

Exploring Portfolio Decarbonization using AI

NUS Group 7

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Rationale



Increasing importance of
ESG Investment



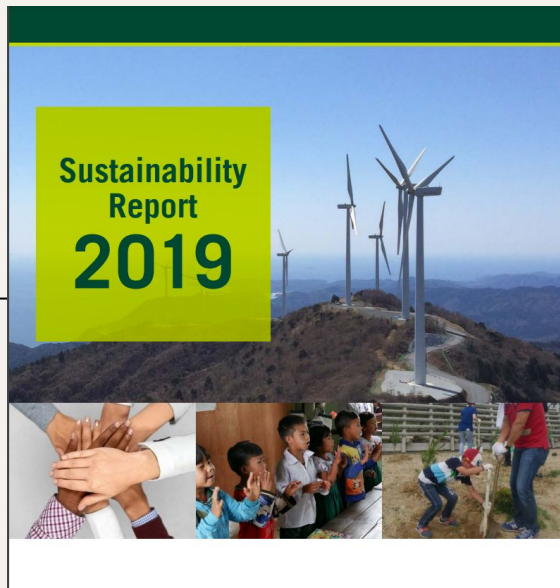
Participation in
global initiatives



Analysis of
Unstructured Data

Project Scope

Capture
decarbonization
**targets, efforts &
approaches** by
financial
institutions

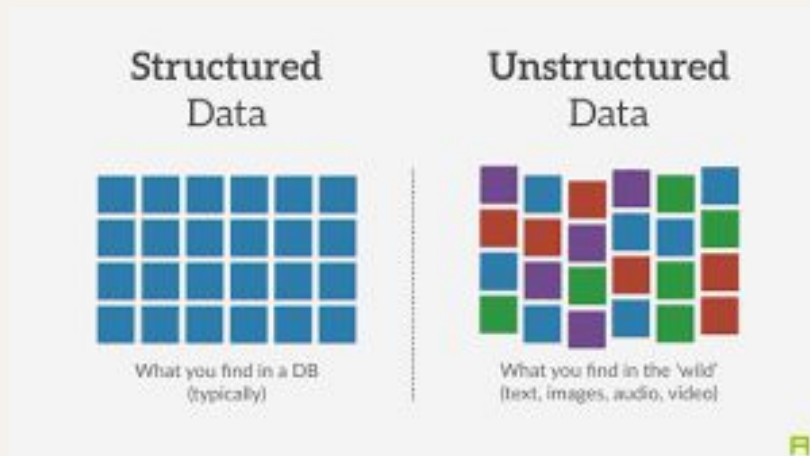


Extract and
understand
information
related to
decarbonization

Convert unstructured data into **useful metrics** to expedite decision making

Current Business Problem

Availability of Information



Information Consolidation



Scraping of text data from PDF files and conversion into text data tables

Optimized machine learning models
to gauge sentiment based on
frequency of words, topic modelling
and classification

Help different companies monitor
their progress towards reaching
their decarbonization targets

Data Collection

> 115

Companies

4

**Types of Financial
Institutions**

Data Extraction



PyPDF2

Illogical order of text



textract

Not compatible with
Windows



PyMuPDF

Optimal Results

Data Extraction



PyMuPDF

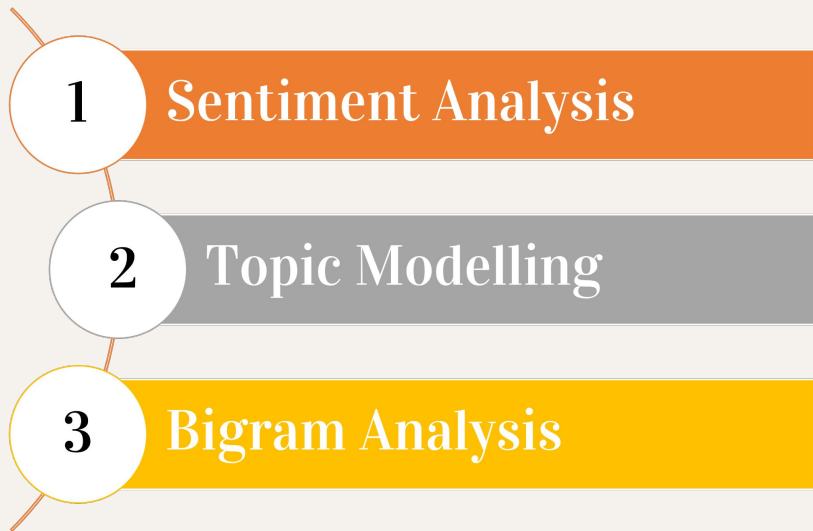
- **Input:** PDF downloaded manually from company's website
- **Process:** Obtain text from a document using Textract package
- **Output:** A .string that contains all the extracted information

```
© Green Operations Commitment • Green Building in energy conservation and emission reduction, and integrated into the construction and operation on in whole lifecycle. • Office: Adopt low-carbon mjects. • Carbon Neutrality: Encourage employees t new energy in architectural design and • Education: arbon ideas. • Target Management and Data Disclosrting results (annual goals and operation on gr en Operations Measures Green Building in Workplace: 1 th LEED/WELL certifications or green design of the same time, Ping An has formulated green bu onstruction standard. 2. Measures of Ping An in practi and adopting thermal insulation materials to main applying intelligent power supply systems, inductive l lighting; reduce water consumption by recycling ra king spaces for electric vehicles. (b) Improve indoc tion, filtration, humidity control, maintenance an to eliminate 95% of PM2.5 by installing customized rough intelligent operation; for example, reduce the ine visitors management, intelligent parking, etc. Off anagement based on its own circumstances. Meanwhi onservatation and emission reduction and garbage re on, Smart HR (Happy Ping An, HR-X), etc. Ping An str
```


Data Pre-processing

- **Text cleaning:** Drop special characters, non-English sentences, and lowercase text
- **Tokenization:** Break the text into smaller chunks for machine learning models
- **Stopwords Removal:** Remove words such as 'in', 'for', to help our model read useful keywords only
- **Lemmatization:** Brings words to their dictionary form with the goal of boosting text mining models

Data Analysis Approach



BlackRock[®]

VS

CREDIT SUISSE 

Compare between
2 companies

Sentiment Analysis

Calculation Of Sentiment Score

- Text Polarity from **TextBlob** library
- Total frequency of ESG related keywords and unique keywords

Sentiment (Comp)

$$= \text{TextBlob Score} + \log [1 + (\sum \text{keywords} \times \sum \text{unique keywords})]$$

Sentiment Analysis

Company's sentiments towards portfolio decarbonization

19%



68%



13%



Comparison of ML models

Model	Accuracy	Recall	F1
Decision Tree Classifier	0.848	0.810	0.823
Logistic Regression Classifier	0.862	0.735	0.820
Adaboost	0.723	0.220	0.363
Naive Bayes Classifier	0.723	0.748	0.675

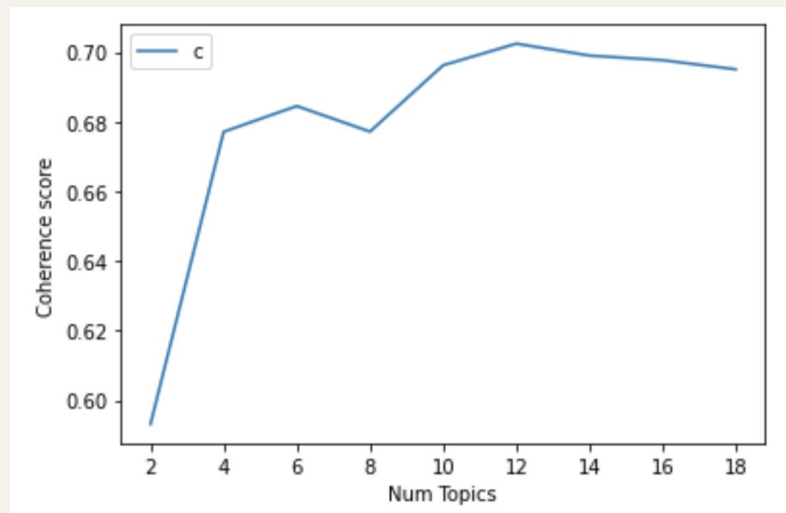
Topic Modelling

Topic Modelling

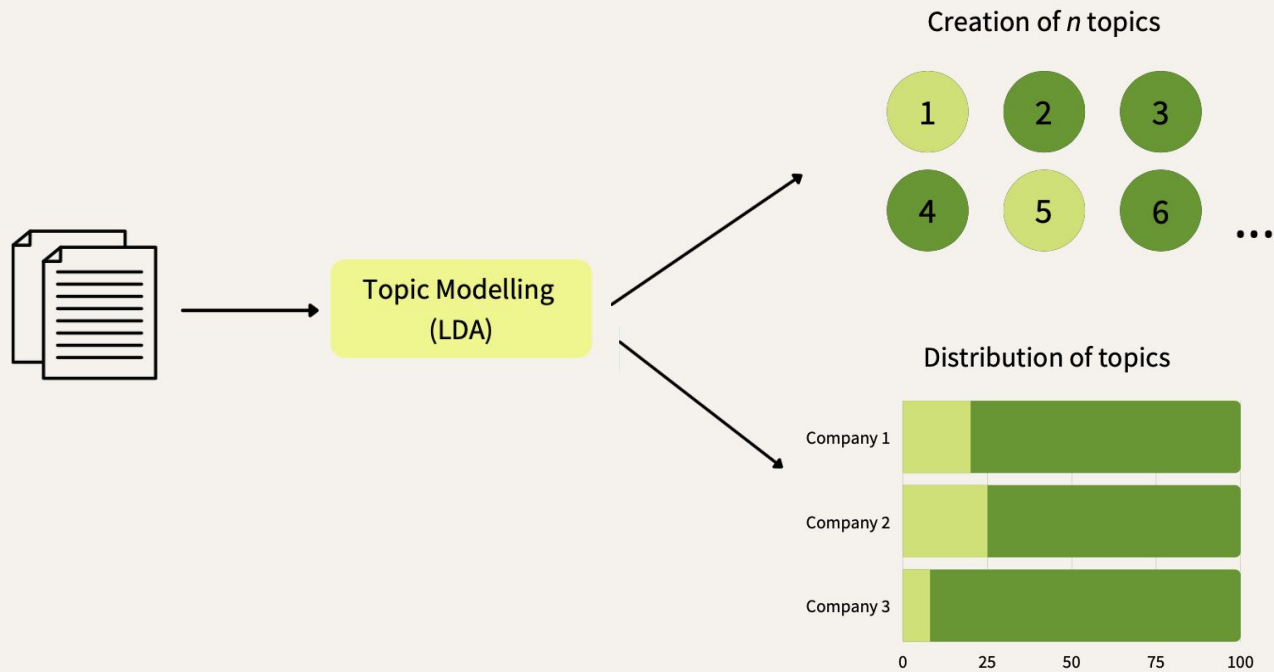
- To discover a **set of topics and words** from the collection of company reports
- Latent Dirichlet Allocation Mallet (LDAMallet) algorithm from the Gensim package
- Find mixture of words associated with each topic
- To summarise complex reports into **specific themes** (decarbonization related vs decarbonization unrelated)
- To infer the **distribution** of decarbonization related topics in a report

Topic Modelling

- Quality of model depends on optimal number of topics
- **Higher coherence score** gives a better LDA model
- Chosen Model: **12 topics** with coherence score of 0.7024



Topic Modelling



Bigram Analysis

Bigram Analysis

- TfidfVectorizer Library
- Useful since a very large text dataset is used
- Bigrams capture **structure** that is overlooked when analysing single words
- Bigrams provide **context**

Single Word	Bigram
Green	Green bond
Finance	Sustainable Finance

Dashboard Overview

Decarbonization Dashboard

Individual Company Company Comparison

Select Type of Financial Institution

Asset Manager (AM)

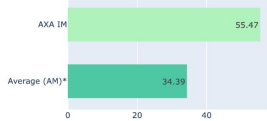
Select a Company

AXA Investment Managers

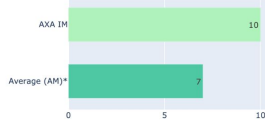
Overall Sentiment Level



Decarbonization Disclosure (%)



Global Standards & Initiatives Count



Global Standards & Initiatives

Initiatives	Acronym	Details
Carbon Disclosure Project	CDP	A global environmental initiative that helps corporations disclose their climate change response information and mitigate climate change risk
Climate Action 100+	-	An initiative to ensure the world's largest corporate greenhouse gas emitters take necessary action on climate change
Climate Bonds Initiative	CBI	An initiative that works on mobilising the \$100 trillion bond market for climate change solutions
Net Zero Asset Managers Initiative	-	A leadership group of asset managers committed to supporting the goal of net zero greenhouse gas emissions by 2050 or sooner
Principles for Responsible Investment	PRI	A principle-based framework that offers a list of possible actions for incorporating ESG issues into investment practice
Science Based Targets initiative	SBTi	An initiative designed to provide guidelines and methods for corporations to set GHG targets in line with the Paris Agreement
Sustainability Accounting Standards Board	SASB	An initiative that facilitates the disclosure of material and decision-useful climate-related information to investors
Sustainable Development Goals	SDGs	A collection of 17 interlinked global goals designed by the UN to be a blueprint to achieve a better and more sustainable future for all
Task Force on Climate-related Financial Disclosure	TCFD	An initiative that recommends corporations to incorporate climate change risk into their financial information

* Average is the mean result of all the companies that belongs under the same type of financial institution.

Decarbonization Dashboard

Individual Company Company Comparison

Select Type of Financial Institution

Asian Bank (AB)

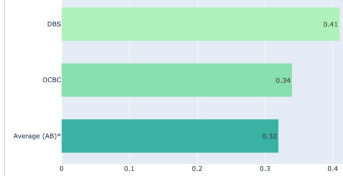
Select the First Company

DBS Bank

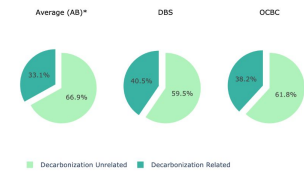
Select the Second Company

OCBC Bank

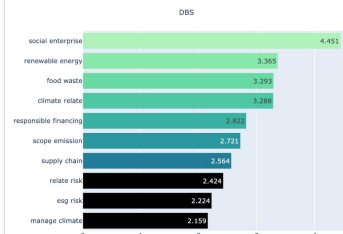
Comparison - Overall Sentiment Level



Comparison - Decarbonization Disclosure (%)

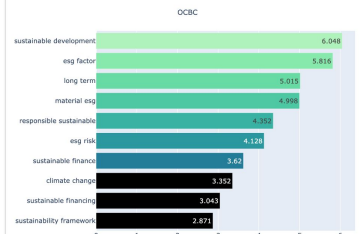


Top 10 Occurring Bigrams



Values represent the TF-IDF score of a word pair in a document where TF-IDF score = term frequency X inverse document frequency

Top 10 Occurring Bigrams



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* Average is the mean result of all the companies that belongs under the same type of financial institution.

Dashboard Objectives



**Relevant &
Informative**



**Diverse Data
Visualization**



**User Friendly
& Interactive**

Future Works

Dashboard

Increase the number of
filter options

01



02



03

Runtime

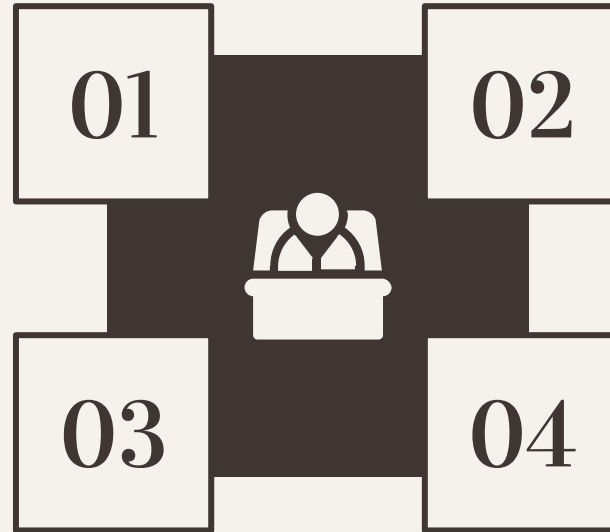
Expedite LDA training
process

Dashboard

Drill down on bigram
analysis

Takeaways

Understanding
business issue



Natural Language
Processing

Teamwork

Project
Management

Conclusion

The image features two thin, dark horizontal lines that span the width of the frame. Each line has a smooth, curved end on the left and right sides, creating a subtle, elegant border.

Thank You



Q&A

References

Photos:

https://www.southpole.com/uploads/thumbs/green-investment-1_800w.png

https://www.ing.com/upload_mm/d/0/d/b0eecce6-dbf4-4559-821a-56b5be093ed2_CDP-680x300_500x220.jpg

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https://asics-corporate-production-draft.s3.amazonaws.com/gor_media_library/gor/widget/view_setting/6400/190924-1.5%E5%BA%A6%E7%9B%AE%E6%A8%99%E3%81%A8C02%E6%8E%92%E5%87%BA%E3%82%BC%E3%83%AD%E3%81%B8%E3%81%AE%E3%82%B3%E3%83%9F%E3%83%83%E3%83%88%E3%83%A1%E3%83%B3%E3%83%88%E8%A1%A8%E6%98%8E2_original.jpg?1569289651

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<https://blog.trello.com/hubfs/DashboardFinal.png>

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https://upload.wikimedia.org/wikipedia/commons/thumb/3/31/Credit_Suisse_Logo.svg/2560px-Credit_Suisse_Logo.svg.png

Appendices

Example of cleaned text:

a and available \nfinancial resources. The Bank aims to work with public \nand private sector partners to channel its own public \nresources, together with private and institutional funds, \ninto sustainable infrastructure investment. As of \nFeb. 2



'The Bank aims to work with public and private sector partners to channel its own public resources, together with private and institutional funds, into sustainable infrastructure investment.'

Appendices: Dashboard (Landing Page)

Decarbonization Dashboard

Individual Company Company Comparison

Select Type of Financial Institution

Asset Manager (AM)

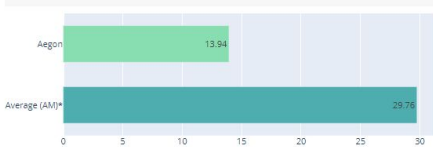
Select a Company

Aegon Asset Management

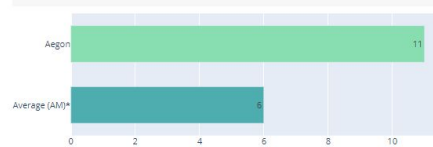
Overall Sentiment Level



Decarbonization Disclosure (%)



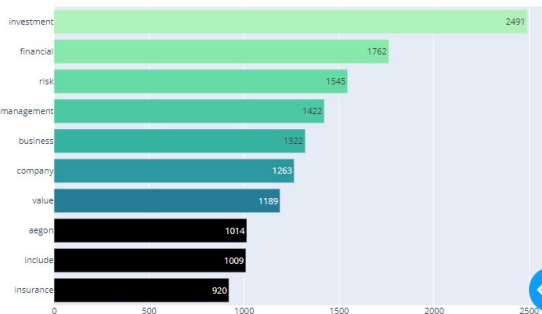
Global Standards & Initiatives Count



Global Standards & Initiatives

Initiatives	Acronym	Details
Carbon Disclosure Project	CDP	A global environmental initiative that helps corporations disclose their climate change response information and mitigate climate change risk.
Climate Action 100+	-	An initiative to ensure the world's largest corporate greenhouse gas emitters take necessary action on climate change.
Global Real Estate Sustainability Benchmark	GRESB	An initiative that provides financial markets with actionable insights, ESG data and benchmarks.
Global Reporting Initiative	GRI	A framework that aims to enable third parties to assess environmental impact from the activities of a company and its supply chain.
Green Bond Principles	GBP	An initiative that supports companies in financing environmentally sound and sustainable projects that foster a net-zero emissions economy.
Institutional Investors Group on Climate Change	IGCC	A collaboration among European members to help define the investment practices, policies and corporate behaviours required to address climate change.
Intergovernmental Panel on Climate Change	IPCC	A United Nations body that assesses the state of climate change and put forwards adaptation and mitigation options.
Investor Group on Climate Change	IGCC	A collaboration of Australian and New Zealand institutional investors with the aim of building a climate-resilient net zero emissions economy by 2050.
Principles for Responsible Investment	PRI	A principle-based framework that offers a list of possible actions for incorporating ESG issues into investment practice.
Sustainable Development Goals	SDGs	A collection of 17 interlinked global goals designed by the UN to be a blueprint to achieve a better and more sustainable future for all.
UN Global Compact	UNGC	The world's largest initiative to encourage businesses worldwide to adopt sustainable and socially responsible policies, and to report on their implementation.

Top 10 Word Count



Appendices: Dashboard (First Interface)

Decarbonization Dashboard

Individual Company

Company Comparison

Select Type of Financial Institution

Asset Manager (AM)



Select a Company

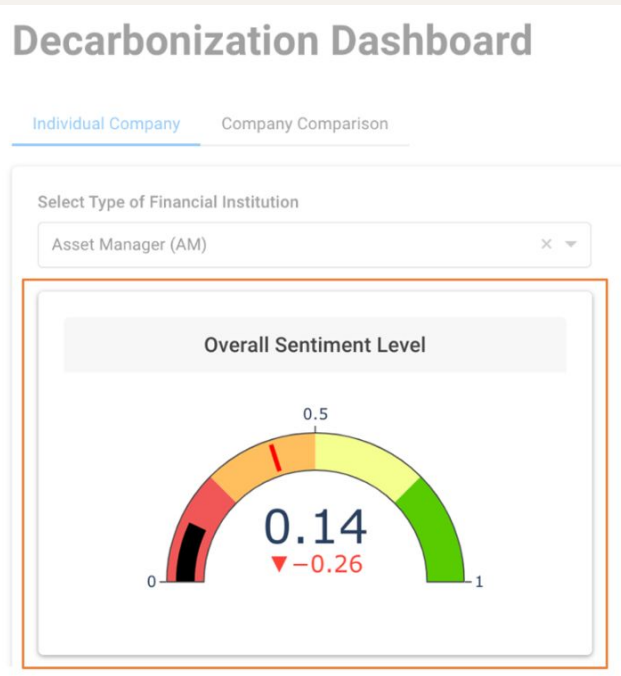
Aegon Asset Management



4 Types of Financial Institutions:

- Asian Bank
- Asset Manager
- Insurance Company
- Pension Fund

Appendices: Dashboard (First Interface)



Overall Sentiment Level

- Overall picture of a company's decarbonization progress
- Summarizes a company's attitude and commitment
- 0 (less desirable) to 1 (desirable)

Appendices: Dashboard (First Interface)

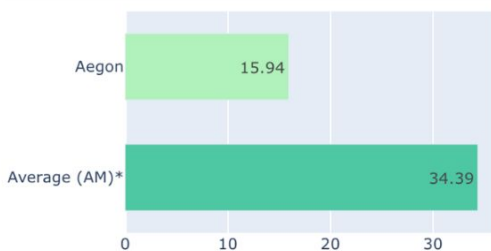
Percentage of Decarbonization Disclosure

- How much a company discusses about their decarbonization effort
- Reflects a company's level of transparency

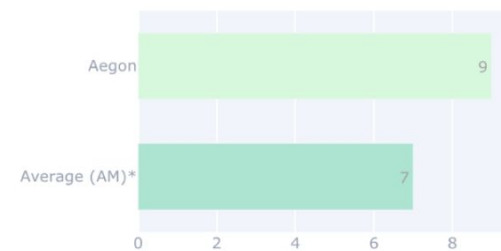
Overall Sentiment Level



Decarbonization Disclosure (%)



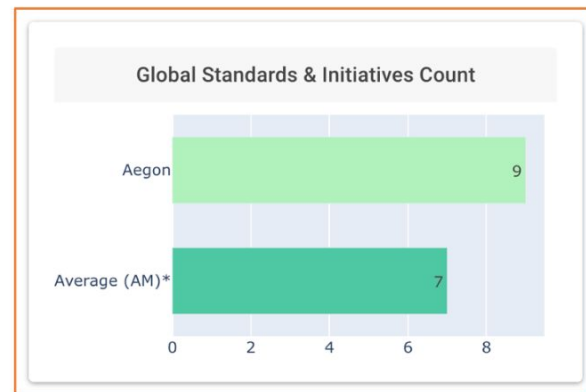
Global Standards & Initiatives Count



Appendices: Dashboard (First Interface)

Number of Global Standards & Initiatives

- Examples: Carbon Disclosure Project, UN Global Compact
- Reflects level of support towards the adoption of industry standards
- Effort in incorporating ESG criteria into decision making



Appendices: Dashboard (First Interface)

Global Standards & Initiatives

Initiatives	Acronym	Details
Carbon Disclosure Project	CDP	A global environmental initiative that helps corporations disclose their climate change response information and mitigate climate change risk
Climate Action 100+	-	An initiative to ensure the world's largest corporate greenhouse gas emitters take necessary action on climate change
Climate Bonds Initiative	CBI	An initiative that works on mobilising the \$100 trillion bond market for climate change solutions
Green Bond Principles	GBP	An initiative that supports companies in financing environmentally sound and sustainable projects that foster a net-zero emissions economy
Institutional Investors Group on Climate Change	IIGCC	A collaboration among European members to help define the investment practices, policies and corporate behaviours required to address climate change
International Corporate Governance Network	ICGN	An initiative that advances the highest standards of corporate governance and investor stewardship worldwide in pursuit of a sustainable economy
Investor Group on Climate Change	IGCC	A collaboration of Australian and New Zealand institutional investors with the aim of building a climate-resilient net zero emissions economy by 2050
Principles for Responsible Investment	PRI	A principle-based framework that offers a list of possible actions for incorporating ESG issues into investment practice
Sustainability Accounting Standards	SASB	An initiative that facilitates the disclosure of material and decision-useful climate-related information to investors

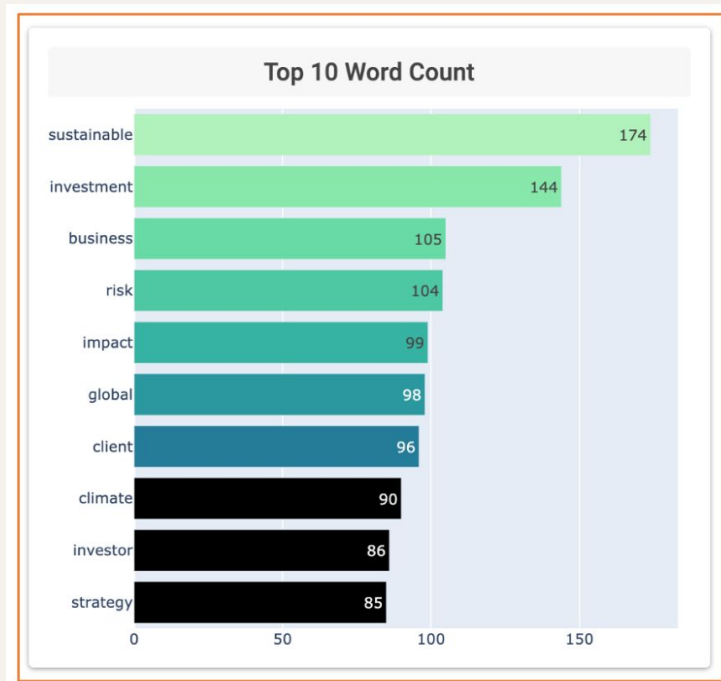
Table of Standards & Initiatives

- List of initiatives & standards
- Short description included

Appendices: Dashboard (First Interface)

Top 10 Word Count

- Represents the commonly discussed topics
- Emphasis on portfolio decarbonization



Appendices: Dashboard (Second Interface)

Decarbonization Dashboard

Individual Company

[Company Comparison](#)

Select Type of Financial Institution

Asian Bank (AB)

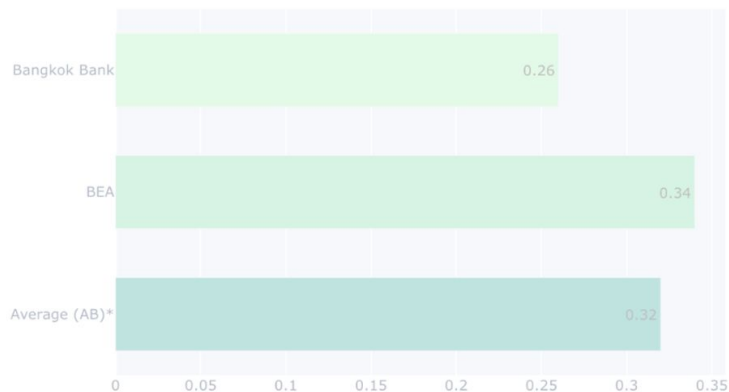
Select the First Company

Bangkok Bank

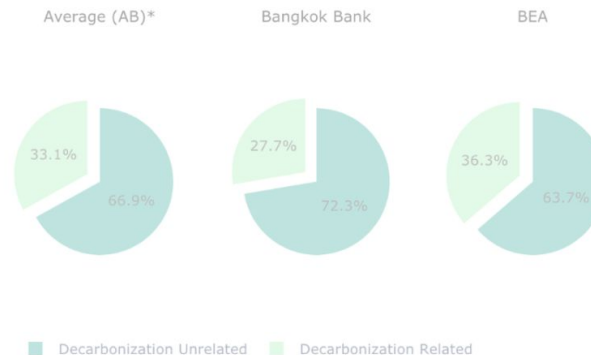
Select the Second Company

Bank of East Asia

Comparison - Overall Sentiment Level



Comparison - Decarbonization Disclosure (%)



Appendices: Dashboard (Second Interface)

Decarbonization Dashboard

Individual Company

Company Comparison

Select Type of Financial Institution

Asian Bank (AB)

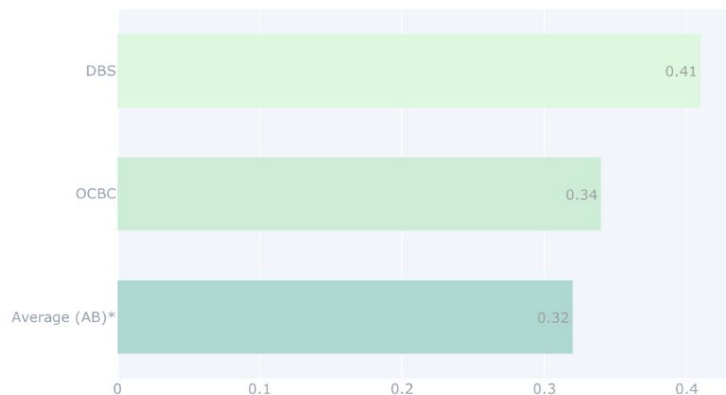
Select the First Company

DBS Bank

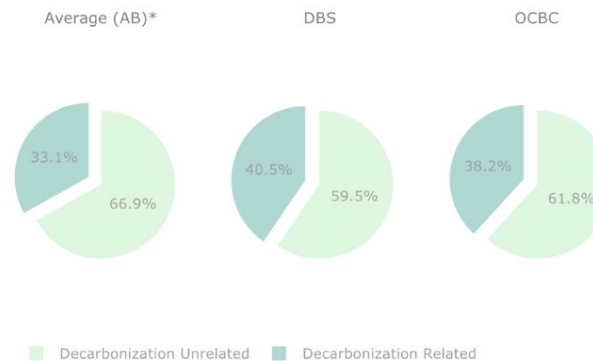
Select the Second Company

OCBC Bank

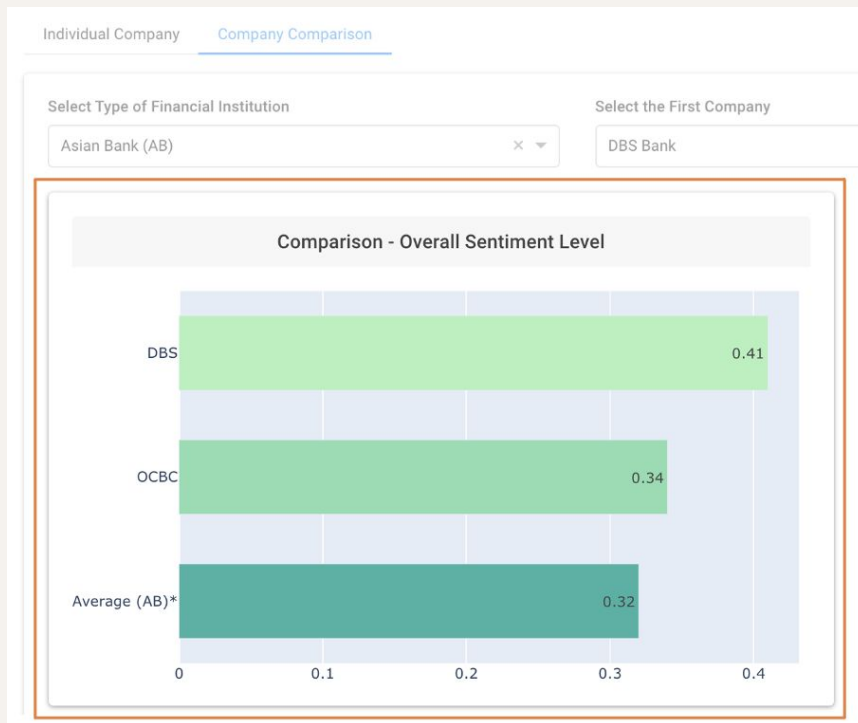
Comparison - Overall Sentiment Level



Comparison - Decarbonization Disclosure (%)



Appendices: Dashboard (Second Interface)



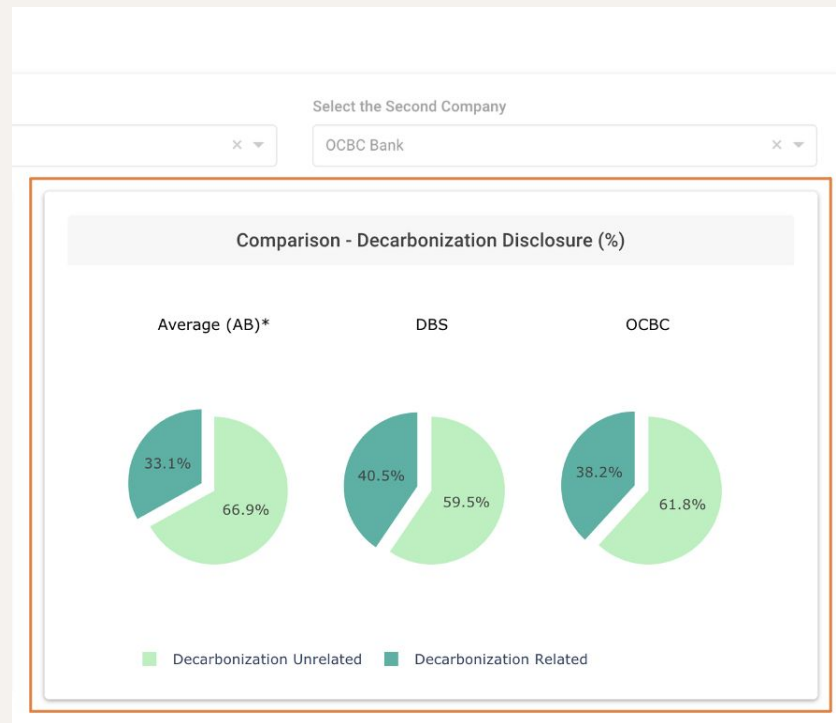
Overall Sentiment Level

- Comparison between companies & against average
- Rough impression of a company's decarbonization efforts
- Calculated based on:
 1. Tone
 2. Frequency of decarbonization related information

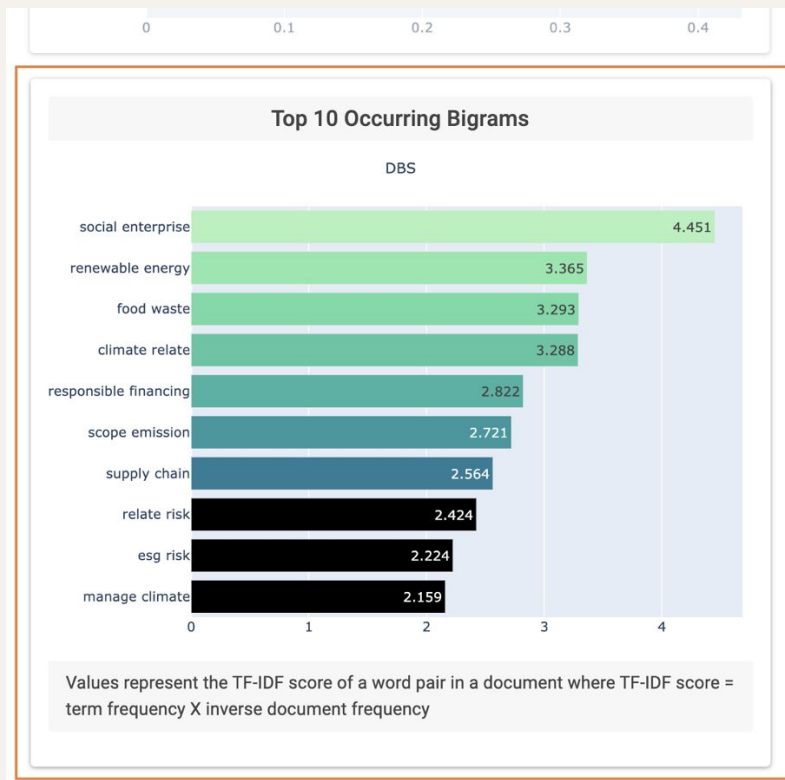
Appendices: Dashboard (Second Interface)

Decarbonization Disclosure (%)

- Breakdown of information in a report
- Compare level of disclosure & transparency between companies
- Useful metric for decision making



Appendices: Dashboard (Second Interface)



Bigram Analysis

- Top 10 occurring word pairs mentioned by each company
- Explains how a company is making progress towards decarbonization
- Approach to align portfolio with a low carbon future