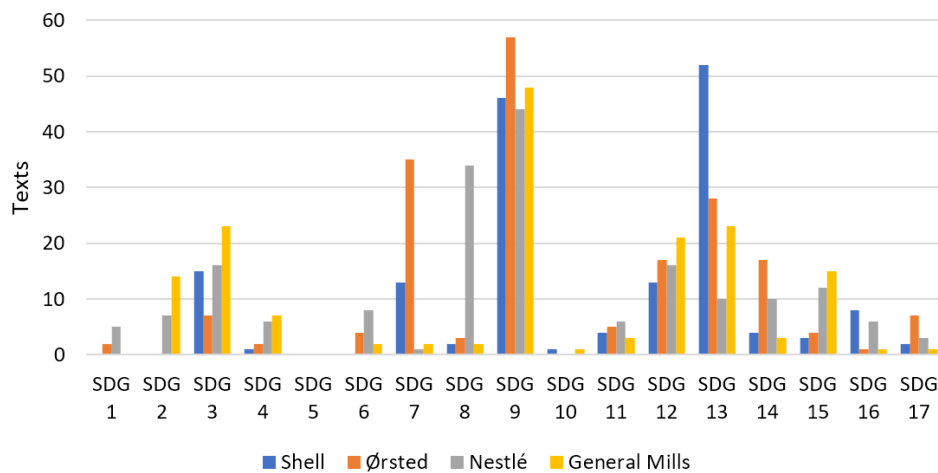


Figure 5.2: Overview of the number of labelled text paragraphs in the news articles.

5.2 Attention Comparison

The results from the previous section show that the number of texts that are labelled depends on the amount of texts that were collected. To be able to compare the numbers between the sustainability reports and news articles percentages are used. I compared the percentages of each SDG to find a difference in attention for the SDGs, which is plotted in Figure 5.3. The plot shows that the majority of the differences is under 6%, but also that for every company there are outliers. These outliers show a significant discrepancy in attention for the SDGs and for attention deflection, especially the cases where there is a under-representation of SDGs in the sustainability reports are important.

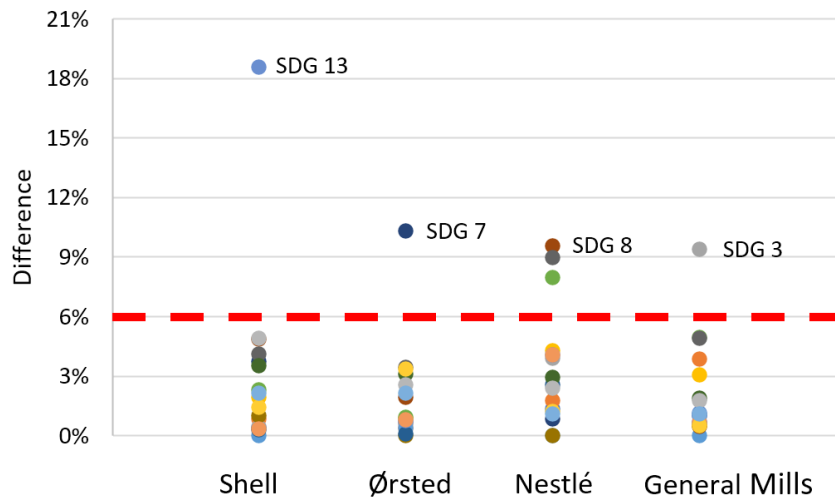


Figure 5.3: The difference in attention for the SDGs between sustainability reports and news articles. The cases where the difference exceeded the 6% due to an under-representation in the sustainability report are annotated.

Figure 5.3 shows that there are three outliers for **Nestlé**. Two of these, SDG 6 (Clean water and sanitation) and SDG 9 (Industry, innovation and infrastructure), however, are cases of

over-representation instead of under-representation and are not relevant for attention deflection. The third outlier, SDG 8 (Decent work and economic growth), is under-represented in the sustainability report of Nestlé with only 9% compared to 18% in the news articles.

For **General Mills**, the SDG with a difference in attention of over 6% is SDG 3 (Good health and well-being). For this SDG, 14% of the news articles were relevant for this SDG, while this is the case for only 4% of the texts from the sustainability report, a difference of 10%.

Ørsted has a slightly higher difference of 11% for SDG 7 (Affordable and clean energy): 19% for the news articles and 8% for the sustainability report.

The biggest difference, however, is found at **Shell** for SDG 13 (Climate action). In its sustainability report 13% of the paragraphs are relevant for this SDG compared to 32% in the news articles, a difference of 19%.

5.3 Sentiment Comparison

For the comparison of sentiment between sustainability reports and news articles only the SDGs that had at least ten texts from both sources are taken into account. For possible indications of greenwashing the cases where the sentiment of news articles of a certain SDG are clearly more negative of tone compared to the sustainability report are of importance. Figure 5.4 shows the distribution of the SDGs for each of the companies.

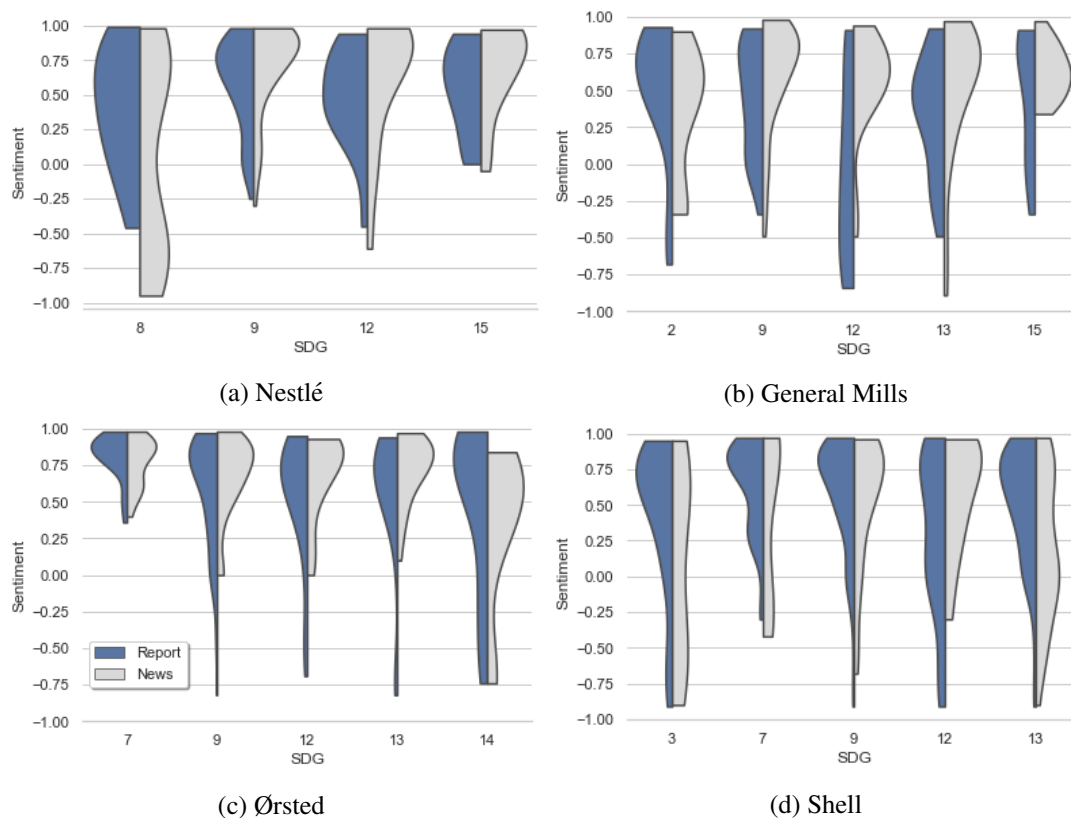


Figure 5.4: The distribution of the sentiment for the selected SDGs per company. The SDGs were selected if it had at least 10 texts from both sources. The more similar the left and the right side of the shape are, the more equal their distribution is.

For **Nestlé** the SDGs that had a high enough frequency in the data to be analysed are SDG 8 (Decent work and economic growth), 9 (Industry, innovation and infrastructure), 12 (Responsible consumption and production) and 15 (Life of land). The sentiment of these SDGs in the sustainability report is mostly positive to neutral, as can be seen in Figure 5.4a. Out of these four SDGs, there is only one for which the distribution between the report and the articles is quite significant, being SDG 8. The distribution for SDG 8 is split equally between positive and negative sentiment in the news articles, whereas it is mostly positive in the sustainability report. For **General Mills** (Figure 5.4b) there were five SDGs, that were frequent enough to analyse: SDG 2 (Zero hunger), SDG 9, SDG 12, SDG 13 (Climate action) and SDG 15. Most of the negative sentiment comes from the sustainability report and the news articles remain mostly positive.

The results for **Ørsted** in Figure 5.4c show that the sentiment of the five selected SDGs (SDG 7, SDG 9, SDG 12, SDG 13, SDG 14 (Life below water)) in news articles is very positive. It is therefore interesting to note that the sustainability report is more negative than the news articles. **Shell**'s results, found in Figure 5.4d, show a wide distribution of sentiment, especially in the sustainability report. The range of four out of five SDGs is almost completely from -1 to +1. For SDG 7, SDG 9 and SDG 12 the negative sentiment in news articles is not very strong. The news articles of SDG 3 have an equal distribution of positive and negative sentiment, while Shell's report is skewed towards positive sentiment. With SDG 13 the sentiment is more negative compared to the report.

5.4 Interpretation

In order to determine whether the detected SDGs from the previous two sections do point to greenwashing, I inspected the data manually. Table 5.3 summarises the findings from the previous two sections.

Table 5.3: The SDGs that were detected as indications of attention deflection and decoupling.

Company	Attention comparison	Sentiment comparison
Nestlé	SDG 8	SDG 8
General Mills	SDG 3	
Ørsted	SDG 7	
Shell	SDG 13	SDG 3, SDG 13

For Nestlé both the difference in attention and difference in sentiment detected SDG 8 (Decent work and economic growth). As it turns out, the cause for both discrepancies is an article from The Guardian (2021) about allegations of child labour on cocoa farms. In its sustainability report Nestlé claims that there are no forms of child labour at the company and that the company is against it (Nestlé, 2021), but at the same time the company could not promise that there was no child labour within its chocolate manufacturing chain (Whoriskey and Siegel, 2019). In my opinion this is a case of greenwashing.

With **General Mills** the only discrepancy that was found, was a difference in attention for SDG 3 (Health and well-being). Inspecting the documents revealed that the reason that many articles were labelled with SDG 3, is because they mention the influence of the COVID-19 pandemic on the company's growth strategy. There are no indications of greenwashing.

Ørsted also did not have any SDGs with a significant difference in sentiment, but a difference in attention for SDG 7 was detected. With clean energy being the core business of the company,

most of the articles that are labelled with SDG 7 mention projects that Ørsted is working on, like offshore wind farms. Again, there are no indications of greenwashing.

Lastly, for **Shell** a difference in attention and a difference in sentiment was detected for SDG 13, while for SDG 3 there was only a difference in sentiment. For the same reason as with Nestlé, the texts that were labelled with SDG 3 (Health and well-being) mention the COVID-19 pandemic. The reason for the negative sentiment in this case, is the negative financial impact that the pandemic had on Shell, were this was not so much the case with Nestlé. This does not point to any forms of greenwashing.

With SDG 13 on the other hand, there does seem to be a real form a greenwashing that is detected. One of the articles with negative sentiment related to this SDG mentions a lawsuit from the city New York against Shell and other oil companies for “misrepresenting themselves by selling fuels as ‘cleaner’ and advertising themselves as leaders in fighting climate change (Offshore Engineer, 2021).” Other articles also mentions Shell’s reluctance to fight climate change. In May 2021, a few weeks after the data for this research was collected, a Dutch court found Shell guilty of not doing enough to stop climate change, while Shell argued that it did (Sathyapalan, 2021). This court order seems to confirm the greenwashing accusations that are expressed in the articles.

Chapter 6

Discussion

In this chapter I look at the impact of the decisions that I have made for this research. In Section 6.1 the assumption of a company being sustainable or unsustainable is discussed, followed by a discussion of the quality of the used news sources in Section 6.2. Lastly, Section 6.3 and Section 6.4 discuss at the reliability of the tools that were used.

6.1 Sustainability Assumption

I selected two sustainable and two unsustainable companies to analyse under the assumption that unsustainable companies are more likely to greenwash than sustainable companies. This assumption did hold for Ørsted and Shell, but the results for the food sector were not as expected, as for Nestlé a greenwashing practice was found and not for General Mills. The Behind the Brand index on which the sustainability assumption of the companies was based for this sector was published in 2016 and might be outdated. The data on which the selection of the energy companies was made was more recent and therefore maybe more reliable. I do, however, want to stress that the results do not necessarily have to mean that Nestlé is indeed a less sustainable company compared to General Mills, as even sustainable companies can greenwash.

6.2 News Sources

The news articles that were used in this research were collected via Google News search. There are several downsides of this approach:

- Only recent articles are found.
- Multiple articles describing the same event are found.
- Quality of the news sources is unknown.

The time span of the articles has a large influence on the results about a company. For example, searching for Volkswagen in 2021 will only mention Dieselgate sporadically, while a few years ago it was one of the biggest stories. If only recent articles would be used with the in this thesis investigated method and Dieselgate might have not been detected.

Somewhat related to this is that as Google News uses multiple sources from which it collects recent articles. This means that a single event that has just happened can result in many publications about it. This can lead to a shift in attention from the news articles and lead to a discrepancy.

The selection criteria of sources that are used in Google News is are unknown. This can lead to non-news or possibly even fake news articles as this is not verified through the greenwashing detection process. An example from the data of such a non-news article is the following text¹ that was labelled with SDG 2 (Zero hunger). The text mentions a nutritional product, but is from an article about a new protein bar from General Mills and reads like it is a commercial:

“Providing 10 grams of protein each, the bars pair creamy and crunchy textures with ingredients such as whole grain oats, peanut butter, nuts, soy protein and whey protein. The protein bars are available in peanut butter and chocolate peanut butter varieties.”

6.3 SDG-classifiers

The example from the previous section demonstrate that the SDG-classifiers can mislabel a text. With a precision of just over 0.5 for the combined classifier that was used, half of the assigned labels are incorrect, which introduces a lot of noise in the data. Then the fact that recall was not taken into account in the evaluation also means that a lot of relevant texts might have been missed. Vanderfeesten et al. (2020) reported a recall of 0.15 for Aurora and the adapted version of Aurora that was used and evaluated in this research dropped the windowing constraints, which could have lead to a slightly higher recall.

Research in SDG-classification has only recently started to gain interest, so it is expected that the quality of the classifiers will only improve as more research will done over time.

6.4 Sentiment Analysis

The tool that I used for the sentiment analysis, VADER, can achieve a high precision depending on the type of text that it is used for. Hutto and Gilbert (2014) found that for texts from social media VADER performed best, but that for editorials from the New York Times, its precision dropped from 0.99 to 0.69. For this research it was used for texts from news articles and from sustainability reports, which are more comparable to the editorial pieces than to social media texts. It might be possible that this negatively impacted the reliability of the sentiment analysis. On manual inspection of the output of VADER I did not find anything that pointed to this.

¹Source: “General Mills unveils new Nature Valley protein bars” from www.foodbusinessnews.net

Chapter 7

Conclusion

In this thesis I investigated the use of SDG-classification and sentiment analysis to detect greenwashing. I analysed discrepancies between sustainability reports and news articles for four companies and found that a large difference in attention and sentiment for SDGs form a good indicator of greenwashing. The methods that were used can be applied on a large scale, but are heavily dependent on the quality of the used tools. SDG-classifiers form a crucial step in this process, however research interest in this form of text classification is relatively new. To determine the quality of the used SDG-classifiers, I performed an evaluation and found that OSDG achieved a precision of 0.61, but had a low sensitivity. A Python implementation of the Aurora classifier that I used specifically for this thesis was evaluated and was found to have a precision of 0.51, but a higher three times higher sensitivity than OSDG. As there was no clear indication of the quality of SDG-classifiers before this research apart from the work of Vanderfeesten et al. (2020), the scores from the evaluation set a baseline for further development of SDG-classifiers. The Python implementation of Aurora along with other tools that were created for this thesis are made available for further research.

With the results from this thesis, the next step is to investigate the application of the presented method on a large scale. To improve the reliability of the method, the precision of SDG-classifiers needs to be further improved. An important step for this would be the development of a high fidelity corpus that can be used for training and evaluating classifiers, as there currently does not exist such a corpus. The setup of the evaluation task performed for this thesis could be used to create this.

Another important aspect in improving the detection of greenwashing that can be investigated is the sources that are used for the news articles. A white list of reliable news sources can be constructed to prevent the amount of noise in the data and also the time span that articles should cover in order to get a good overview of a company can be investigated.

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Appendix A

Annotation Guidelines

A.1 Introduction

The Sustainable Development Goals (SDGs) are 17 interconnected goals that were developed by the United Nations and published in 2015. The intention of the SDGs is to define the areas that are of importance for sustainable development. The SDGs are 17 very broad goals by design. In Table A.1 they are listed with a short description. To make the goals more concrete target points were added to each goal. For this task only a global understanding of the goals is required. In Appendix B a complete overview of the SDGs and their targets is given. It is advised that you read these carefully to get a better understanding of what each goal entails.

The goal of this annotation task is to select all SDGs that are relevant to short fragments of texts. For each question in the task the text fragment is provided with a list of SDGs to choose from. The task is sent to you through a Google Form and consists of 50 questions. It takes approximately an hour to complete the task.

A.2 Guidelines

The intention is to keep the annotation task as simple as possible. These guidelines are important to keep in mind while annotating:

- It is advised to keep these annotation guidelines with you during the task to look up the SDGs.
- The text of each question stands on its own and is not connected to the texts of other questions.
- From the listed SDGs, you can select multiple if you think that they are applicable to the text. It is also possible that none of the provided options are applicable, in which case you should select the 'None of the options above' answer.
- Base your answer purely on the text. It can be tempting to connect subjects of the text with your own experiences or knowledge. For example, if a text mentions the generation of energy by building wind turbines, there are lots of other things that are affected by such a project. Wind turbines can have a significant impact on the lives of people or animals surrounding it. But as long as these effects are not mentioned explicitly, you should not take these into account.

1 NO POVERTY 	End poverty in all its forms everywhere	10 REDUCED INEQUALITIES 	Reduce inequality within and among countries
2 ZERO HUNGER 	End hunger, achieve food security and improved nutrition and promote sustainable agriculture	11 SUSTAINABLE CITIES AND COMMUNITIES 	Make cities and human settlements inclusive, safe, resilient and sustainable
3 GOOD HEALTH AND WELL-BEING 	Ensure healthy lives and promote well-being for all at all ages	12 RESPONSIBLE CONSUMPTION AND PRODUCTION 	Ensure sustainable consumption and production patterns
4 QUALITY EDUCATION 	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	13 CLIMATE ACTION 	Take urgent action to combat climate change and its impacts
5 GENDER EQUALITY 	Achieve gender equality and empower all women and girls	14 LIFE BELOW WATER 	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
6 CLEAN WATER AND SANITATION 	Ensure availability and sustainable management of water and sanitation for all	15 LIFE ON LAND 	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
7 AFFORDABLE AND CLEAN ENERGY 	Ensure access to affordable, reliable, sustainable and modern energy for all	16 PEACE, JUSTICE AND STRONG INSTITUTIONS 	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
8 DECENT WORK AND ECONOMIC GROWTH 	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	17 PARTNERSHIPS FOR THE GOALS 	Strengthen the means of implementation and revitalize the global partnership for sustainable development
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation		

Table A.1: The 17 SDGs with description (United Nations, 2015).

- If an organisation or project is mentioned that you are unfamiliar with, try to deduce its meaning from the text. You are *not* supposed to look up information online.
- Since the SDGs are so broadly formulated, it can be difficult to decide whether or not a text is relevant for a certain SDG. In this case, you can choose for yourself what is the best options, as there are no right or wrong answers.
- The SDGs can also be applicable in a negative way. SDG 15: Life on land is not only relevant to projects that prevent deforestation, but also projects that enable deforestation for example.

A.3 Examples

A.3.1

"Farmers want to learn from the scientists," said Rosenzweig. "Showing them how they're collecting the data and what they're finding. There's a huge educational opportunity to transfer that knowledge from the scientists to the farmers and vice versa. The farmers are also seeing lots of things that scientists might not necessarily catch."

- ☐ SDG 4
- ☐ None of the options above

For this text you have to decide whether or not it is relevant to *SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all*. In the text it is explained that farmers want to learn from scientists. However, it mentions no programs or initiatives that will allow them to do this. Based on this text, the right option would be to select **None of the options above**.

A.3.2

The new yogurt, called Ratio: Protein, follows the company's introduction of Ratio: Keto, which target consumers tracking their three macro nutrients: fat, protein and carbohydrates. It's a more "adult-focused" brand for wellness-minded consumers looking to replenish and build muscle following a hard workout or someone just looking to stave off hunger for longer, said Doug Martin, president of General Mills dairy unit.

- ☐ SDG 2
- ☐ None of the options above

This text introduces a new food product. Again there is one SDG to consider for this text: *SDG 2:*

End hunger, achieve food security and improved nutrition and promote sustainable agriculture. Although the text mentions that the product can be used to “stave off hunger”, it is not meant in a way of structurally ending hunger or providing food security. It does mention nutritional value of the product, but it seems more like marketing talk than a solution for malnutrition. Again, **None of the options above** is the right choice here.

A.3.3

The COVID-19 pandemic has had a severe impact on people’s livelihoods and access to basic services, such as health and education. We are working to help people in the communities where we work and community liaison officers have used online platforms to maintain relations with communities and continue social investment programmes during lockdowns and quarantines. *

- ☐ SDG 1
- ☐ SDG 3
- ☐ SDG 4
- ☐ None of the options above

For this example, there are three possibly relevant SDGs. *SDG 1: No poverty* does not seem relevant immediately, but looking at the targets, *target 1.3: Apply social protection systems for the poor and the vulnerable* actually is relevant. This text is clearly about the well-being of people, so also *SDG 3: Good health and well-being* is applicable here. Lastly, also *SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all* is mentioned in the text. Therefore **all the listed SDGs are relevant**.

A.3.4

Using cocoa fruit pulp, which is normally discarded, to flavour products reduces sugar and cuts food waste while boosting the income of cocoa farmers who can “upcycle” their cocoa by selling both the pulp and the beans.

- ☐ SDG 2
- ☐ SDG 12
- ☐ None of the options above

SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture is relevant to this text, because a way of increasing productivity is mentioned. This is described in *target 2.4: Establish sustainable food production systems; increase productivity, maintain ecosystems, strengthen capacity to adapt to climate change and other weather con-*

*ditions and disasters. Also **SDG 12: Responsible consumption and production** is relevant, as targets 12.2, 12.3, 12.5, 12.a listed in Appendix B all apply.*

A.4 Challenging Cases

A.4.1 Mentions of COVID-19

Mentions of COVID-19 are only relevant to SDG 3 (Good health and wellbeing) when its effect on health or wellbeing or prevention of pandemics or diseases in general are discussed. When the effects of the pandemic are discussed without this view, it is not relevant to SDG 3. The text below is therefore not relevant to SDG 3.

Since late 2019, Shell has wiped out over \$20 billion from the value of its oil and gas reserves after lowering the outlook for commodity prices because of the energy transition and the impact on demand of the COVID-19 pandemic.

A.4.2 Incomplete texts

Some text may contain only keywords or parts of sentences instead of well written sentences. For these cases, try to make out whether or not it is still relevant to an SDG as best as you can. For the text below, based on the keywords, SDG 13 (Climate action) is still relevant, because the Paris Agreement is an agreement to tackle climate change.

*• Paris Agreement • Greenhouse Gas Protocol & Science Based Targets initiative •
IPCC Special Report: Global Warming of 1.5 °C*

Appendix B

The Sustainable Development Goals

This chapter is taken from Buckens, van der Ende, and den Uijl (2021).

Source: <https://sdgs.un.org/goals>

SDG 1 **No Poverty**

The first goal is to end poverty worldwide. This goal consists of the following targets:

- Target 1 Establishing a minimum income of \$1.25 per day for all people everywhere on earth.
- Target 2 Reduce number of people living in poverty by factor 2, based on the national definitions.
- Target 3 Apply social protection systems for the poor and the vulnerable.
- Target 4 Establish equal rights and access to economic resources.
- Target 5 Reduce the exposure and vulnerability to climate events and economic, social and environmental disasters for the poor and the vulnerable.
- Target a Ensure a substantial mobilization from different sources in order to provide sufficient and predictable means for developing countries. In particular for least developed countries, to adopt programs and policies to end poverty in all its aspects.
- Target b Create a framework at regional, national and international level to support investment in plans to overcome poverty.

SDG 2 **Zero Hunger**

The second goal of the SDGs is to end hunger, to achieve food security and improvement of nutrition and to promote sustainable agriculture. This goal consists of the following targets:

- Target 1 End hunger and make nutritious and sufficient food accessibility for everyone worldwide, all year round.
- Target 2 End all forms of malnutrition, including ending prevalence of both underweight and overweight in children.
- Target 3 Double the agricultural productivity and incomes for small scale producers of food by providing equal access to land, productive resources and inputs, knowledge and financial services.
- Target 4 Establish sustainable food production systems; increase productivity, maintain ecosystems, strengthen capacity to adapt to climate change and other weather conditions and disasters.

Target 5 Maintain the diversity of seeds, plants and farmed and domesticated animals and their related wild species.

Target a Increase investment in rural infrastructure, agricultural research and plant and livestock banks.

Target b Avoid and correct restrictions on trade in agricultural markets.

Target c Limit extreme food price volatility by facilitating access to market information.

SDG 3 **Good Health and Well-being**

The third Global Goal is to ensure healthy lives and to promote the well-being for everyone at all ages. This goal consists of the following targets:

Target 1 Reduce the global maternal mortality ratio to less than 70 per 100,000 births.

Target 2 Reduce neonatal mortality (preventable death of newborns and children under the age of 5) to 12 per 1,000 births.

Target 3 End epidemics of AIDS, tuberculosis, malaria and tropical diseases.

Target 4 Reduce the premature mortality by one third by prevention and treatment of non-communicable (chronic) diseases.

Target 5 Reinforce the prevention and treatment of narcotic drug and alcohol abuse.

Target 6 Reduce the number of deaths from road traffic accidents with the factor 2.

Target 7 Make universal sexual and reproductive health-care services accessible.

Target 8 Achieve global health coverage including financial risk protection, access to health-care and access to safe medicine and vaccines for all.

Target 9 Reduce the number of deaths and illnesses from chemicals in air, water and soil.

Target a Strengthen the WHO its convention on tobacco control in all countries.

Target b Support research and development of vaccines and medicines for diseases.

Target c Increase health financing and the recruitment, development and training of the health workforce in developing countries.

Target d Strengthen global capacity for risk reduction and management and global health risks.

SDG 4 **Quality Education**

The fourth goal on the global agenda of the UN is to ensure inclusive and qualitative education for all, and to promote life-long learning. This goal consists of the following targets:

Target 1 Make sure all children complete free and qualitative primary and secondary education for effective learning outcomes.

Target 2 Ensure children have access to care and pre-primary education so that they are ready for primary education.

Target 3 Make education accessible for all men and women.

Target 4 Increase the number of youths and adults who are relevantly skilled.

Target 5 Eliminate disparity in education based on gender, race and disability.

Target 6 Achieve literacy and numeracy for a substantial portion of people.

Target 7 Make sure that all learners achieve a level of knowledge to promote development on - among others - human rights, culture, gender equality.

Target a Upgrade education facilities to make them non-violent and inclusive for all.

Target b Expand the number of available scholarships for developing countries.

Target c Increase the supply of qualified teachers.

SDG 5 Gender Equality

SDG 5 is to achieve gender equality and to empower all women and girls. This goal consists of the following targets:

Target 1 End all forms of gender discrimination

Target 2 End all forms of violence against females in public and private spheres.

Target 3 End all harmful practices against women, such as forced marriage and genital mutilation.

Target 4 Provide public services for unpaid care and domestic work.

Target 5 Ensure participation of women for leadership at all levels.

Target 6 Ensure accessibility to sexual and reproductive health.

Target a Give women equal rights to economic resources.

Target b Enhance the use of technology by women.

Target c Strengthen and reform policies for the promotion of gender equality.

SDG 6 Clean Water and Sanitation

Goal 6 aims at ensuring availability and sustainable management of water and sanitation. This goal consists of the following targets:

Target 1 Achieve global access to safe drinking water for all.

Target 2 Achieve global access to sanitation and hygiene for all.

Target 3 Improve water quality.

Target 4 Increase water-use efficiency.

Target 5 Implement water resource management at all levels.

Target 6 Protect and restore water-related ecosystems.

Target a Expand global cooperation and capacity-building to developing countries in water related activities.

Target b Strengthen the participation of local communities in water and sanitation management.

SDG 7 Affordable and Clean Energy

The seventh goal of the seventeen SDGs is to ensure access to affordable, reliable, modern and sustainable energy for everyone. This goal consists of the following targets:

Target 1 Establish global access to modern energy services.

Target 2 Increase the share of renewable energy.

Target 3 Double the rate of improvement in efficient energy usage.

Target a Intensify the international cooperation to facilitate access to clean energy.

Target b Expand infrastructure and upgrade technology for energy supply in developing countries.

SDG 8 Decent Work and Economic Growth

Goal 8 is to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. The following targets are part of this goal:

- Target 1 Support economic growth per capita; at least 7% gross domestic product growth.
- Target 2 Reach higher levels of economic productivity.
- Target 3 Promote development policies for productive activities as job creation and entrepreneurship.
- Target 4 Improve progressively global resource efficiency in consumption.
- Target 5 Achieve full and productive employment and work for all regardless of gender, race and disability.
- Target 6 Reduce the proportion of unemployed youth.
- Target 7 Take measures to end forced labor, modern slavery and human trafficking.
- Target 8 Protect labor rights and promote safe and secure environments for all employers.
- Target 9 implement policies to promote sustainable tourism.
- Target 10 Strengthen capacity of domestic financial institutions.
- Target a Increase Aid for Trade for developing countries.
- Target b Develop a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization.

SDG 9 Industry, Innovation and Infrastructure

Goal 9 is to build infrastructure, to promote inclusive and sustainable industrialization and to foster innovation. The following 8 targets are part of the ninth SDG:

- Target 1 Develop infrastructure that is qualitative, reliable and sustainable to support economic development and human well-being.
- Target 2 Promote inclusive and sustainable industrialization.
- Target 3 Increase accessibility of small-scale industries and enterprises.
- Target 4 Upgrade infrastructure and industries to make them more sustainable with increased resource-use efficiency.
- Target 5 Upgrade technological capabilities of industrial sectors in all countries and encourage scientific research.
- Target a Facilitate infrastructure development in developing countries.
- Target b Support technology development in developing countries.
- Target c Increase accessibility of information and communication technology.

SDG 10 Reduced Inequality

The 10th SDG focuses on reducing inequality within and among countries. This goal consists of the following targets:

- Target 1 Accomplish and support pay development of the last 40% of the populace at a rate higher than the national average.

- Target 2 Enable and advance the social, financial and political incorporation of all, regardless of age, gender, disability, race, nationality, origin, religion or other status.
- Target 3 Guarantee equivalent freedom and lessen imbalances of result, including taking out prejudicial laws, and advancing proper enactment, strategies and activity in such manner.
- Target 4 Make arrangements, particularly fiscal, wage and social security approaches, and continuously accomplish more equality.
- Target 5 Improve the guidelines and monitoring of worldwide business sectors and foundations and reinforce the usage of such guidelines.
- Target 6 Guarantee upgraded portrayal and voice for agricultural nations in dynamic in global international economic and financial institutions.
- Target 7 Facilitate safe and responsible migration and mobility for all.
- Target a Execute the rule of uncommon and differential treatment for developing countries, specifically least developed nations, as per World Trade Organization arrangements.
- Target b Enhance official development assistance and financial flows.
- Target c Reduce the transaction costs of migrant remittances to less than 3 per cent.

SDG 11 Sustainable Cities and Communities

SDG 11 aims at making cities and human settlements inclusive, safe and sustainable. The following targets form this goal:

- Target 1 Make housing and basic services affordable, safe and adequate for all.
- Target 2 Provide safe, accessible and sustainable transport systems.
- Target 3 Increase inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning.
- Target 4 Protect the world's cultural and natural heritage.
- Target 5 Reduce the number of deaths and number of people affected by disasters directly related to economic losses.
- Target 6 Improve the environmental impact of cities by monitoring air quality and waste management.
- Target 7 Make public spaces safe, accessible and green.
- Target a Support links between urban, per-urban and rural areas based on economic, social and environmental impact.
- Target b Increase the number of cities and human settlements that have plans for inclusion, resources efficiency and mitigation.
- Target c Support developing countries in building sustainable buildings through financial and technical assistance.

SDG 12 Responsible Consumption and Production

The main focus of goal 12 is to ensure the sustainable consumption and production patterns. This goal includes the following targets:

- Target 1 Conduct a ten-year framework for programs on sustainable consumption and production.
- Target 2 Achieve sustainable management and efficiency on the use of natural resources.

- Target 3 Reduce the global food waste at retail and consumer level by factor 2.
- Target 4 Achieve environmental management of chemicals and waste throughout the human life cycle.
- Target 5 Reduce waste generation.
- Target 6 Encourage companies to adopt sustainable programs.
- Target 7 Promote sustainable public procurement practices.
- Target 8 Create awareness and provide relevant information on sustainable development and lifestyles in harmony with nature.
- Target a Support developing countries towards more sustainable patterns of consumption and production by strengthening their scientific and technological capacity.
- Target b Develop and implement tools to monitor sustainable development.
- Target c End inefficient use of fossil-fuels.

SDG 13 Climate Action

Goal 13 of the SDGs is to take urgent action to combat climate change and the impacts of climate change. The following targets are documented to achieve this goal:

- Target 1 Strengthen the adaptive capacity for climate related hazards and disasters in all countries.
- Target 2 Integrate climate change measures into policies, strategies and planning nation wide.
- Target 3 Improve education and human and institutional capacity on climate change.
- Target a Commit to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 for developing countries.
- Target b Advance systems for raising limit with regards to compelling environmental change-related arranging and the executives in least created nations and little island creating States, remembering centering for ladies, youth and nearby and minority networks.

SDG 14 Life Below Water

Goal 14 aims at conserving and sustainable using the oceans, seas and marine resources for sustainable development. The targets of this goal are the following:

- Target 1 Prevent and significantly reduce marine pollution of all kinds.
- Target 2 Sustainable manage and protect marine and coastal ecosystems.
- Target 3 Minimize the impact on ocean acidification.
- Target 4 Regulate harvesting and over-fishing and end illegal, unreported and unregulated fishing.
- Target 5 Conserve 10 percent of coastal and marine areas.
- Target 6 Prohibit the subsidisation of fisheries that contribute to over-fishing and illegal, unreported and unregulated fishing.
- Target 7 Increase the benefits of Small Island developing States and developing countries from sustainable use of marine resources.
- Target a Increase scientific knowledge, research capacity and marine technology to improve ocean health.
- Target b Provide access for small-scale fishers to marine sources and markets.

Target c Improve the protection and manageable conservation of seas and their assets by executing global law as reflected in UNCLOS. To give a lawful structure to the preservation and practical conservation of seas and their assets

SDG 15 **Life on Land**

Goal 15 is to protect, restore and promote the sustainable use of terrestrial ecosystems. To sustainably manage forests, combat desertification and halt and reverse land degradation and to prevent biodiversity loss. The targets of which this goal consists are the following:

- Target 1 Conserve and sustainably use the terrestrial and inland freshwater ecosystems, forests, mountains, drylands and wetlands.
- Target 2 Promote the implementation of sustainable management of forests. Halt deforestation, restore degraded forests and sustainably increase afforestation and reforestation globally.
- Target 3 Combat desertification and restore land and soil.
- Target 4 Ensure the conservation of mountain ecosystems.
- Target 5 Take action to reduce degradation of natural habitats.
- Target 6 Promote fair share of benefits from genetic resources.
- Target 7 End trading and trafficking of protected species of flora and fauna.
- Target 8 Introduce measures to prevent the impact of invasive species in various ecosystems.
- Target 9 Implement biodiversity and ecosystem values into national and local planning.
- Target a Mobilize and increase financial resources to conserve biodiversity and ecosystems.
- Target b Mobilize and increase resources to conserve biodiversity and ecosystems for developing countries.
- Target c Globally support efforts to combat trafficking of protected species.

SDG 16 **Peace and Justice Strong Institutions**

Goal 16 is to promote peaceful and inclusive societies for sustainable development. As well as providing access to justice for all, and build effective, accountable and inclusive institutions at all levels. The targets of this goal are:

- Target 1 Reduce violence and violence related death rates.
- Target 2 End trafficking, abuse, exploitation and all other forms of violence against children.
- Target 3 Ensure equal access to justice for all.
- Target 4 Reduce all forms of organized crimes
- Target 5 Reduce bribery and corruption of all forms.
- Target 6 Develop institutions that are transparent, accountable and effective at all levels.
- Target 7 Enhance inclusive and representative decision-making at all levels.
- Target 8 Increase the participation of developing countries in global governance.
- Target 9 Make legal identity and birth registration accessible for all.
- Target 10 Make public information accessible and ensure fundamental freedoms.
- Target a Make the national institutions stronger through international cooperation.
- Target b Enforce non-discriminatory laws.

SDG 17 Partnerships to achieve the Goal

The last goal of the 17 SDGs is to strengthen the means of implementation and revitalize the global partnership for sustainable development.

- Target 1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection
- Target 2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of ODA/GNI to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries
- Target 3 Mobilize additional financial resources for developing countries from multiple sources
- Target 4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress
- Target 5 Adopt and implement investment promotion regimes for least developed countries
- Target 6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism
- Target 7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed
- Target 8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology
- Target 9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation
- Target 10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda
- Target 11 Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020
- Target 12 Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access

- Target 13 Enhance global macroeconomic stability, including through policy coordination and policy coherence
- Target 14 Enhance policy coherence for sustainable development
- Target 15 Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development Multi-stakeholder partnerships
- Target 16 Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries
- Target 17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships Data, monitoring and accountability
- Target 18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts
- Target 19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries