

Using NLP to Understand Corporate Sustainability Issues

Jenica Andersen
Metis DSML

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“Once considered tangential to business decision-making, **environmental, social and governance factors have now become business imperatives**—and, for those companies with foresight, sustainable business strategies are also a **pathway to stable, profitable, long-term economic growth and social prosperity.**”

—Ceres.org



Introduction

-Research Question:

**What are the main topics within corporate sustainability shareholder resolutions?
What are the sentiments?**

-Business Use:

Consultants, companies, investors and activists can understand the current state of sustainability practices and can apply the best practices to their own operations.

Modeled After :



sustainability



Article

Identifying Corporate Sustainability Issues by Analyzing Shareholder Resolutions: A Machine-Learning Text Analytics Approach

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Abstract: Corporations have embraced the idea of corporate environmental, social, and governance (ESG) under the general framework of sustainability. Studies have measured and analyzed the impact of internal sustainability efforts on the performance of individual companies, policies, and projects. This exploratory study attempts to extract useful insight from shareholder sustainability resolutions using machine learning-based text analytics. Prior research has studied corporate sustainability disclosures from public reports. By studying shareholder resolutions, we gain insight into the shareholders' perspectives and objectives. The primary source for this study is the Ceres sustainability shareholder resolution database, with 1737 records spanning 2009–2019. The study utilizes a combination of text analytic approaches (i.e., word cloud, co-occurrence, row-similarities, clustering, classification, etc.) to extract insights. These are novel methods of transforming textual data into useful

2020 paper in *Sustainability* by Dr. Viju Raghupathi, et al.

Introduction - Method - Results - Summary - Appendix

The Data: Ceres.org

Climate and Sustainability Shareholder Proposals

engagements.ceres.org/?_ga=2.193001133.1671682996.1654368102-1475954746.1654368096

Ceres

Show 25 entries

Status	Proposal	Company	Filer	Year
Filed	Adopt stewardship practices to reduce diversified portfolio ESG costs	3M Co.	The Shareholder Commons	2022
Vote	Report on lobbying	Abbott Laboratories	Unitarian Universalist Association	2022
Vote	Report on lobbying in line with company values/policy	AbbVie Inc.	As You Sow	2022
Withdrawn: Commitment	Adopt GHG reduction targets	Air Products & Chemicals Inc.	The Nathan Cummings Foundation	2022
Withdrawn: Strategic	Adopt GHG reduction targets	Allegheny Technologies Inc.	As You Sow	2022
Withdrawn: Commitment	Report on benefits of product repair	Alphabet Inc.	Green Century Capital Management	2022
Filed	Report on water use risks	Alphabet Inc.	As You Sow	2022
Filed	Report on ESG risks to diversified investors	Alphabet Inc.	John Chevedden	2022
Filed	Establish board committee on sustainability	Alphabet Inc.	SustainInvest Asset Management	2022
Filed	Report on corporate climate lobbying in line with Paris Agreement	Alphabet Inc.	Zevin Asset Management	2022
Vote	Report on retirement plan option alignment with climate policy	Amazon.com Inc.	As You Sow	2022
Vote	Report on plastic pollution	Amazon.com Inc.	As You Sow	2022
Vote	Report on lobbying	Amazon.com Inc.	International Brotherhood of Teamsters, Pension Fund	2022
Withdrawn: Commitment	Report on GHG emissions targets	Amedisys Inc	As You Sow	2022
Withdrawn: Commitment	Report on corporate climate lobbying in line with Paris Agreement	American Airlines Group Inc.	Presbyterian Church (USA)	2022
Withdrawn: Commitment	Adopt financing policy in line with IEA Net Zero Scenario	American International Group, Inc.	Presbyterian Church (USA)	2022
Withdrawn: Commitment	Adopt GHG reduction targets	American Water Works Company, Inc.	Proxy Impact	2022

 Ceres

Adopt stewardship practices to reduce diversified portfolio ESG costs (MMM, 2022)

Organization: 3M Co.
Year: 2022
Whereas:

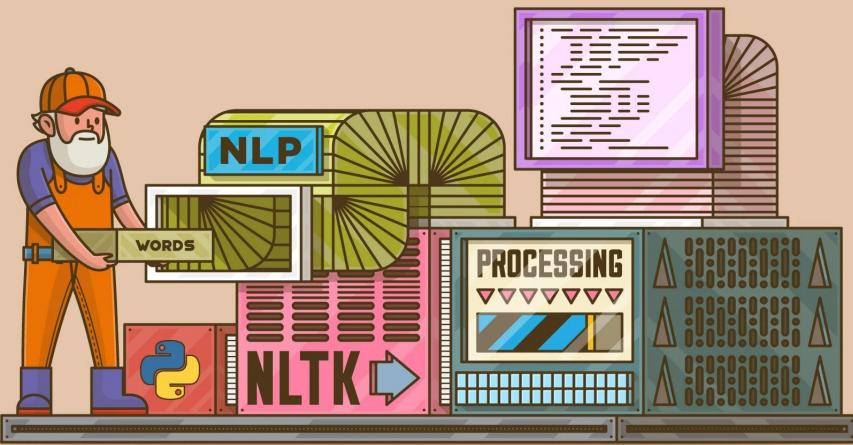
In our Company's 2021 Sustainability Report, CEO Mike Roman states, "We are committed to being leaders in sustainability." A review of that report reveals our Company has addressed many environmental concerns. But 3M's commitment is limited. For example:

- 3M is active in three trade associations that work against comprehensive U.S. policies to address climate change.²
- 3M does not appear to have committed to meet the Science-Based Targets initiative for a 1.5-degree Celsius world³ and failed to receive an "A" grade in 2020 from CDP, a widely used and respected climate rating.⁴
- Belgian regulators recently ordered 3M to stop PFAS production after recent blood samples taken from 800 people near 3M's plant showed elevated levels of PFAS.⁵

Industry	Industrial Conglomerates
Sector	Industrials
Filed By	The Shareholder Commons
Votes	%
Status	Filed
View Memo	View

- **923 documents**
- **~410,000 words**
- **2019-2022**

Natural Language Processing



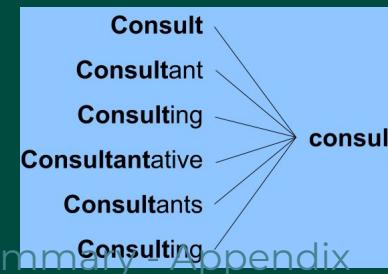
Real Python

scikit
learn

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PREPROCESSING

- Remove stop words & special characters
English stop words + some custom:
'www', 'whereas', 'include', 'full', 'request',
'resolved', 'shareholder', 'company',
'companies', 'use', 'https', 'pdf'
- Stem the words- Used Porter (most aggressive)



NLP Topic Modeling

Countvectorizer
N-grams
NMF
WordCloud

Data = ['The', 'quick', 'brown', 'fox', 'jumps', 'over', 'the', 'lazy', 'dog']



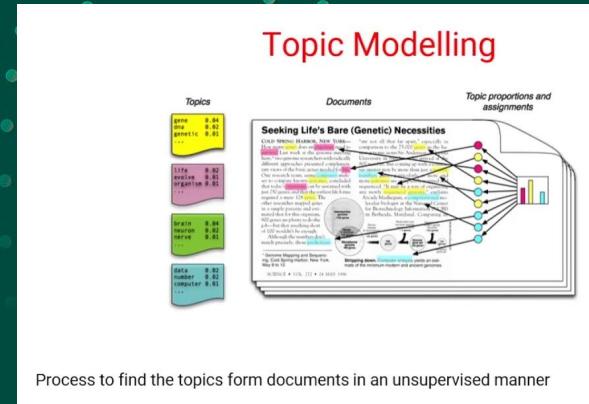
The	quick	brown	fox	jumps	over	lazy	dog
2	1	1	1	1	1	1	1

min_df = 6 (got rid of "Zuckerberg")

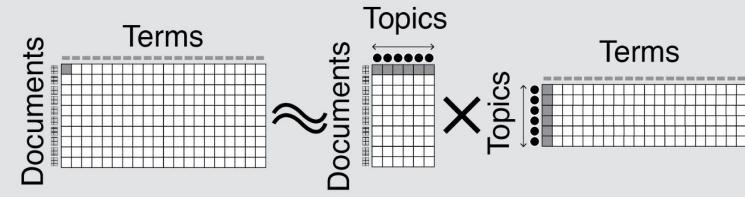
max_df = .99 (conservative, could go lower)



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Non-Negative Matrix Factorization Generic Diagram



V **W** **X** **H**

Visible Variables
Input

Document x Term Matrix
 $n \times m$

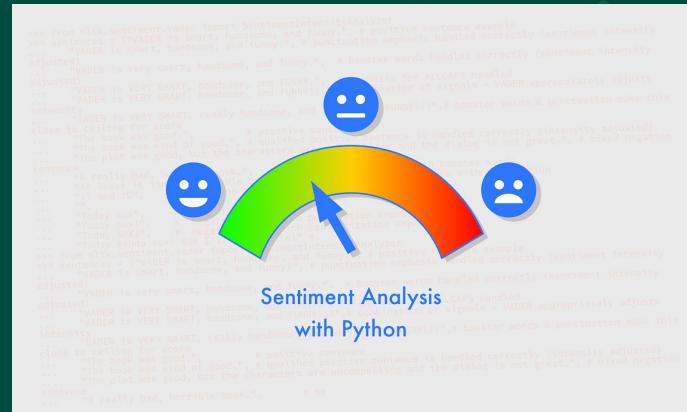
Weights
Feature Set

Document x Topic Matrix
 $n \times p$

Hidden Variables
Coefficients

Topic x Term Matrix
 $p \times m$

NLP Sentiment Analysis

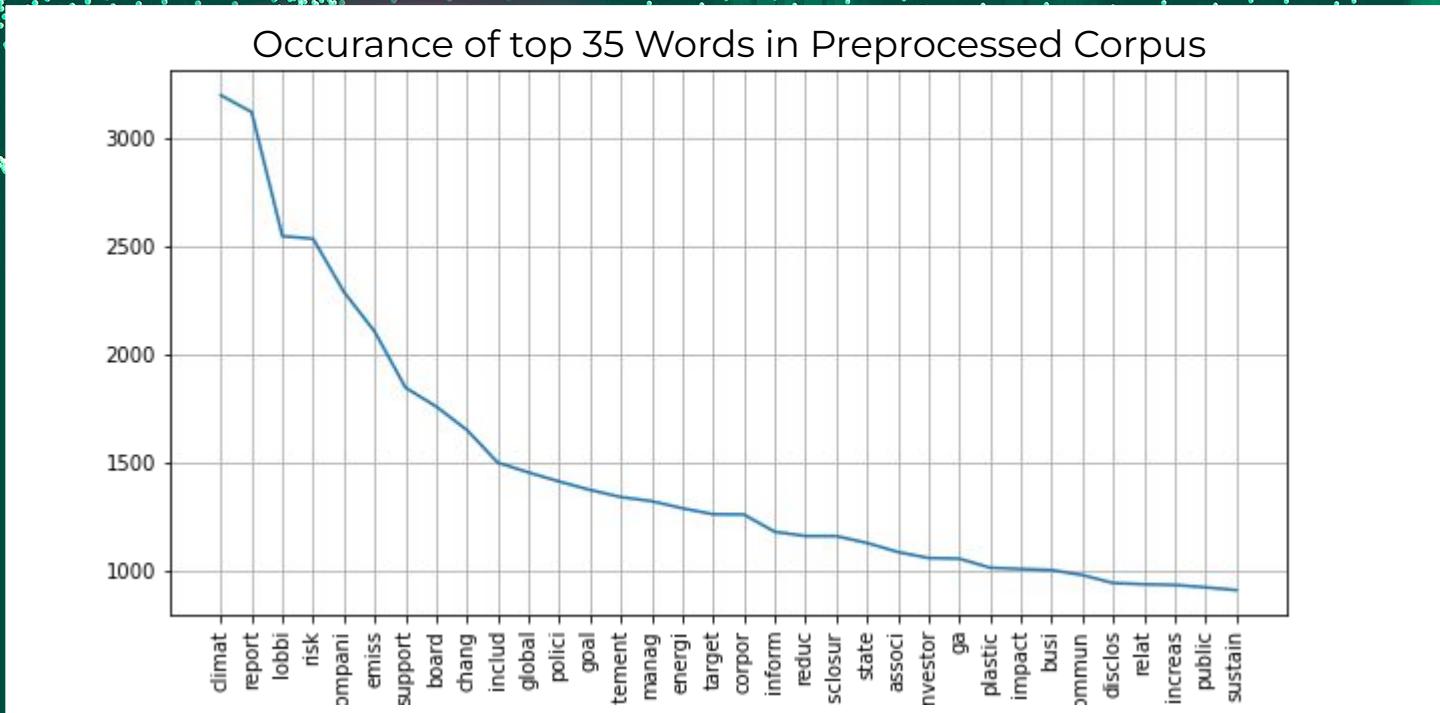


Vader SentimentIntensityAnalyzer Applied to entire corpus of resolutions



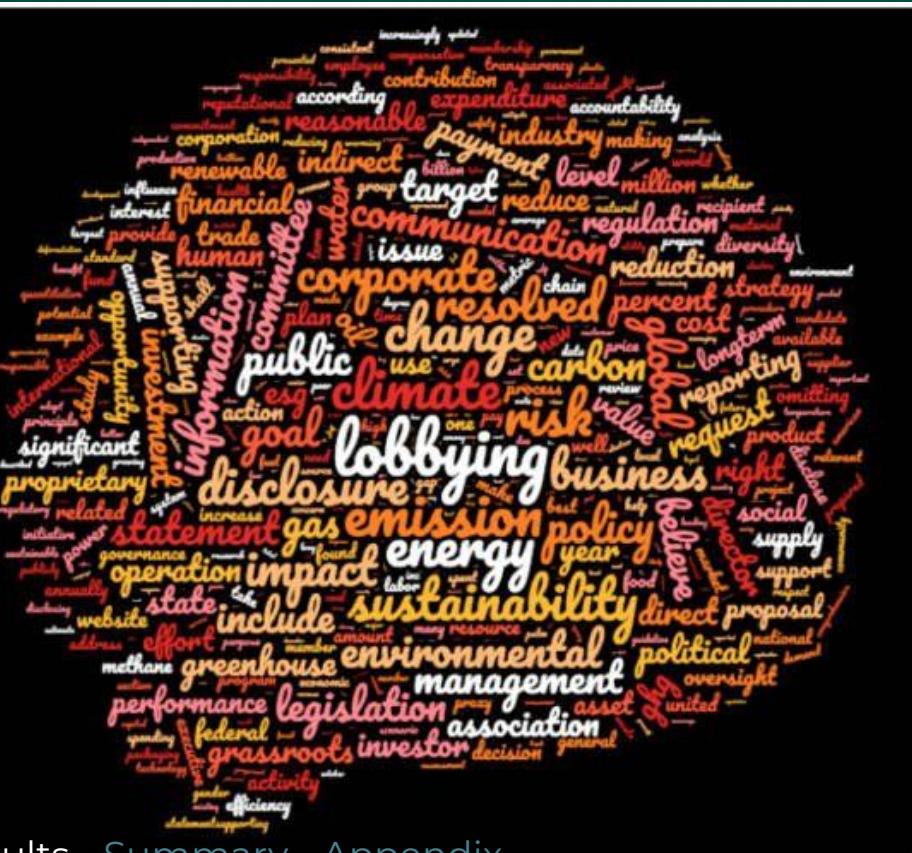
Results

Word Count



Word frequency results

vs. Raghupathi et al



NMF Cluster Topics

Topics 2019 - 2022

- 1. Climate Emissions Targets**
- 2. Activism/lobbying**
- 3. Female Wage Disparity**
- 4. Campaign Contributions**
- 5. ESG Management and Corporate Policies**
- 6. Plastic Pollution and the Ocean**
- 7. Human Rights Impact Assessments**

Raghupathi's Topics circa 2020:

- Emission & energy
- Board
- Regulation
- Politics
- Governance
- Product
- Management
- Accountability

NMF Topics & top 5 terms

Topic 1. Climate Emissions Targets

Climat, emiss, target, chang, energi

Adopt GHG reduction targets (APD, 2022
Resolution)

Organization: Air Products & Chemicals Inc.

Year: 2022

Resolved:

Shareholders request Air Products address the risks and opportunities presented by climate change and the global transition toward net zero emissions by setting emission reduction targets covering the company's full value chain (Scope 1, 2, and 3) GHG emissions.

Supporting Statement:

In assessing what targets to set, we recommend, at management's discretion, consideration of the following:

- Adopting short, medium, and long-term GHG emissions reduction targets taking into consideration approaches used by advisory groups such the Science Based Targets initiative (through which over 1,700 companies have set or committed to set science-based GHG reduction targets).
- Adopting quantitative targets to increase sourcing of renewable energy, energy efficiency, and production of green hydrogen.
- Assessing disparate impacts of the company's climate change contributions on communities of color, and, committing to reduce or mitigate local community health impacts from the cumulative emissions generated from its facilities.

Industry	Chemicals
Sector	Materials
Filed By	The Nathan Cummings Foundation
Votes	%
Status	Withdrawn: Commitment
View Memo	

NMF Topics & top 5 terms

Topic 2. Activism/Lobbying

Lobbi, commun, payment, legisl, indirect

Report on lobbying (ABT, 2022 Resolution)

Organization: Abbott Laboratories

Year: 2022

Whereas:

We believe in full disclosure of Abbott Laboratories' ("Abbott") direct and indirect lobbying activities and expenditures to assess whether Abbott's lobbying is consistent with its expressed goals and in the best interests of stockholders.

Resolved:

The stockholders of Abbott request the preparation of a report, updated annually, disclosing:

1. Company policy and procedures governing lobbying, both direct and indirect, and grassroots lobbying communications.
2. Payments by Abbott used for (a) direct or indirect lobbying or (b) grassroots lobbying communications, in each case including the amount of the payment and the recipient.
3. Abbott's membership in and payments to any tax-exempt organization that writes and endorses model legislation.
4. Description of management's decision-making process and the Board's oversight for making payments described in section 2 above.

Supporting Statement:

Abbott spent \$36,700,000 from 2010 – 2019 on federal lobbying. This figure does not

Industry	Health Care Equipment & Supplies
Sector	Health Care
Filed By	Unitarian Universalist Association
Votes	34.7%
Status	Vote
View Memo	View

NMF Topics & top 5 terms

Topic 3. Female Wage Disparity

Pay, gap, pay gap, percent, median

bi-gram

Report on pay disparity (FB, 2020 Resolution)

Organization: Facebook, Inc.

Year: 2020

Whereas: Whereas: The World Economic Forum estimates the gender pay gap costs the economy 12 trillion dollars annually. The median income for women working full time in the United States is 80 percent that of men. This disparity can equal half a million dollars over a career. Intersecting race, the gap for African American and Latina women is 60 percent and 55 percent. At the current rate, women overall will not reach pay equity until 2059, African American women until 2130, and Latina women until 2224. Research suggests diverse leadership leads to superior stock performance and return on equity. McKinsey states, the business case for the advancement and promotion of women is compelling. Best practices include tracking and eliminating gender pay gaps. Women account for 36.9 percent of our company's workforce and 32.6 percent of leadership. Actively managing pay equity is associated with higher current female representation at the professional through executive levels and a faster trajectory to improved representation. Assessing if a company has pay gaps requires analyzing both equal pay and equal opportunity. This is done using adjusted and unadjusted (median) pay data. The objective of this proposal-median pay gap disclosure-addresses the structural bias affecting the jobs women and minorities hold, when white men hold most higher paying jobs. It is the key metric used by the Organization for Economic

Industry	Internet Software & Services
Sector	Information Technology
Filed By	Not Disclosed in Proxy
Votes	8.607336519%
Status	Vote
View Memo	

NMF Topics & top 5 terms

Topic 4. Campaign Contributions

Compani, corpor, thi, elector, spend

Report on indirect political spending (XOM, 2022 Resolution)

Organization: Exxon Mobil Corporation

Year: 2022

Resolved:

That the shareholders of Exxon Mobil Corporation (Exxon or Company) hereby request the Company to prepare and semiannually update a report, which shall be presented to the pertinent board of directors committee and posted on the Company's website, disclosing the Company's:

- Policies and procedures for making electoral contributions and expenditures (direct and indirect) with corporate funds, including the board's role (if any) in that process; and
- Monetary and non-monetary contributions or expenditures that could not be deducted as an ordinary and necessary business expense under section 162(e)(1)(B) of the Internal Revenue Code, including (but not limited to) contributions or expenditures on behalf of candidates, parties, and committees and entities organized and operating under section 501(c)(4) of the Internal Revenue Code, as well as the portion of any dues or payments made to any tax-exempt organization (such as a trade association) used for an expenditure or contribution that, if made directly by the Company, would not be deductible under section 162(e)(1)(B) of the Internal Revenue Code.
- The report shall be made available within 12 months of the annual meeting

Industry	Oil, Gas & Consumable Fuels
Sector	Energy
Filed	Unitarian Universalist
By	Association
Votes	26.7%
Status	Vote
View	
Memo	

NMF Topics & top 5 terms

Topic 5. ESG management and corporate policies

Report, sustain, risk, board, manag

Adopt stewardship practices to reduce diversified portfolio ESG costs (MMM, 2022)

Organization: 3M Co.

Year: 2022

Whereas:

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Industry	Industrial Conglomerates
Sector	Industrials
Filed By	The Shareholder Commons
Votes	%
Status	Filed
View Memo	View

It appears our Company only addresses sustainability issues when that pursuit optimizes 3M's financial return. The Sustainability Report states:

Our priority is the comprehensive management of enterprise risks through an ethical tone, governance processes, and clear roles, responsibilities, and accountability.⁶

NMF Topics & top 5 terms

Topic 6. Plastic Pollution & the Ocean

Plastic, package, recycl, reduc, report

Report on plastic pollution (AMZN, 2022 Resolution)

Organization: Amazon.com Inc.

Year: 2022

Description:

from As You Sow website: supporting individual filer Sara Sackner

Whereas:

The growing plastic pollution crisis poses increasing risks to our company. Corporations could face an annual **financial risk of approximately \$100 billion** should governments require them to cover the waste management costs of the packaging they produce, a policy that is increasingly being enacted around the globe.

Recently, Pew Charitable Trusts released a groundbreaking study, *Breaking the Plastic Wave*, concluding that if all current industry and government commitments were met, ocean plastic deposition would be reduced by only 7%. Without immediate and sustained new commitments throughout the plastics value chain, annual flows of plastics into oceans could nearly triple by 2040.

The Pew report also finds that improved recycling must be coupled with reductions in use, materials redesign, and substitution. It concludes that plastic demand should be reduced by least 1/3, stating that reducing plastic production is the most attractive solution from environmental, economic, and social perspectives. The European Union has banned 10 single-use plastic products commonly found in

Industry	Internet & Direct Marketing Retail
Sector	Consumer Discretionary
Filed By	As You Sow
Votes	48.9%
Status	Vote
View Memo	View

NMF Topics & top 5 terms

Topic 7. Human Rights Impacts Assessments

Right, human, human rights, risk, impact

another
bi-gram

Report on indigenous peoples policy (GS,
2019 Resolution)

Organization: Goldman Sachs

Year: 2019

Whereas:

Whereas, our Company has been identified as one of the banks financially supporting companies engaged in the development or construction of the Dakota Access Pipeline (DAPL) (Bakken Pipeline), a controversial project which received extensive media coverage and public condemnation because of its environmental destruction, pollution and encroachment upon sacred Sioux Nation land;

Industry	Capital Markets
Sector	Financials
Filed	Harrington Investments, Inc.
Votes	%
Status	Withdrawn: Dialogue
View Memo	

Whereas, in accordance with the United Nations Declaration on the Rights of Indigenous Peoples, Article 11, asserts "the right to maintain, protect and develop the past, present and future manifestations of their cultures, such as archaeological and historical sites... yet the Dakota Access Pipeline construction has already desecrated various ancestral sites, disregarding previous treaties in blatant violation of Indigenous Peoples' Human Rights;

Whereas, Article 29 of the Declaration states "Indigenous Peoples have the right to the conservation and protection of the environment and the productive capacity of their lands or territories and resources";

Less Frequent Topics

- **Financing fossil fuels**
- **Compensation review**
- **Water use and management**
- **Natural gas and liquified natural gas**
- **Plastic pellets pollution/chemical spills**
- **Corporate leaders and accountability**
- **Gender diversity in tech**
- **Sexual harassment reporting**

Sentiments

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Summary

This could be the part of the presentation where you can introduce yourself, write your email...

Next steps!

**NMF
coherence
scoring for
optimal
number of
topics**

Topics by year

**Scrape all
resolutions
(2009 - 2022)**

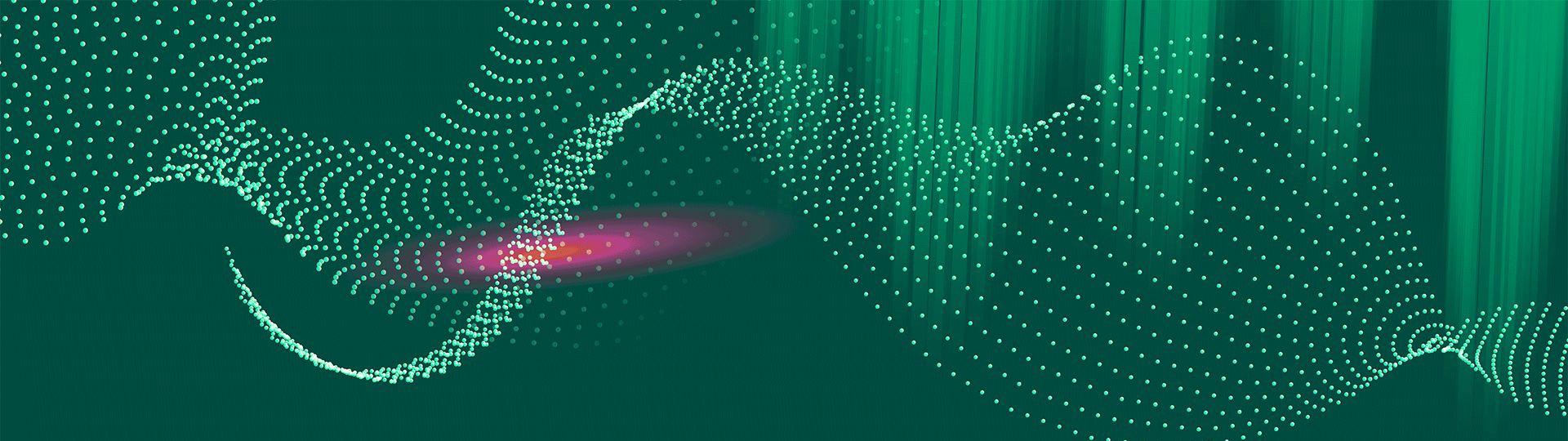
**Compare
results with
other
clustering/
dimensionality
reduction
methods**

**Topics by
industry**

**Compare NMF
for other
Lancaster and
Snowball
stemmers**

**Sentiments by
topic**

**Compare & share
larger results
with
Raghupahti et al.**



References

Raghupathi, V.; Ren, J.; Raghupathi, W. Identifying Corporate Sustainability Issues by Analyzing Shareholder Resolutions: A Machine-Learning Text Analytics Approach. *Sustainability* 2020, 12, 4753. <https://doi.org/10.3390/su12114753>

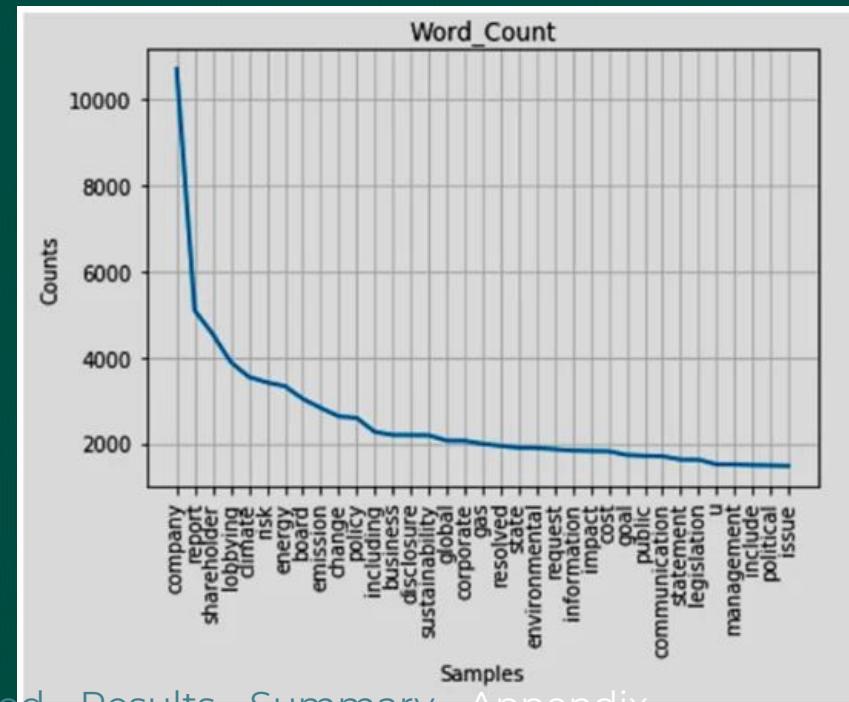
THANK YOU!

I would love feedback to help me make this better!



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Compare Word Count to Raghupathi et al.



Raghupathi cluster word clouds

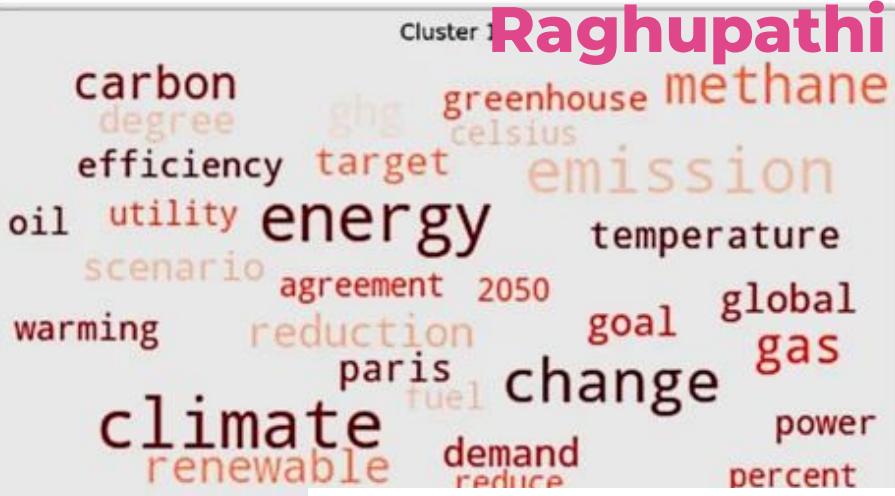
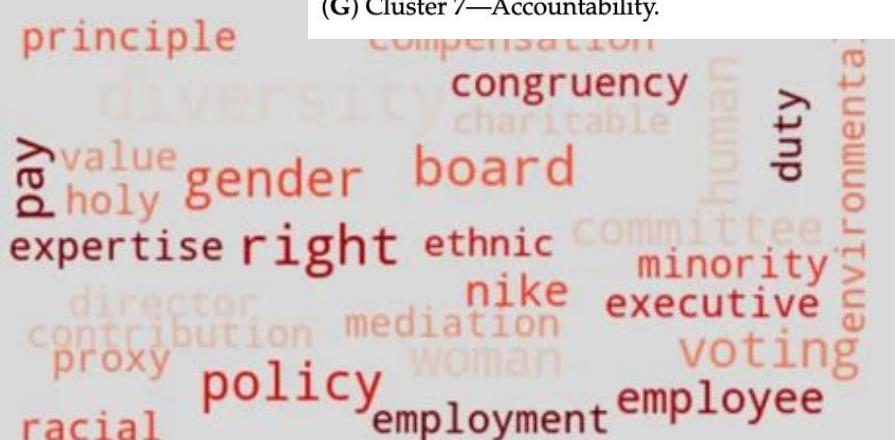


Figure 11. (A) Cluster 1—Emission and Energy. (B) Cluster 2—Board. (C) Cluster 3—Regulation. (D) Cluster 4—Politics. (E) Cluster 5—Governance. (F) Cluster 6—Product Management. (G) Cluster 7—Accountability.



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political expenditure support internal proper candidate campaign supreme company transparency accountability used entity section payment election association citizen monetary activity trade behalf corporate disclosure code

Raghupathi cluster word clouds

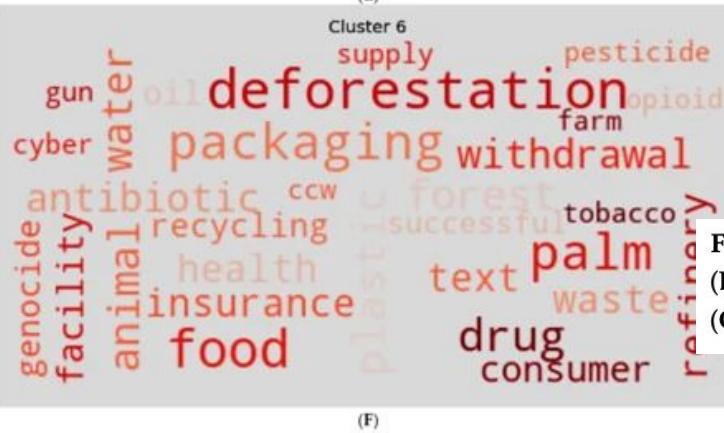


Figure 11. (A) Cluster 1—Emission and Energy. (B) Cluster 2—Board. (C) Cluster 3—Regulation. (D) Cluster 4—Politics. (E) Cluster 5—Governance. (F) Cluster 6—Product Management. (G) Cluster 7—Accountability.