Sustainability and ESG Data Analytics

NTPU
國立臺北大學
National Taipei University

Introduction to Sustainability and ESG Data Analytics

1131ESGDA01
MBA, IM, NTPU (M5265) (Fall 2024)
Wed 2, 3, 4 (9:10-12:00) (B3F17)

https://meet.google.com/miy-fbif-max

aws educate | Cloud Ambassador
2020 Cohort

aws academy Accredited Educator
aws certified Cloud Practitioner
aws certified Solutions Architect Associate

Min-Yuh Day, Ph.D,
Professor

Institute of Information Management, National Taipei University

https://web.ntpu.edu.tw/~myday

2024-09-11

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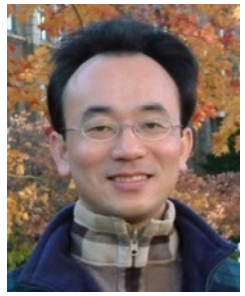

Min-Yuh Day, Ph.D.

aws educate | Cloud Ambassador
2020 Cohort

Professor, Information Management, NTPU

Visiting Scholar, IIS, Academia Sinica

Ph.D., Information Management, NTU

Director, Intelligent Financial Innovation Technology, IFIT Lab, IM, NTPU

Director, Fintech and Green Finance Research Center, NTPU

Division Director, Sustainable Development, Sustainability Office, NTPU

Artificial Intelligence, Financial Technology, Big Data Analytics,
Data Mining and Text Mining, Electronic Commerce

國立臺北大學
National Taipei University

中央研究院 ACADEMIA SINICA 1928

Course Syllabus
National Taipei University
Academic Year 113, 1st Semester (Fall 2024)

- **Course Title: Sustainability and ESG Data Analytics**
- **Instructor: Min-Yuh Day**
- **Course Class: MBA, IM, NTPU (3 Credits, Elective)**
- **Details**
  - **In-Class and Distance Learning EMI Course (3 Credits, Elective, One Semester) (M5265)**
- **Time & Place: Wed, 2, 3, 4, (9:10-12:00) (B3F17)**
- **Google Meet:** https://meet.google.com/miy-fbif-max

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Course Objectives

1. Understand the fundamental concepts of sustainability and ESG data analytics.
2. Equip with Hands-on practices of sustainability and ESG data analytics.
3. Integrate innovative thinking of big data analysis to enhance the operational model of sustainable development.
4. In the context of sustainability, use data analysis to formulate responses to sustainable issues and cultivate students' ability to extract management-relevant data analysis skills from the data.

The Course Includes Sustainable Development Goals (SDGs)

1. SDG4｜Quality Education
2. SDG7｜Affordable and Clean Energy
3. SDG8｜Decent Work and Economic Growth
4. SDG9｜Industry, Innovation and Infrastructure
5. SDG11｜Sustainable Cities and Communities
6. SDG12｜Responsible Consumption and Production
7. SDG13｜Climate Action
8. SDG17｜Partnerships for the Goals

Course Outline

- This course introduces the fundamental concepts and hands-on practices of Sustainability and ESG Data Analytics.
- Topics include
  1. Introduction Sustainability and ESG Data Analytics
  2. Environmental, Social, and Governance (ESG) in Net-Zero Digital Transformation
  3. Data Science for Sustainability and ESG
  4. Web 3.0 and Big Data Analysis in Fintech, Green Finance, Sustainable Finance
  5. Task Force on Climate-Related Financial Disclosures (TCFD) and En-Roads Interactive
  6. ESG Data Gathering, Analysis, and Visualization
  7. ESG Data Reporting, Corporate Sustainability Reports
  8. ESG Data Verification
  9. Energy Star Reporting and Data Disclosure
  10. Artificial Intelligence of things (AIoT) in ESG and Sustainability Applications
  11. Generative AI for ESG Rating and Reporting Generation
  12. Case Study on Sustainability and ESG Data Analytics

Core Competence

- **Exploring new knowledge in information technology, system development and application 80 %**
- **Internet marketing planning ability 10 %**
- **Thesis writing and independent research skills 10 %**

Four Fundamental Qualities

- Professionalism
  - Creative thinking and Problem-solving 40 %
  - Comprehensive Integration 40 %
- Interpersonal Relationship
  - Communication and Coordination 10 %
  - Teamwork 5 %
- Ethics
  - Honesty and Integrity 0 %
  - Self-Esteem and Self-reflection 0 %
- International Vision
  - Caring for Diversity 0 %
  - Interdisciplinary Vision 5 %

College Learning Goals

- Ethics/Corporate Social Responsibility
- Global Knowledge/Awareness
- Communication
- Analytical and Critical Thinking

Department Learning Goals

- **Information Technologies and System Development Capabilities**
- **Internet Marketing Management Capabilities**
- **Research capabilities**

Syllabus

Week	Date	Subject/Topics
1	2024/09/11	Introduction Sustainability and ESG Data Analytics
2	2024/09/18	Environmental, Social, and Governance (ESG) in Net-Zero Digital Transformation
3	2024/09/25	Data Science for Sustainability and ESG
4	2024/10/02	Case Study on Sustainability and ESG Data Analytics I
5	2024/10/09	Web 3.0 and Big Data Analysis in Fintech, Green and Sustainable Finance
6	2024/10/16	Task Force on Climate-Related Financial Disclosures (TCFD) and En-Roads Interactive

Syllabus

Week	Date	Subject/Topics
7	2024/10/23	ESG Data Gathering, Analysis, and Visualization
8	2024/10/30	Midterm Project Report
9	2024/11/06	Self-Learning
10	2024/11/13	ESG Data Reporting; Corporate Sustainability Reports
11	2024/11/20	ESG Data Verification
12	2024/11/27	Case Study on Sustainability and ESG Data Analytics II

Syllabus

Week	Date	Subject/Topics
13	2024/12/04	Artificial Intelligence of things (AIoT) in ESG and Sustainability Applications
14	2024/12/11	Generative AI for ESG Rating and Reporting Generation
15	2024/12/18	Final Project Report I
16	2024/12/25	Final Project Report II

Course and Teaching Features

1. Combine Web3.0 to introduce basic concepts of big data analysis, research topics, and practical operations.
2. Provide theories and tools for data integration and communication planning.
3. Apply to analyze data from various domains and present analysis results through data visualization.

Expected Social Impact:

1. Learn from data analysis, cultivating the ability to analyze responses when facing sustainable issues and risks.
2. Train talents who possess basic concepts of big data analysis, research topics, practical operations, and practical abilities in sustainable data analysis.

Innovative Teaching Strategies

1. USR (University Social Responsibility) Local Connection and Collaboration
2. Group Learning
3. Problem-Based Learning (PBL)
4. Thematic Teaching
5. Learning by Thinking Teaching Method

Evaluation Methods

- Individual Presentation 60 %
- Group Presentation 10 %
- Case Report 10 %
- Class Participation 10 %
- Assignment 10 %

Required Texts

- **Cino Robin Castelli, Cyril Shmatov (2022), Quantitative Methods for ESG Finance, Wiley**

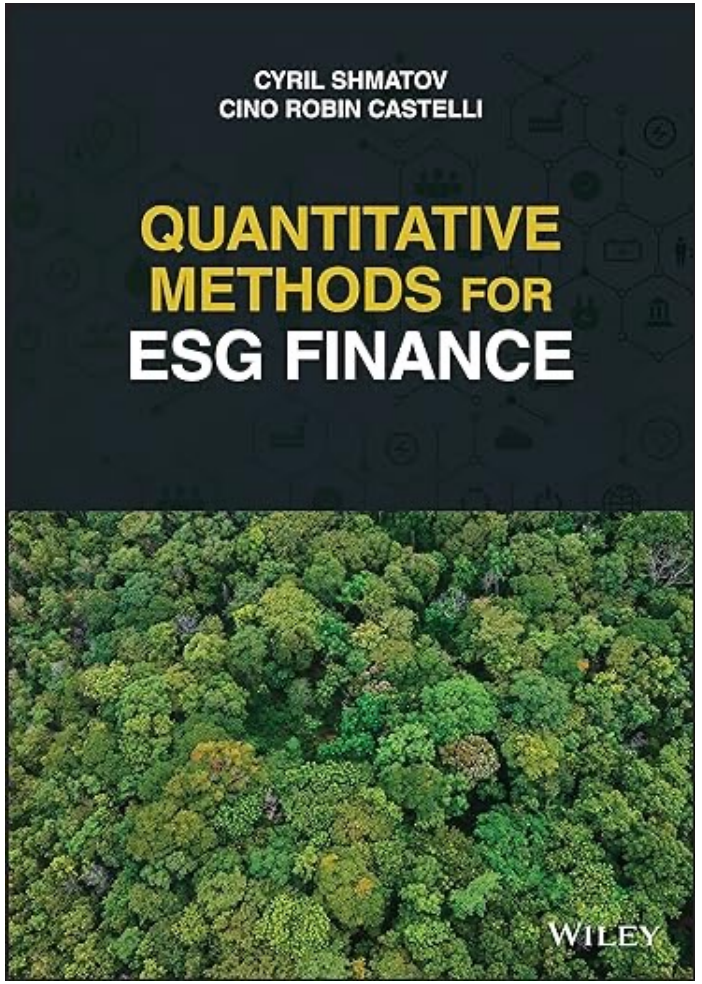
Reference Books

1. Simon Thompson (2023), Green and Sustainable Finance: Principles and Practice in Banking, Investment and Insurance, 2nd Edition, Kogan Page.
2. Chrissa Pagitsas (2023), Chief Sustainability Officers At Work: How CSOs Build Successful Sustainability and ESG Strategies, Apress.
3. Hariom Tatsat, Sahil Puri, Brad Lookabaugh (2020), Machine Learning and Data Science Blueprints for Finance: From Building Trading Strategies to Robo-Advisors Using Python, O'Reilly Media
4. Aurélien Géron (2022), Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd Edition, O'Reilly Media.
5. Chris Kelliher (2022), Quantitative Finance With Python: A Practical Guide to Investment Management, Trading, and Financial Engineering, Chapman and Hall/CRC.
6. Abdullah Karasan (2021), Machine Learning for Financial Risk Management with Python: Algorithms for Modeling Risk, O'Reilly Media.
7. Numa Dhamani and Maggie Engler (2024), Introduction to Generative AI, Manning.
8. Denis Rothman (2024), Transformers for Natural Language Processing and Computer Vision - Third Edition: Explore Generative AI and Large Language Models with Hugging Face, ChatGPT, GPT-4V, and DALL-E 3, 3rd ed. Edition, Packt Publishing.

Other References

1. **GRI (Global Report Initiative):** https://www.globalreporting.org/
2. **CDP (Carbon Disclosure Project):** https://www.cdp.net/
3. **SASB (Sustainability Accounting Standards Board):** https://sasb.org/
4. **ISSB (International Sustainability Standards Board):** https://www.ifrs.org/groups/international-sustainability-standards-board/
5. **TCFD (Task Force on Climate-related Financial Disclosures):** https://www.fsb-tcfd.org/
6. **Research Papers**

Cino Robin Castelli, Cyril Shmatov (2022), Quantitative Methods for ESG Finance, Wiley



Source: https://www.amazon.com/Quantitative-Methods-Finance-Robin-Castelli/dp/1119903807/

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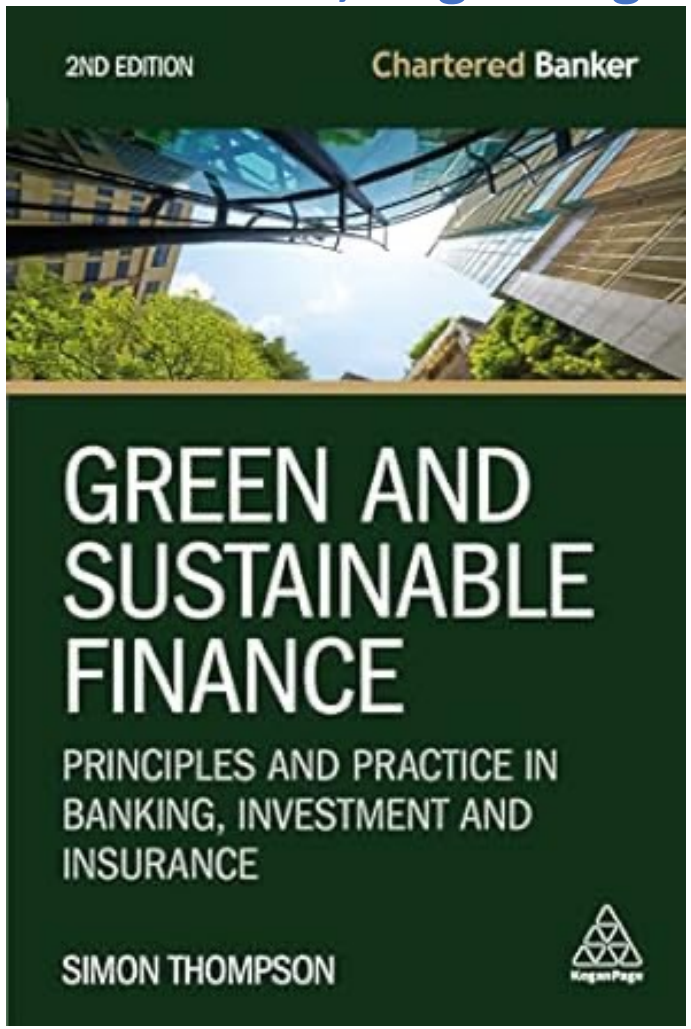


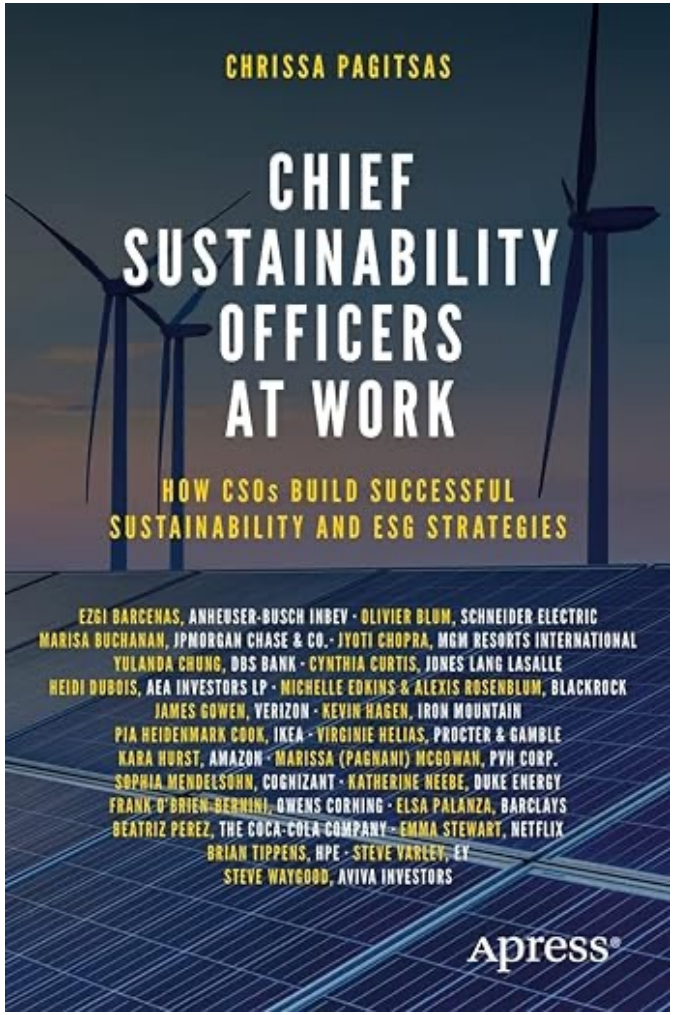
Source: https://www.amazon.com/Green-Sustainable-Finance-Principles-Investment/dp/1398609242/

Chrissa Pagitsas (2023),

Chief Sustainability Officers At Work:

How CSOs Build Successful Sustainability and ESG Strategies,

Apress.

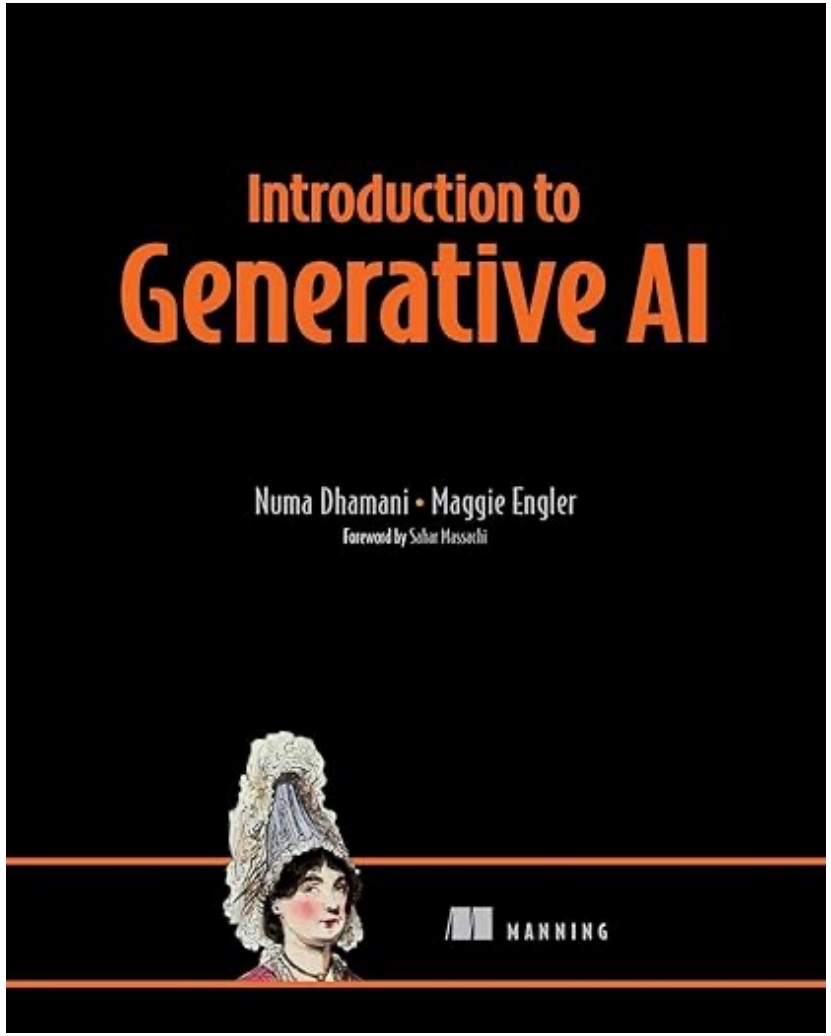


Source: https://www.amazon.com/Chief-Sustainability-Officers-Work-Successful/dp/1484278658/

Numa Dhamani and Maggie Engler (2024),

Introduction to Generative AI,

Manning



Source: Numa Dhamani and Maggie Engler (2024), Introduction to Generative AI, Manning
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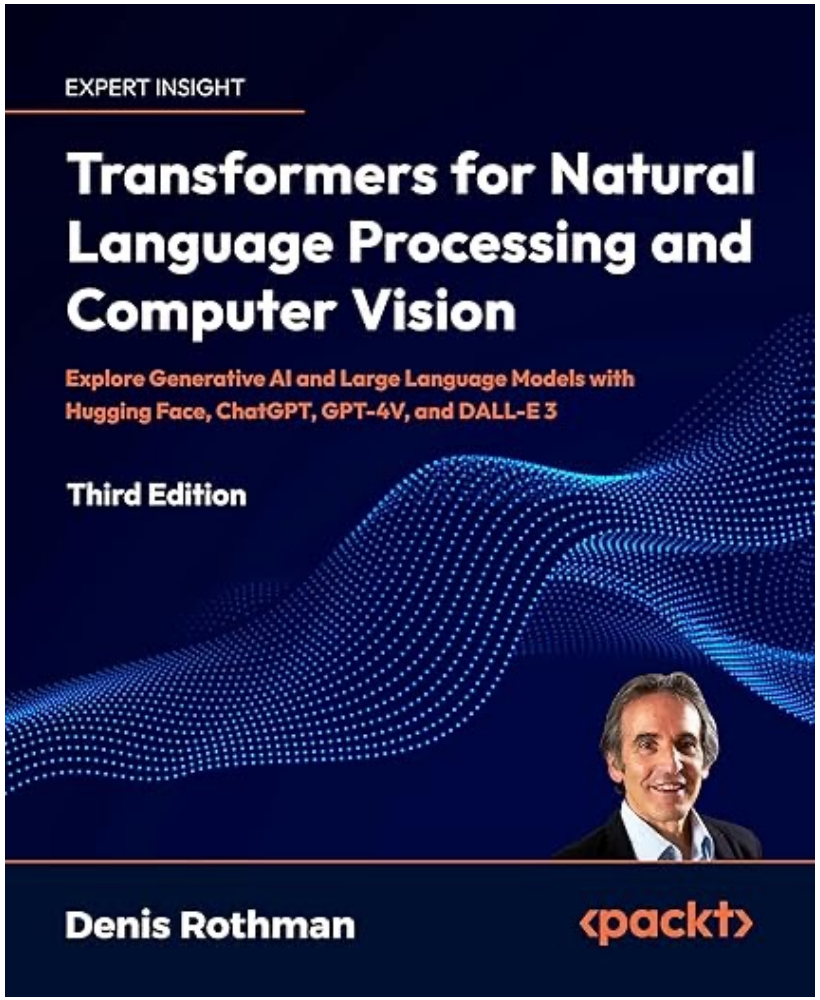

Source: https://www.amazon.com/Transformers-Natural-Language-Processing-Computer/dp/1805128728

Aurélien Géron (2022),

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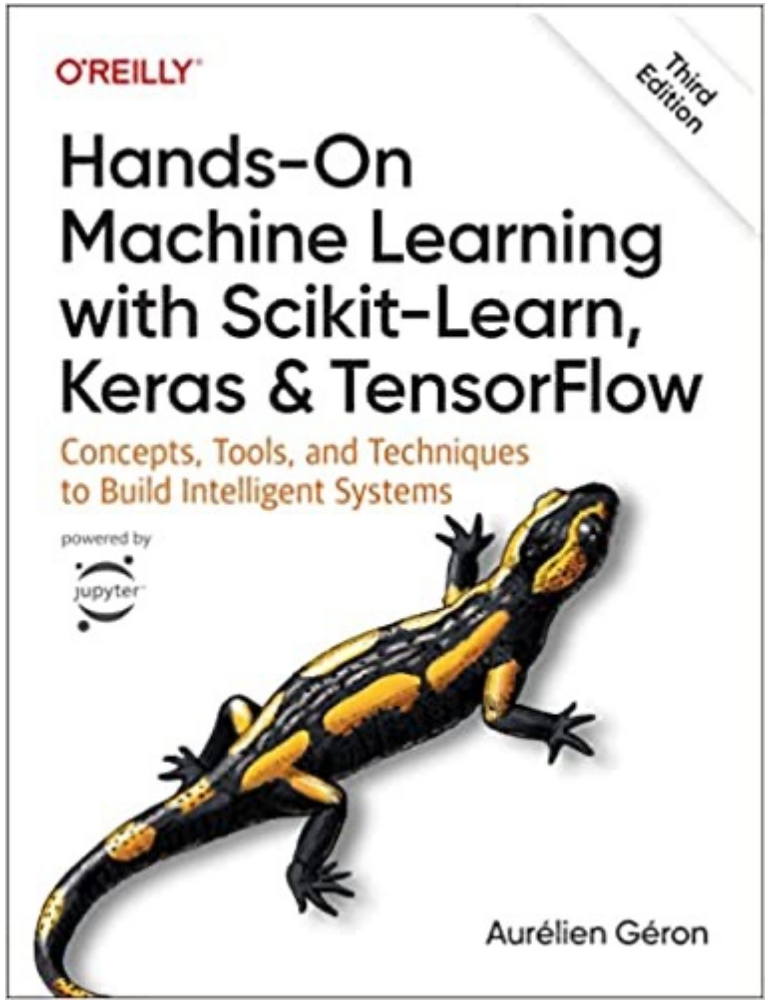
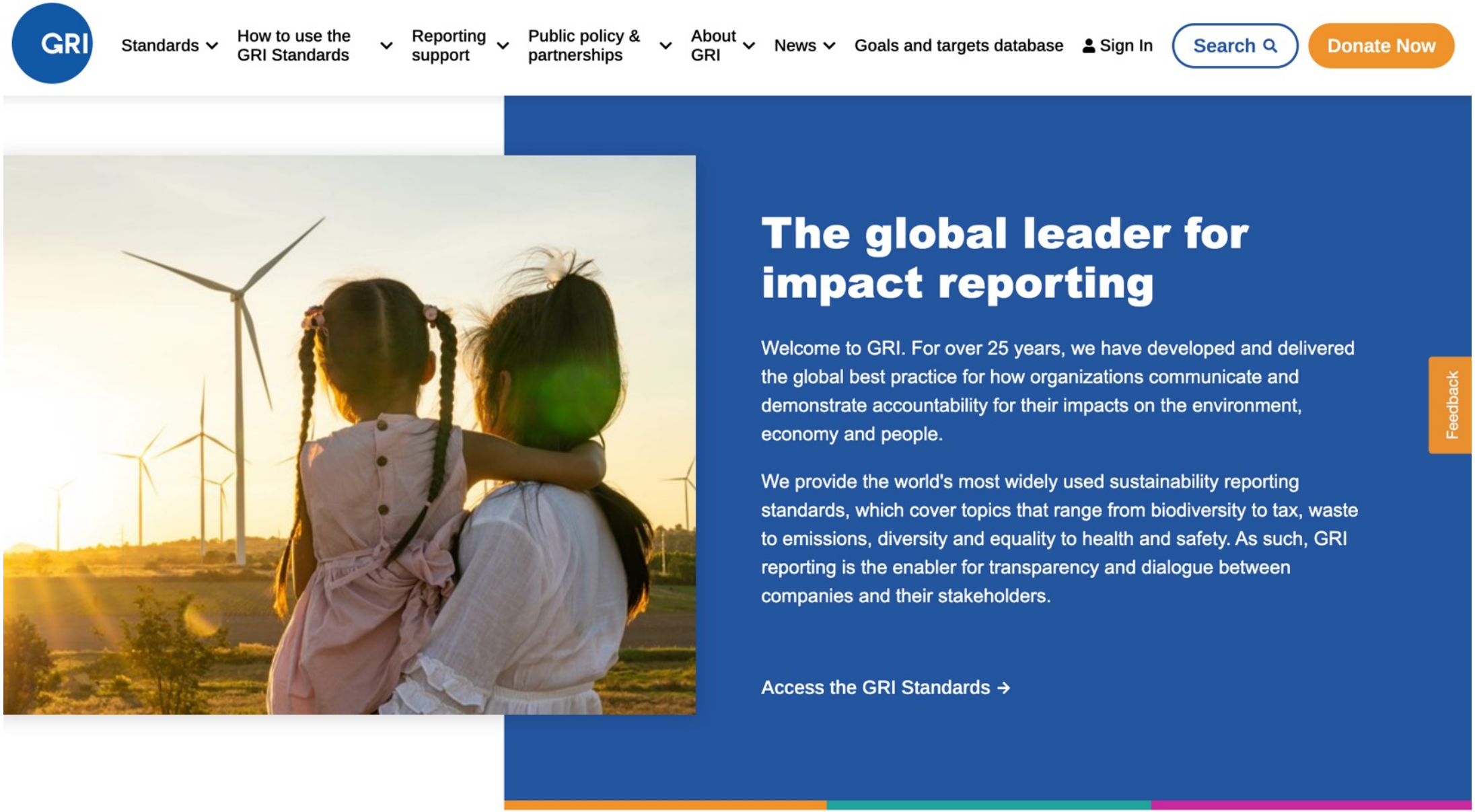


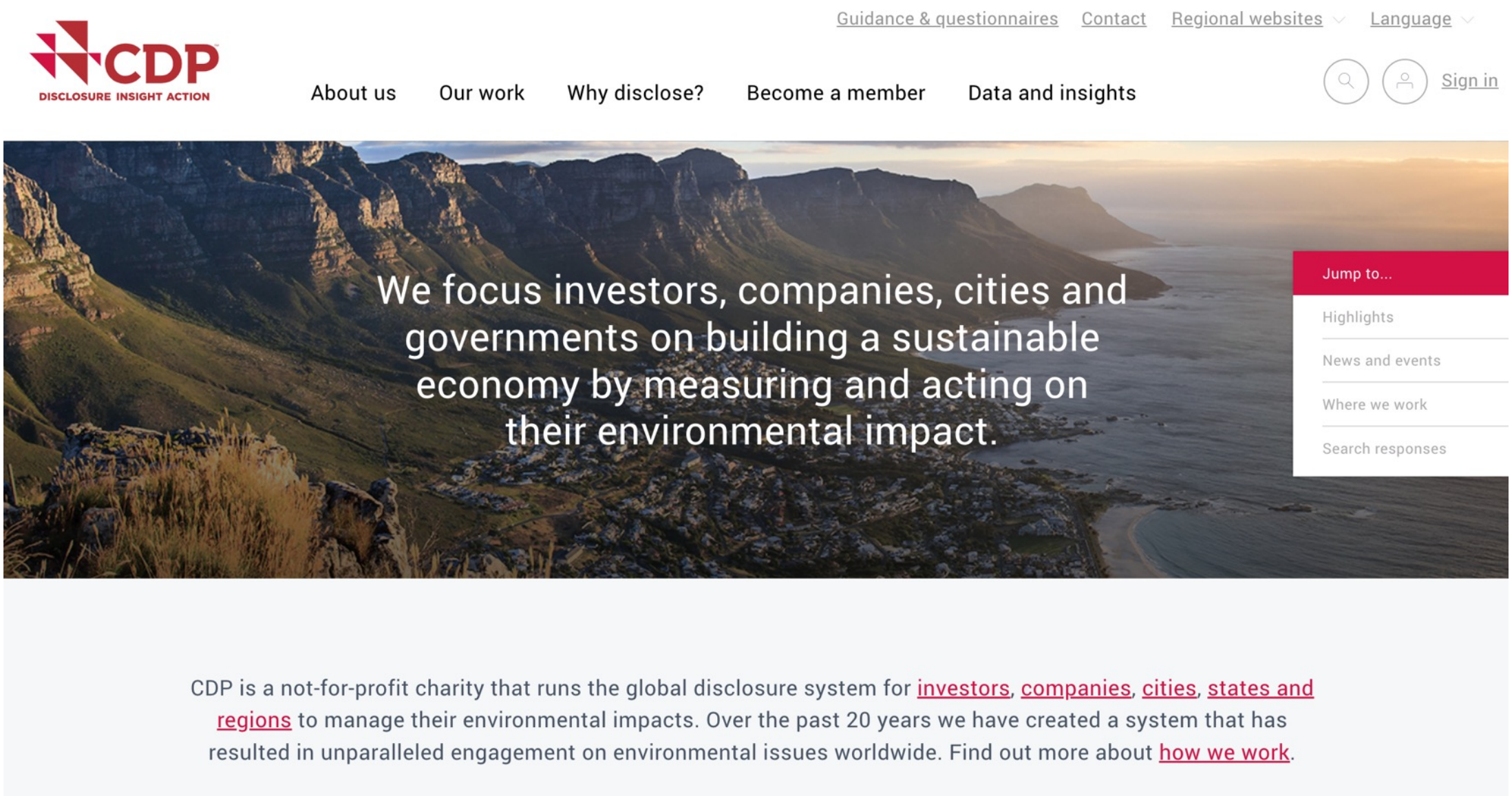
Source: https://www.amazon.com/Hands-Machine-Learning-Scikit-Learn-TensorFlow/dp/1098125975

GRI (Global Report Initiative)



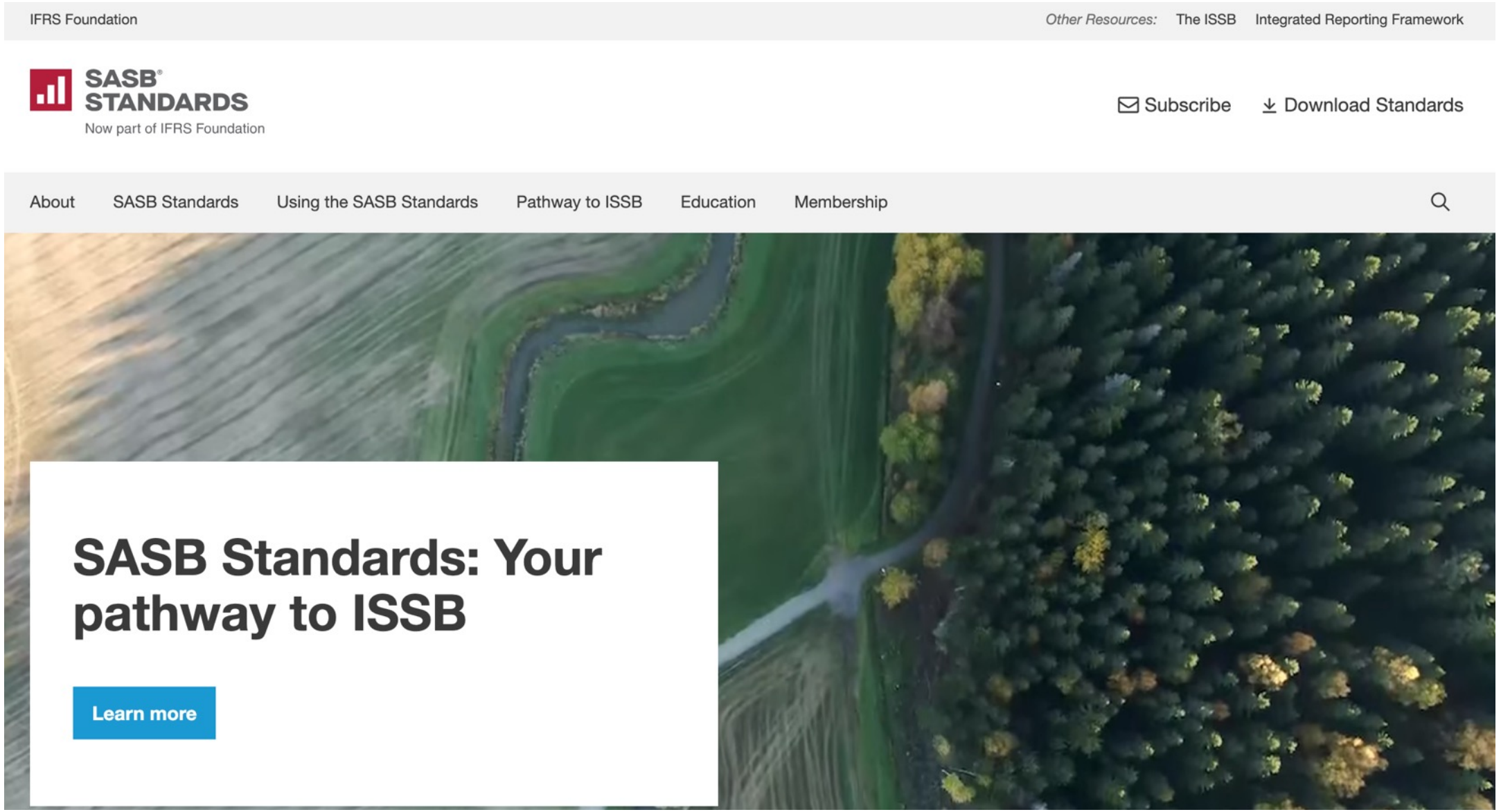
https://www.globalreporting.org/

CDP (Carbon Disclosure Project)



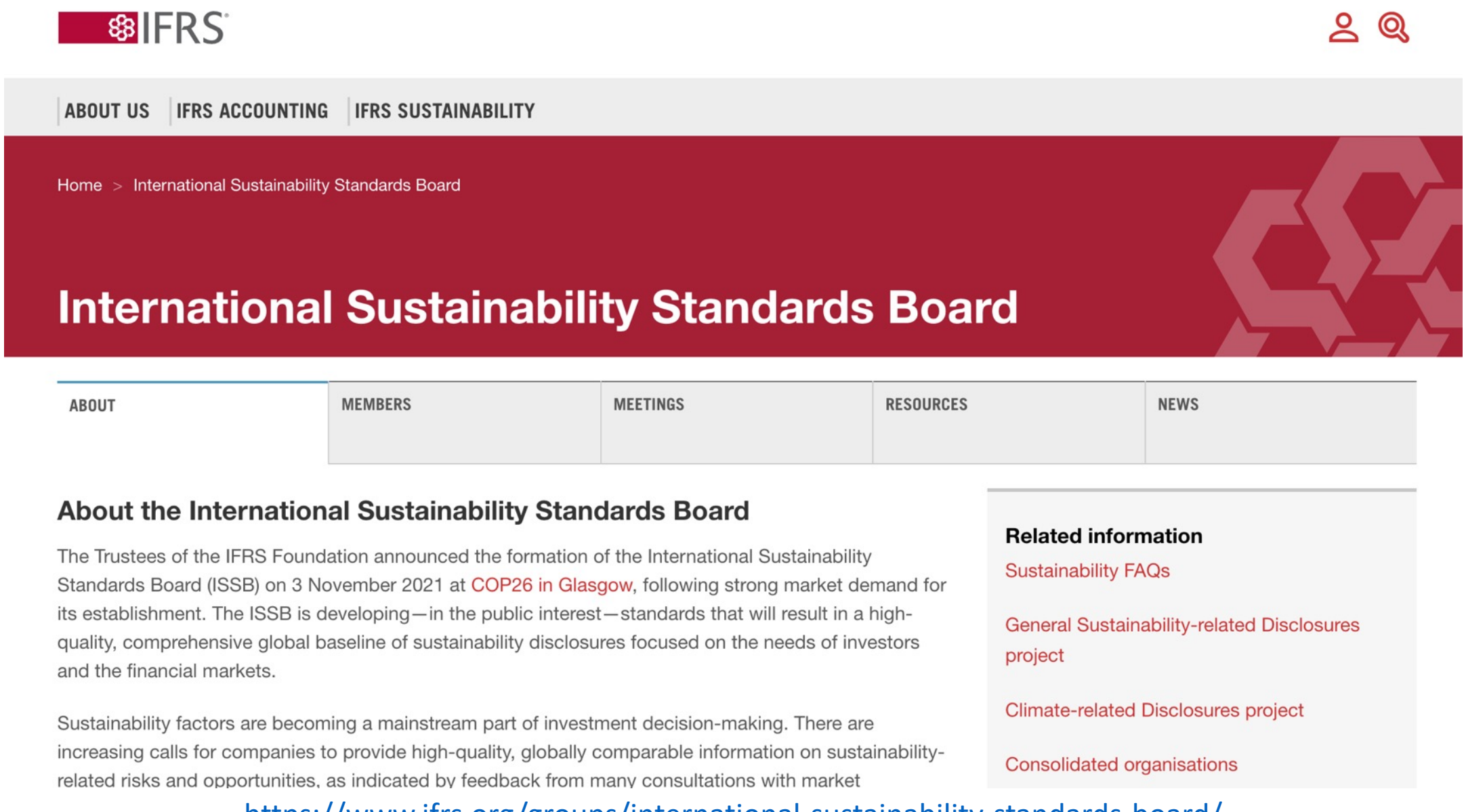
https://www.cdp.net/

SASB (Sustainability Accounting Standards Board)



https://sasb.org/

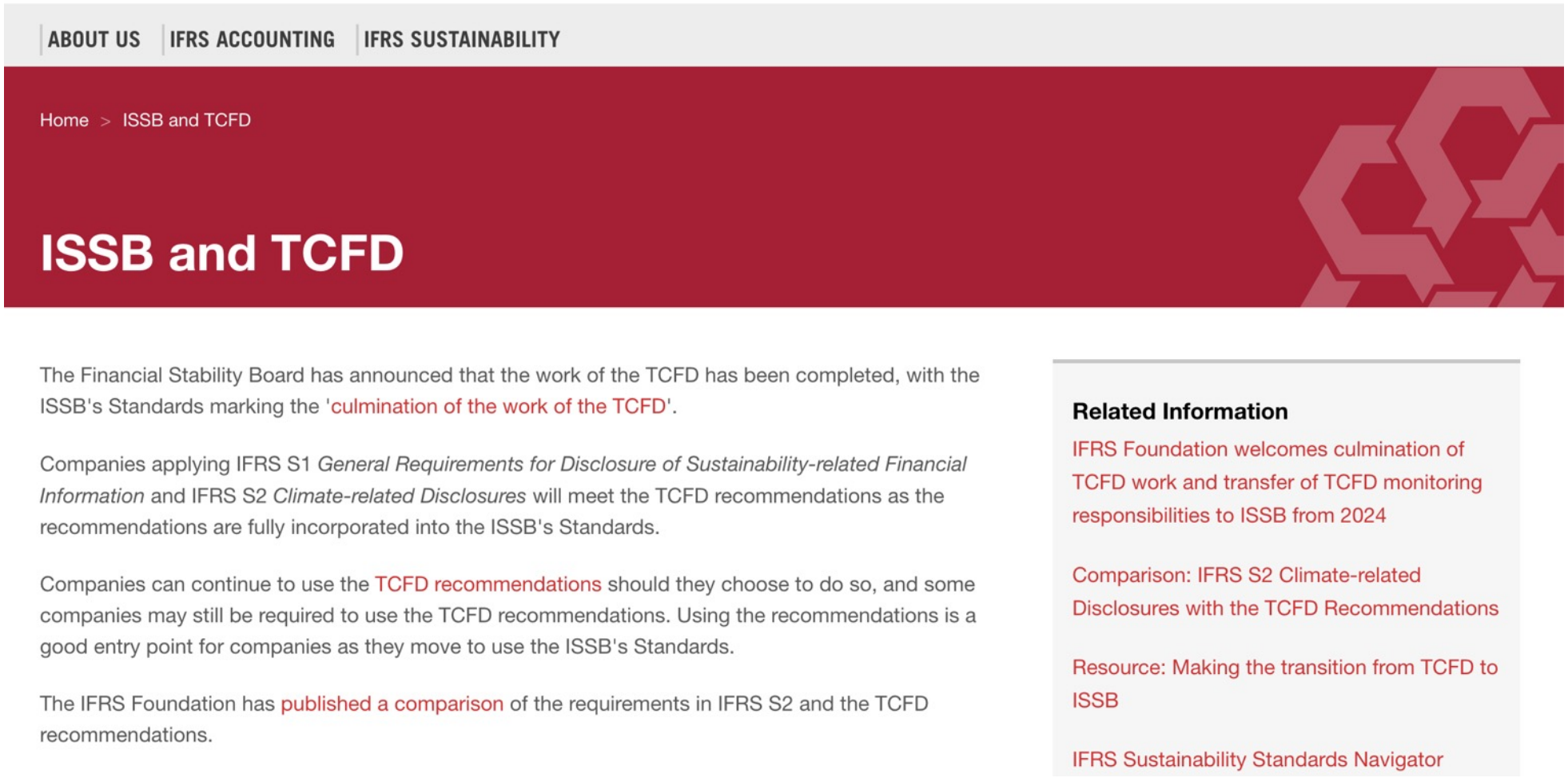
ISSB (International Sustainability Standards Board)



https://www.ifrs.org/groups/international-sustainability-standards-board/

TCFD
(Task Force on Climate-related Financial Disclosures)

https://www.ifrs.org/sustainability/tcfd/



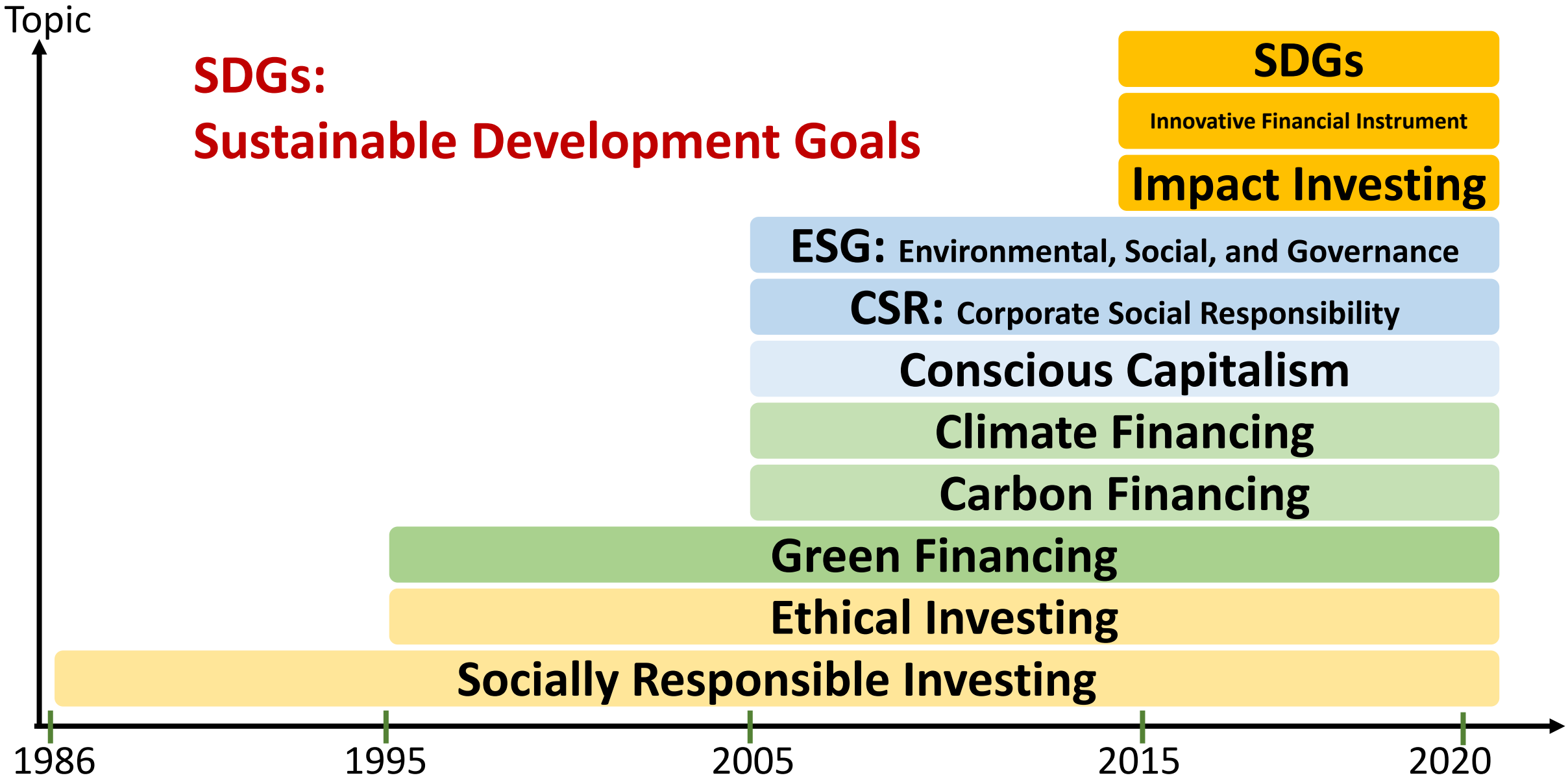
https://www.fsb-tcfd.org/

Sustainability
and
ESG Data Analytics

Sustainable Development Goals (SDGs)

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

Evolution of Sustainable Finance Research



Source: Kumar, S., Sharma, D., Rao, S., Lim, W. M., & Mangla, S. K. (2022). Past, present, and future of sustainable finance: Insights from big data analytics through machine learning of scholarly research. Annals of Operations Research, 1-44.

Sustainable Development Goals (SDGs) and 5P

Partnership

Peace

Prosperity

People

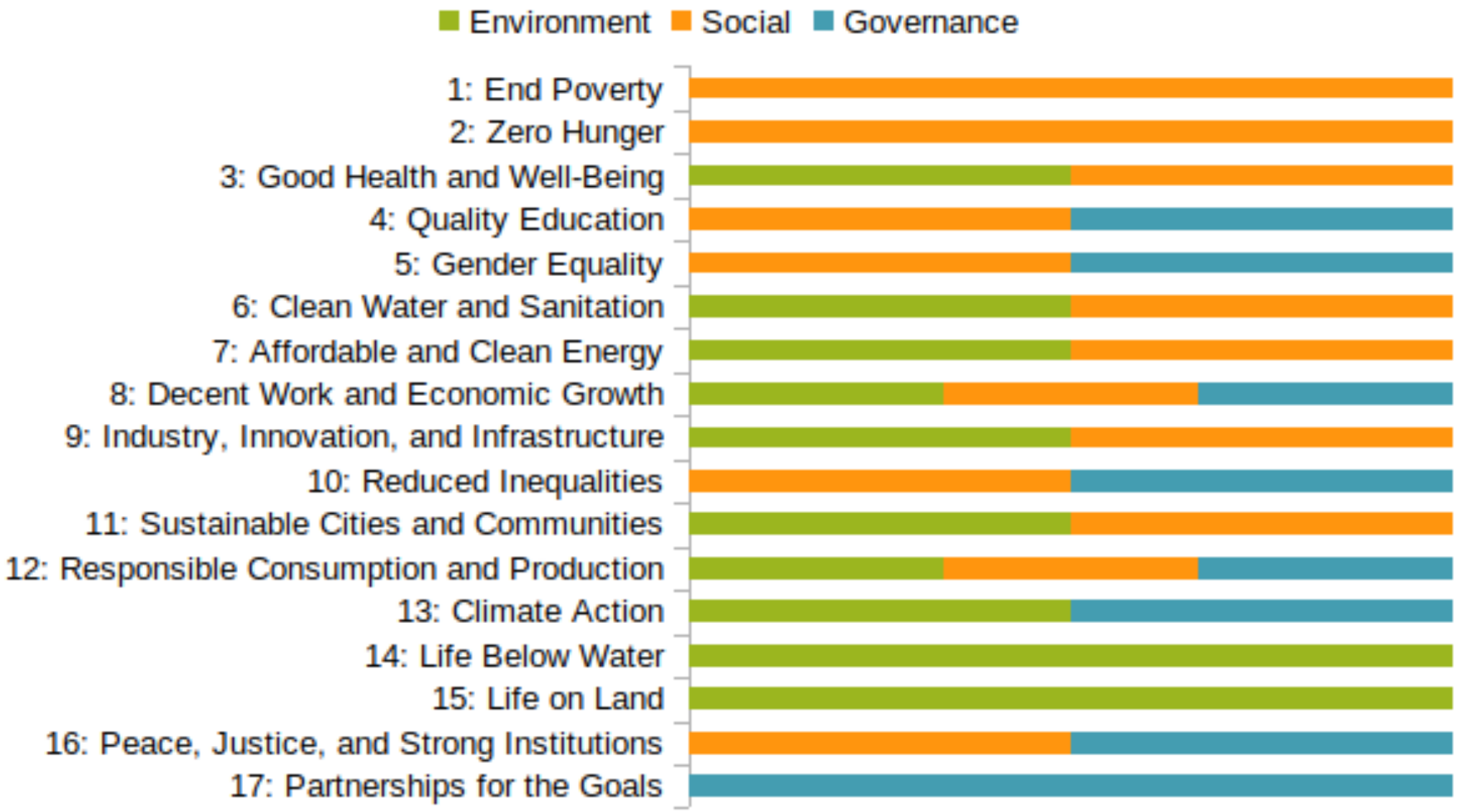
Planet

Source: Folke, Carl, Reinette Biggs, Albert V. Norström, Belinda Reyers, and Johan Rockström. "Social-ecological resilience and biosphere-based sustainability science."Ecology and Society 21, no. 3 (2016).

ESG to 17 SDGs

Source: Henrik Skaug Sætra (2021) "A Framework for Evaluating and Disclosing the ESG Related Impacts of AI with the SDGs." Sustainability 13, no. 15 (2021): 8503.

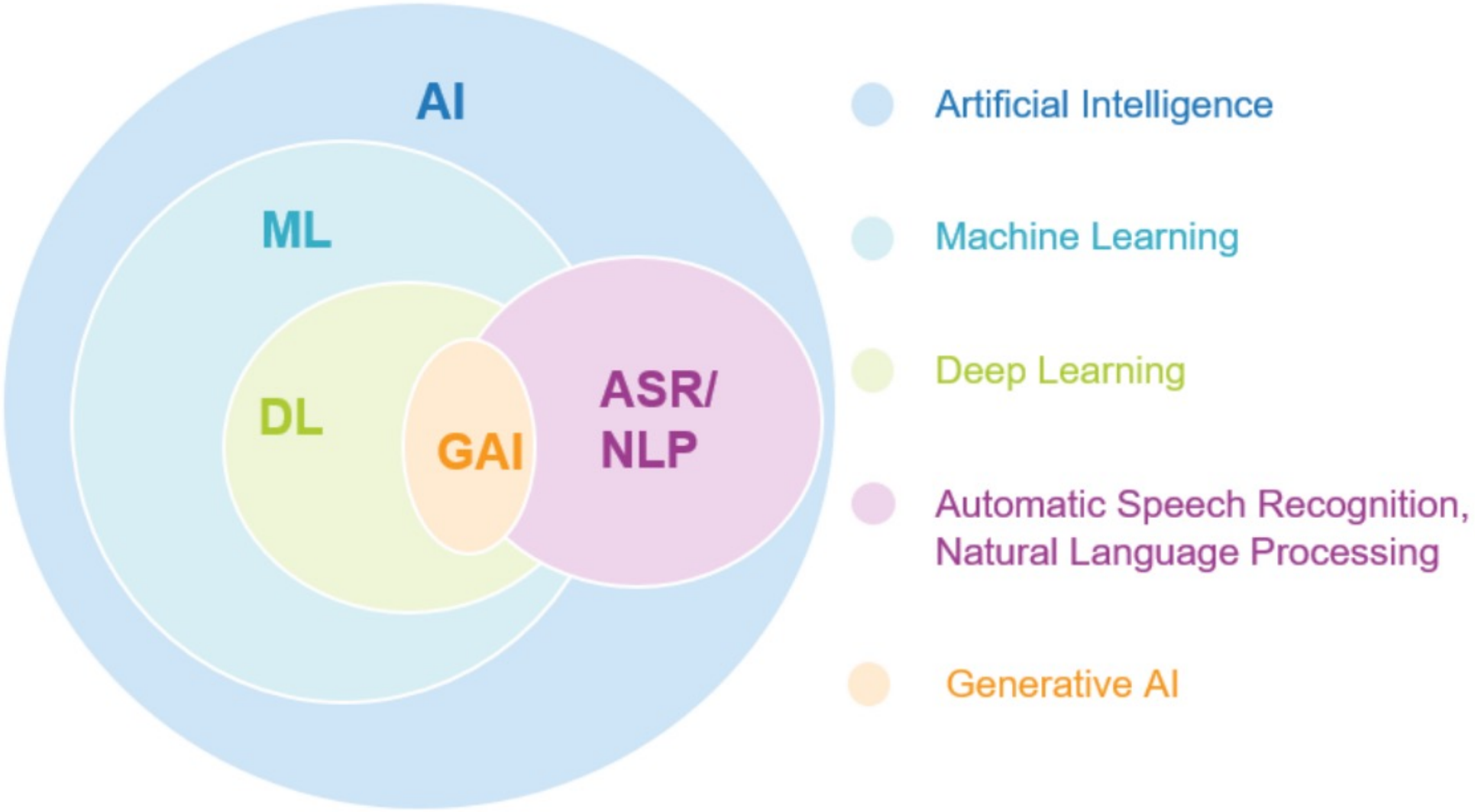
ESG to 17 SDGs



Source: https://sustainometric.com/esg-to-sdgs-connected-paths-to-a-sustainable-future/

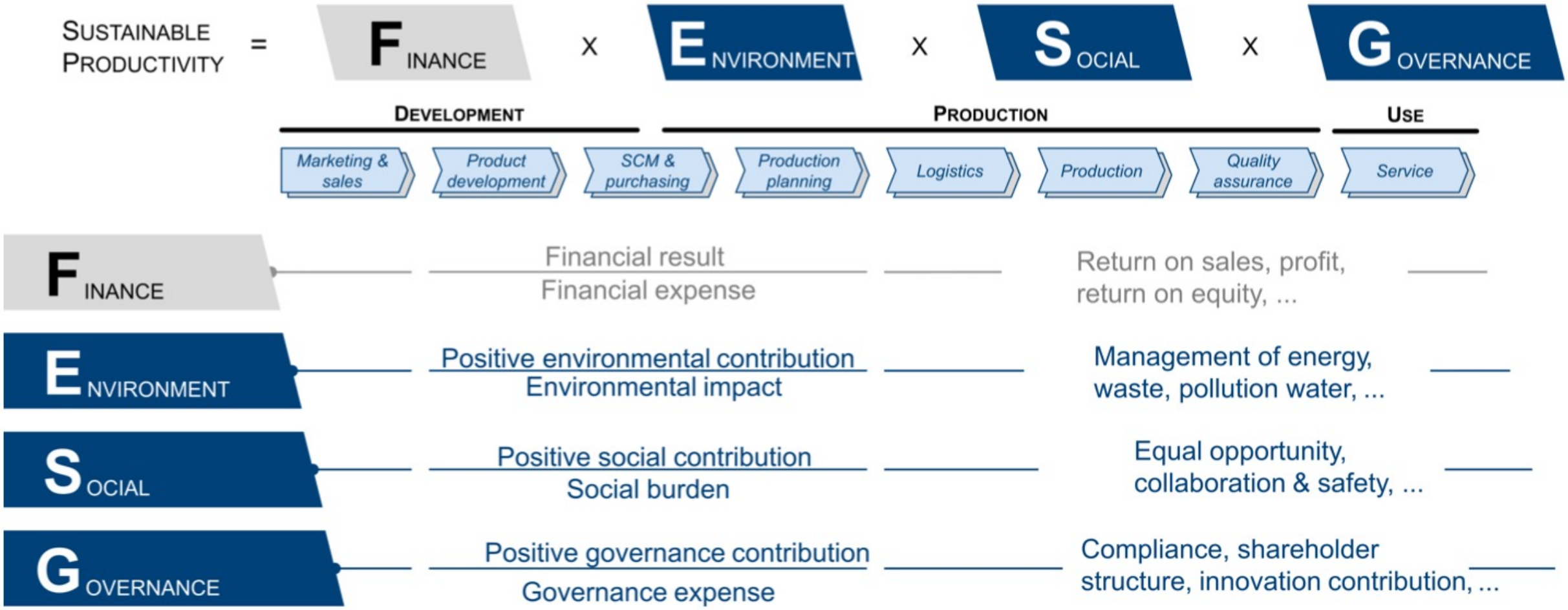
Generative AI for ESG Applications

AI, ML, DL, Generative AI



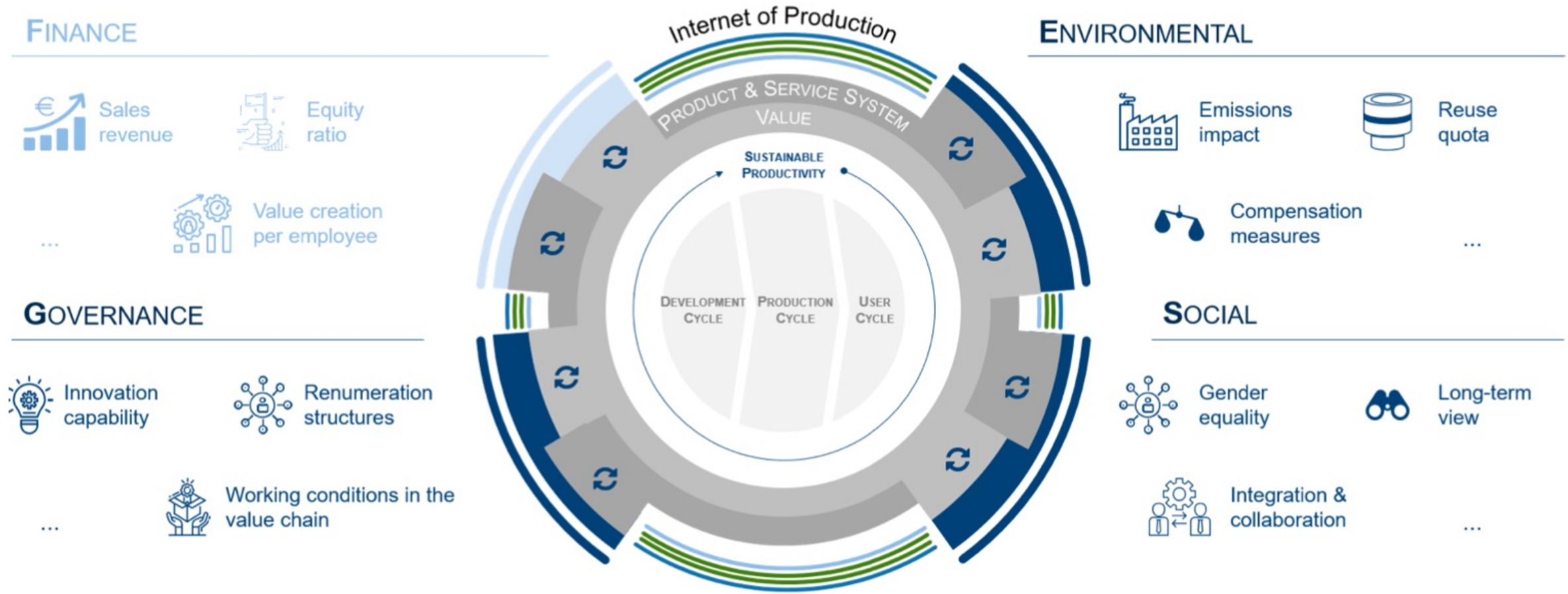
Source: Jeong, Cheonsu. "A Study on the Implementation of Generative AI Services Using an Enterprise Data-Based LLM Application Architecture." arXiv preprint arXiv:2309.01105 (2023).

Sustainable Productivity: Finance ESG



Source: Huang, Ziqi, Yang Shen, Jiayi Li, Marcel Fey, and Christian Brecher (2021). "A survey on AI-driven digital twins in Industry 4.0: Smart manufacturing and advanced robotics." Sensors 21, no. 19: 6340.

Sustainable Resilient Manufacturing
ESG

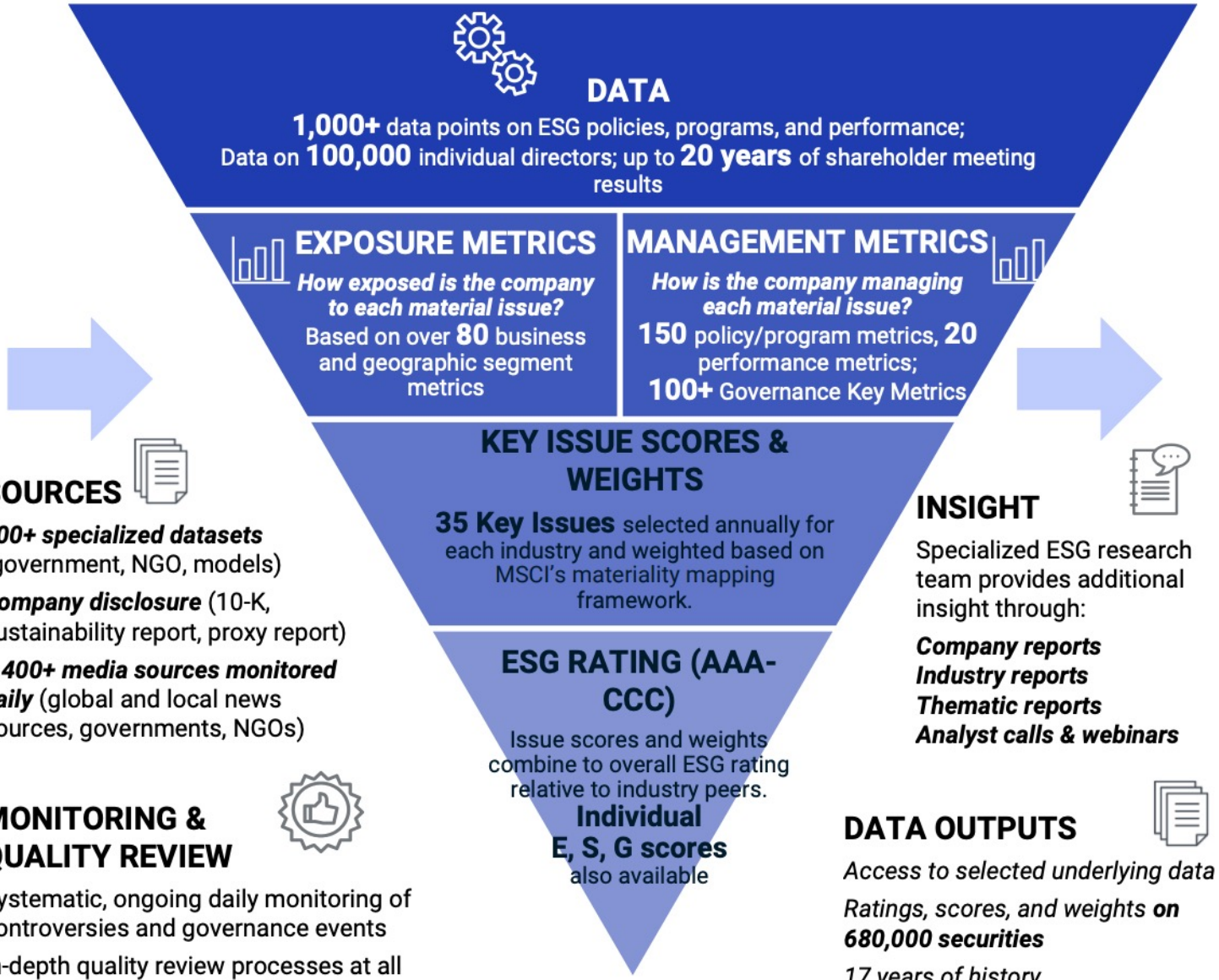


Source: Huang, Ziqi, Yang Shen, Jiayi Li, Marcel Fey, and Christian Brecher (2021). "A survey on AI-driven digital twins in Industry 4.0: Smart manufacturing and advanced robotics." Sensors 21, no. 19: 6340.

ESG Indexes

- MSCI ESG Index
- Dow Jones Sustainability Indices (DJSI)
- FTSE ESG Index

MSCI ESG Rating Framework



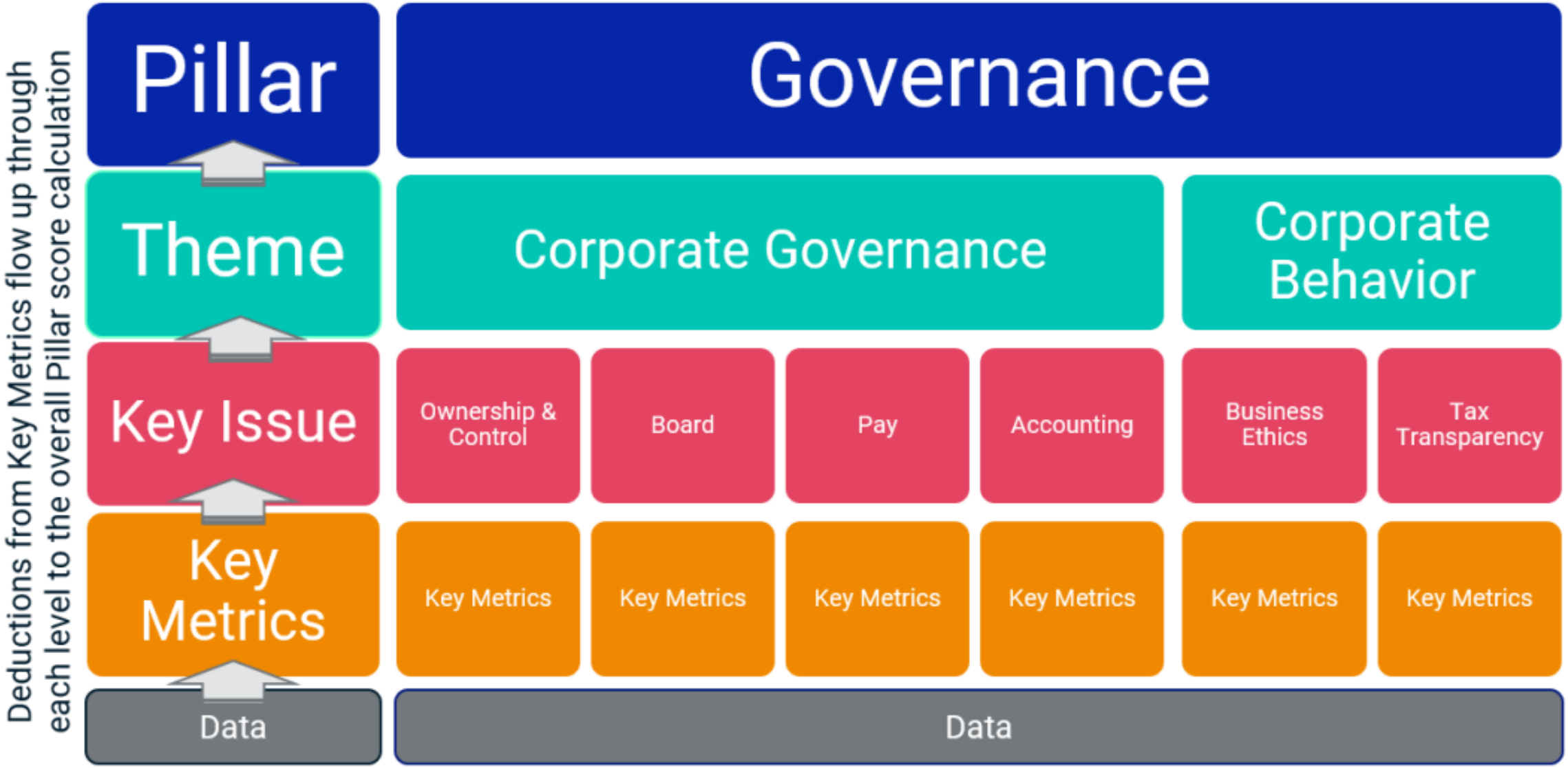
Source: https://www.msci.com/documents/1296102/21901542/ESG-Ratings-Methodology-Exec-Summary.pdf

MSCI ESG Key Issue Hierarchy

3 Pillars	10 Themes	35 ESG Key Issues	
Environment	**Climate Change**	Carbon Emissions	Financing Environmental Impact
		Product Carbon Footprint	Climate Change Vulnerability
	Natural Capital	Water Stress	Raw Material Sourcing
		Biodiversity & Land Use	
	Pollution & Waste	Toxic Emissions & Waste	Electronic Waste
		Packaging Material & Waste	
	Environmental Opportunities	Opportunities in Clean Tech	Opportunities in Renewable Energy
		Opportunities in Green Building	
Social	**Human Capital**	Labor Management	Human Capital Development
		Health & Safety	Supply Chain Labor Standards
	Product Liability	Product Safety & Quality	Privacy & Data Security
		Chemical Safety	Responsible Investment
		Consumer Financial Protection	Health & Demographic Risk
	Stakeholder Opposition	Controversial Sourcing	
		Community Relations	
	Social Opportunities	Access to Communications	Access to Health Care
		Access to Finance	Opportunities in Nutrition & Health
Governance	**Corporate Governance**	Ownership & Control	Pay
		Board	Accounting
	Corporate Behavior	Business Ethics	
		Tax Transparency	

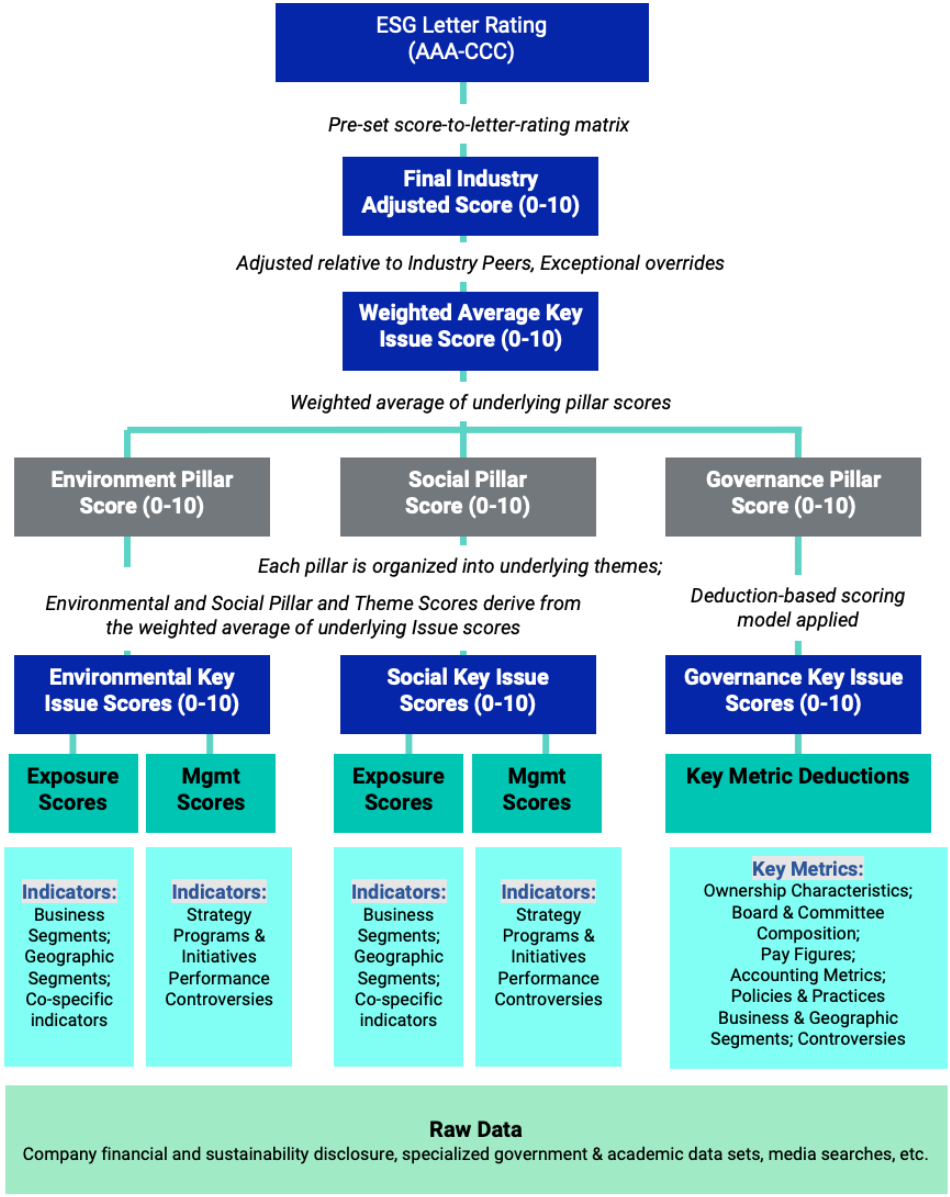
Source: https://www.msci.com/documents/1296102/21901542/ESG-Ratings-Methodology-Exec-Summary.pdf

MSCI Governance Model Structure



Source: https://www.msci.com/documents/1296102/21901542/ESG-Ratings-Methodology-Exec-Summary.pdf

MSCI Hierarchy of ESG Scores



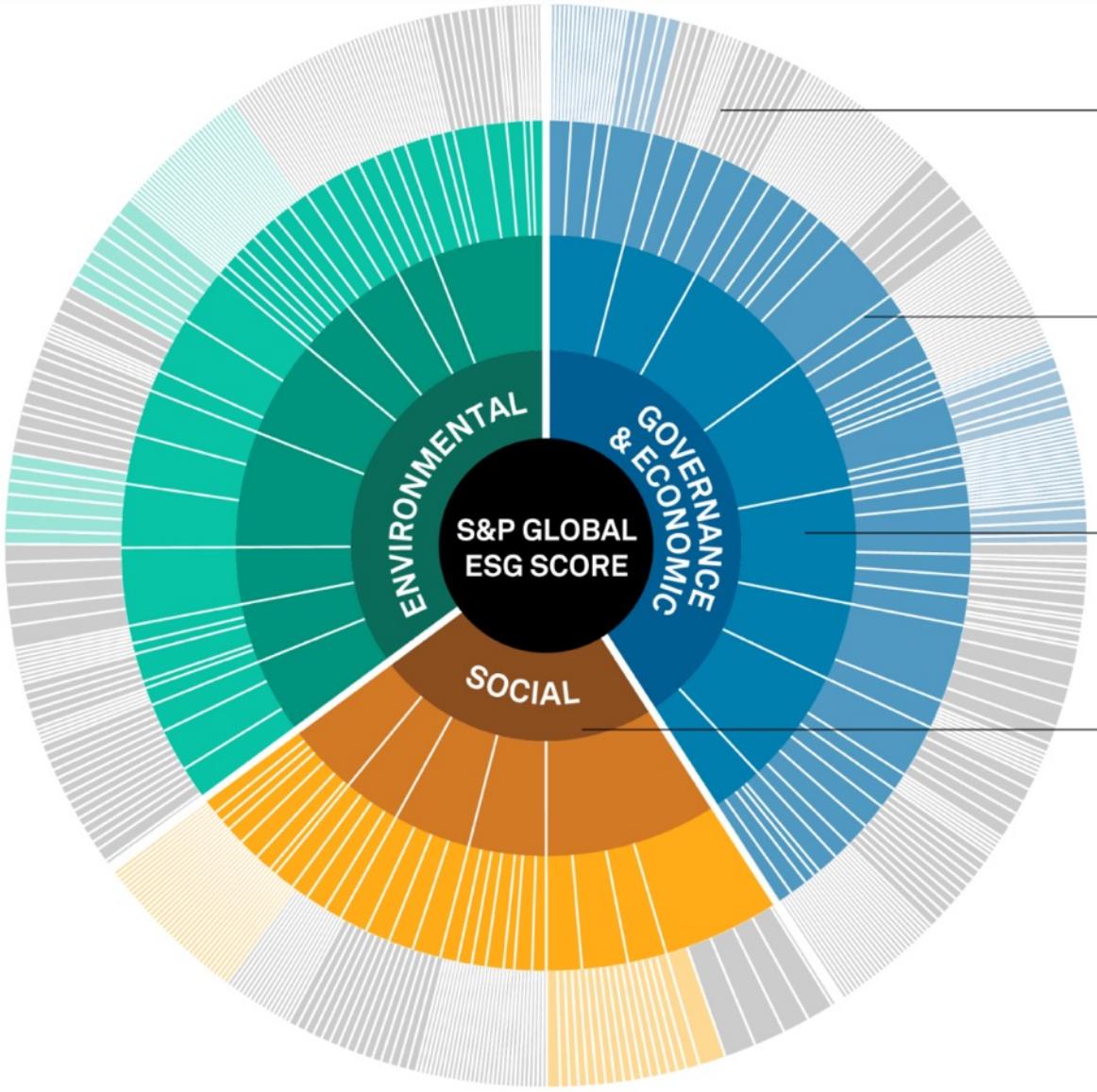
Source: https://www.msci.com/documents/1296102/21901542/ESG-Ratings-Methodology-Exec-Summary.pdf

DJSI S&P Global ESG Score

8,000
Companies

90%
Global market capitalization

340,000+
Current Research Universe and Active Securities



Approx.
1,000
Datapoints

Assessed values, text, checkboxes, documents
Sources: Web-based questionnaire and company documents

130+
Questions

Weighted data point scores
Up to 50% industry-specific

Ave.
30+
Criteria scores

Weighted question scores
61 industry specific approaches, with tailored questions, criteria and related weightings

3
Dimension scores

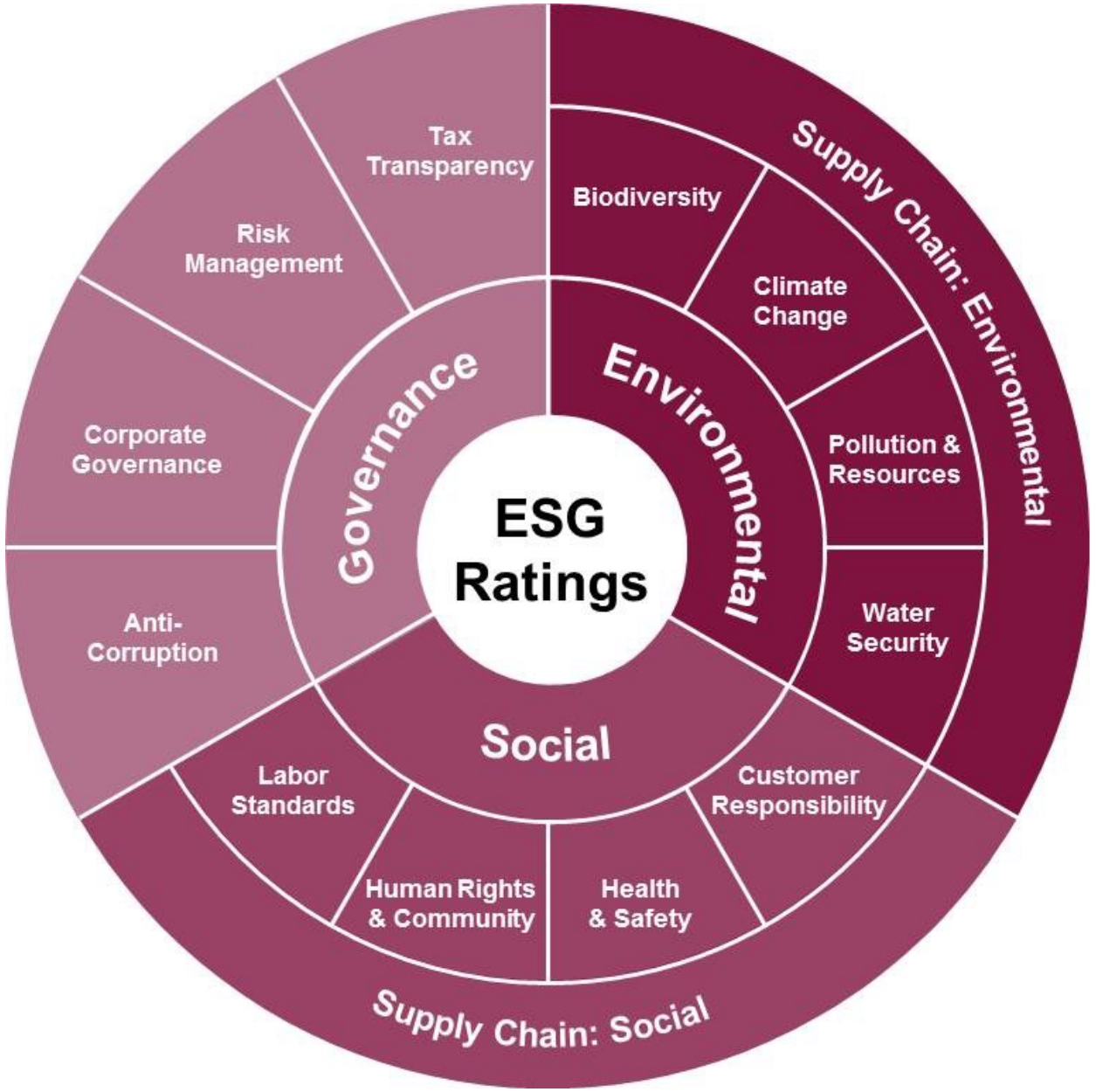
Weighted criteria scores
Adjusted for corporate ESG controversies where applicable

1
S&P Global ESG Score

Sum of weighted dimension scores

Source: DJSI, S&P Global Corporate Sustainability Assessment (CSA), https://www.spglobal.com/esg/solutions/data-intelligence-esg-scores

FTSE Russell ESG Ratings



Source: https://www.ftserussell.com/data/sustainability-and-esg-data/esg-ratings

SUSTAINALYTICS
a Morningstar company

Sustainalytics ESG Risk Ratings

Analyst-based approach

Sustainalytics' ESG Risk Ratings measure a company's exposure to industry-specific material ESG risks and how well a company is managing those risks.

Negligible	Low	Medium	High	Severe
0 - 10	10 - 20	20 - 30	30 - 40	40+

Source: https://www.sustainalytics.com/esg-data

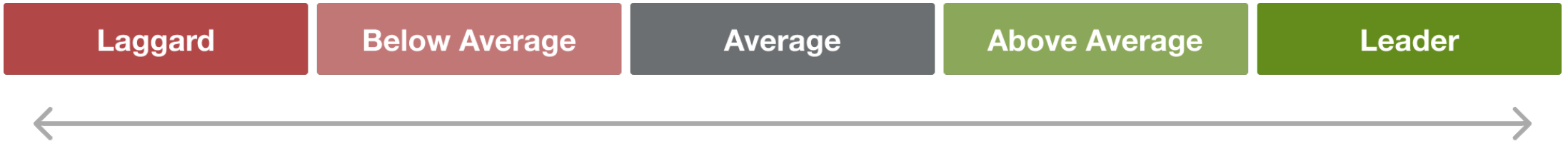
TruValue Labs

FACTSET

Truvalue ESG Ranks

Machine-based approach

- **Truvalue Labs applies AI to analyze over 100,000 sources and uncover ESG risks and opportunities hidden in unstructured text.**
- **The ESG Ranks data service produces an overall company rank based on industry percentile leveraging the 26 ESG categories defined by the Sustainability Accounting Standards Board (SASB).**
- **The data feed covers 20,000+ companies with more than 13 years of history.**



Source: :https://developer.truvaluelabs.com/data/esg-ranks

Analyst-driven vs. AI-driven ESG

Analyst-driven ESG research

Derives ratings in a structured data model

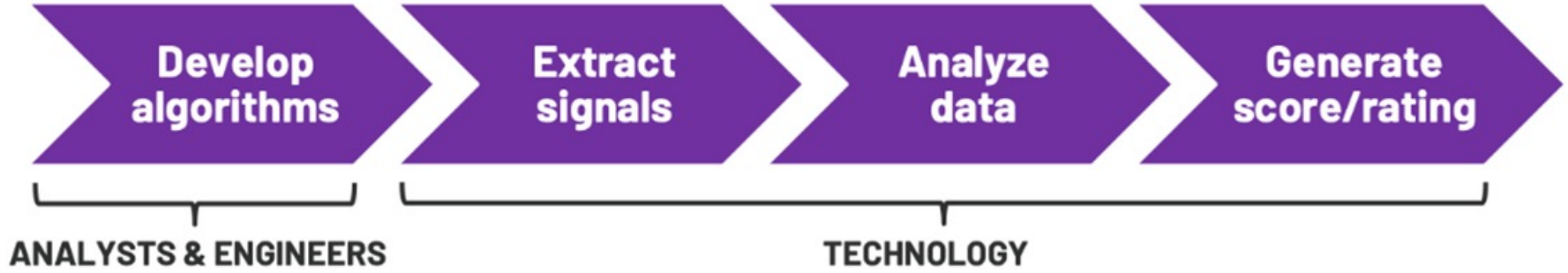
Sustainalytics

Analyst role at the end of the process allows subjectivity to color results

AI-driven ESG research

Derives signals from unstructured data

Truvalue Labs

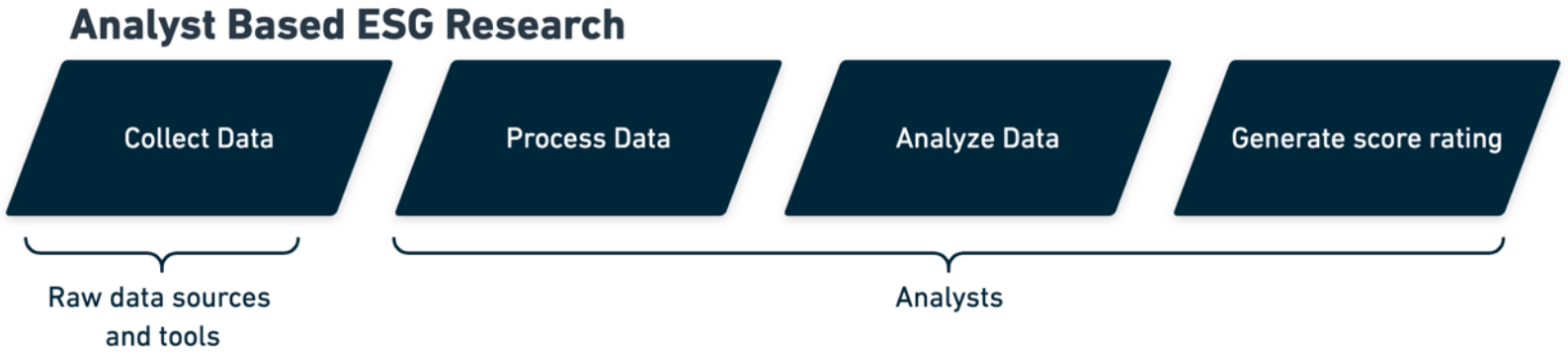


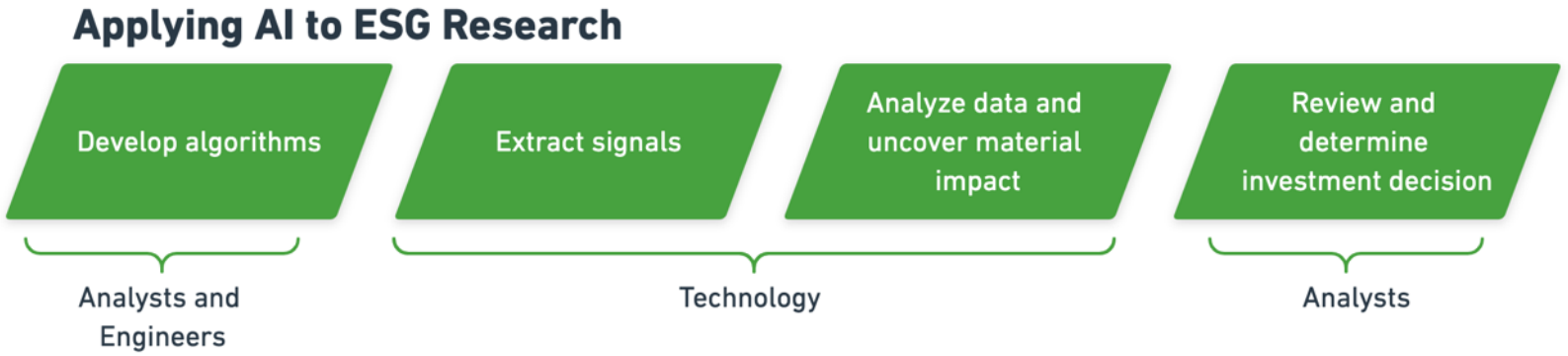
Analyst expertise at the beginning of the process produces consistent results

Source: Mark Tulay (2020), Man vs. machine: A tale of two sustainability ratings systems, GreenBiz, https://www.greenbiz.com/article/man-vs-machine-tale-two-sustainability-ratings-systems

Analyst based ESG Research

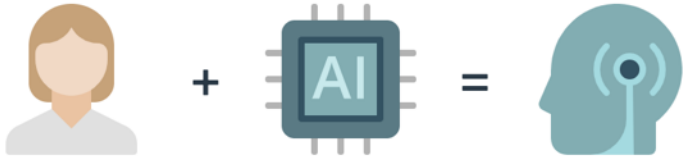
AI based ESG Research





It would take an analyst over 5 years to do what our AI can in 1 week

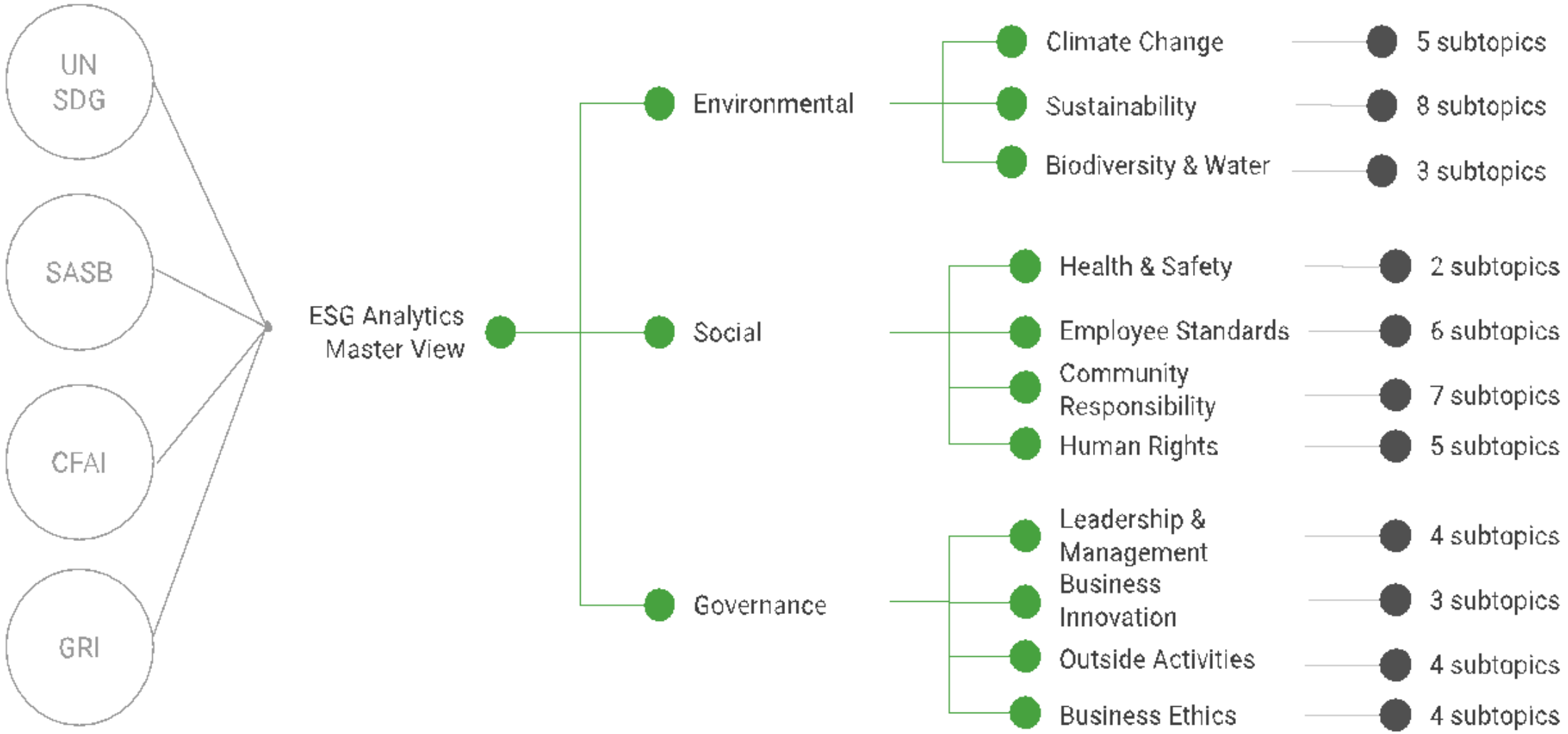
Combining analysts with AI creates gives you the full picture



ESG ANALYTICS
Invest where it matters.

Source: https://www.esganalytics.io/insights/how-data-is-accelerating-esg

ESG Analytics: NLP Taxonomy

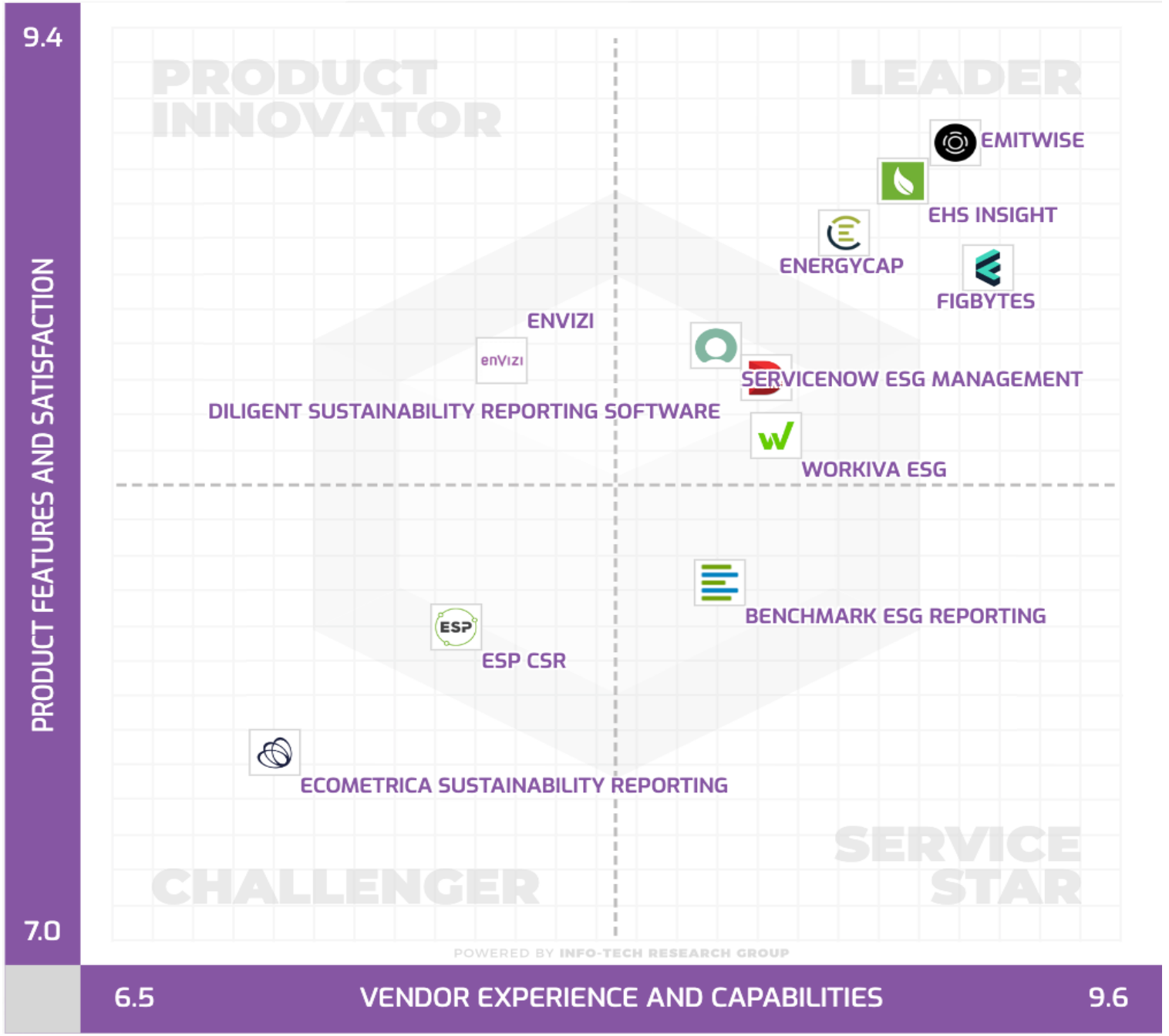


ESG ANALYTICS

Source: https://www.esganalytics.io/insights/how-data-is-accelerating-esg

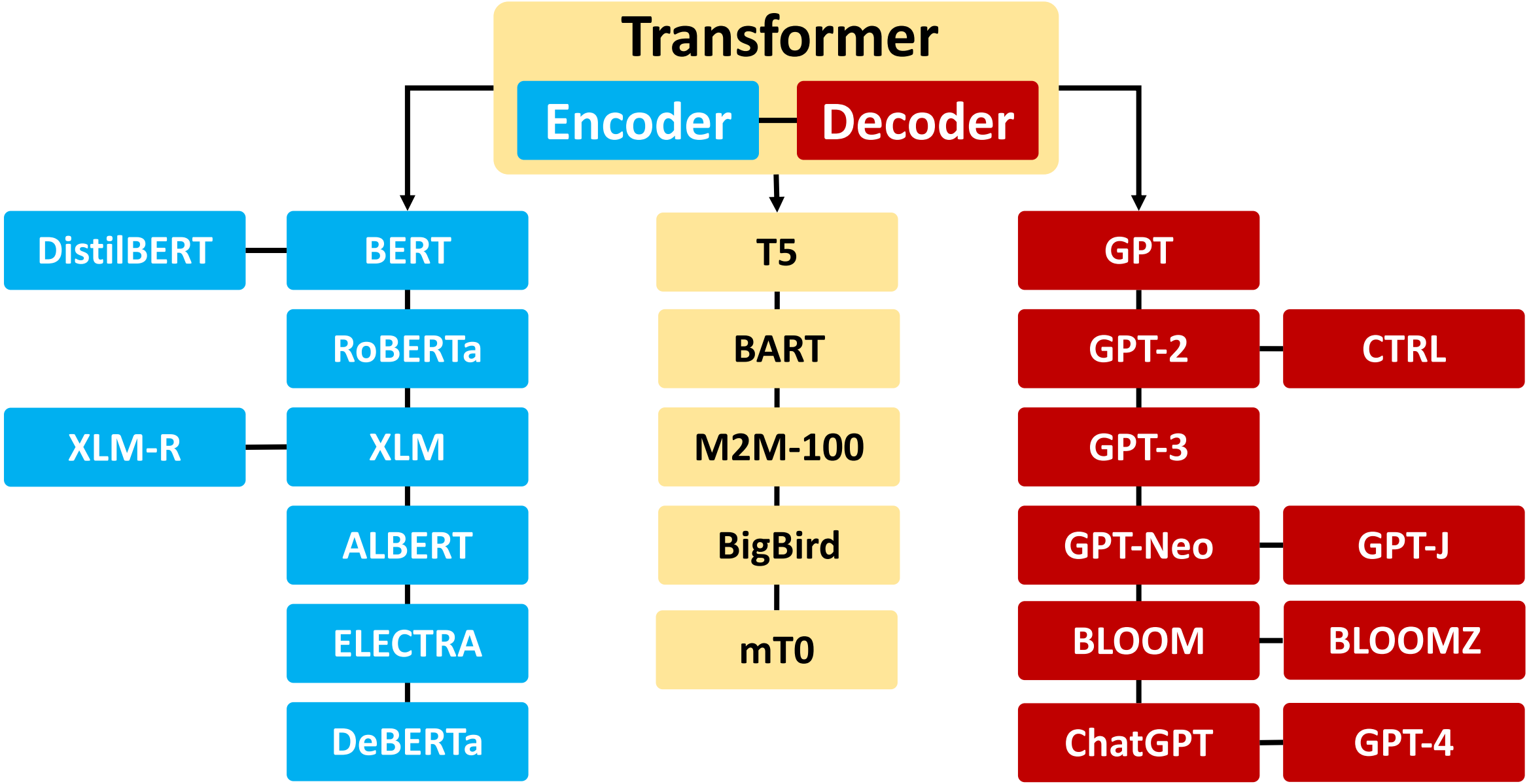
Top ESG Reporting Software

Environmental, Social and Governance (ESG) Reporting software or **Sustainability software** helps organizations manage their operational data, evaluate their impact on the environment and provide reporting to perform audits.



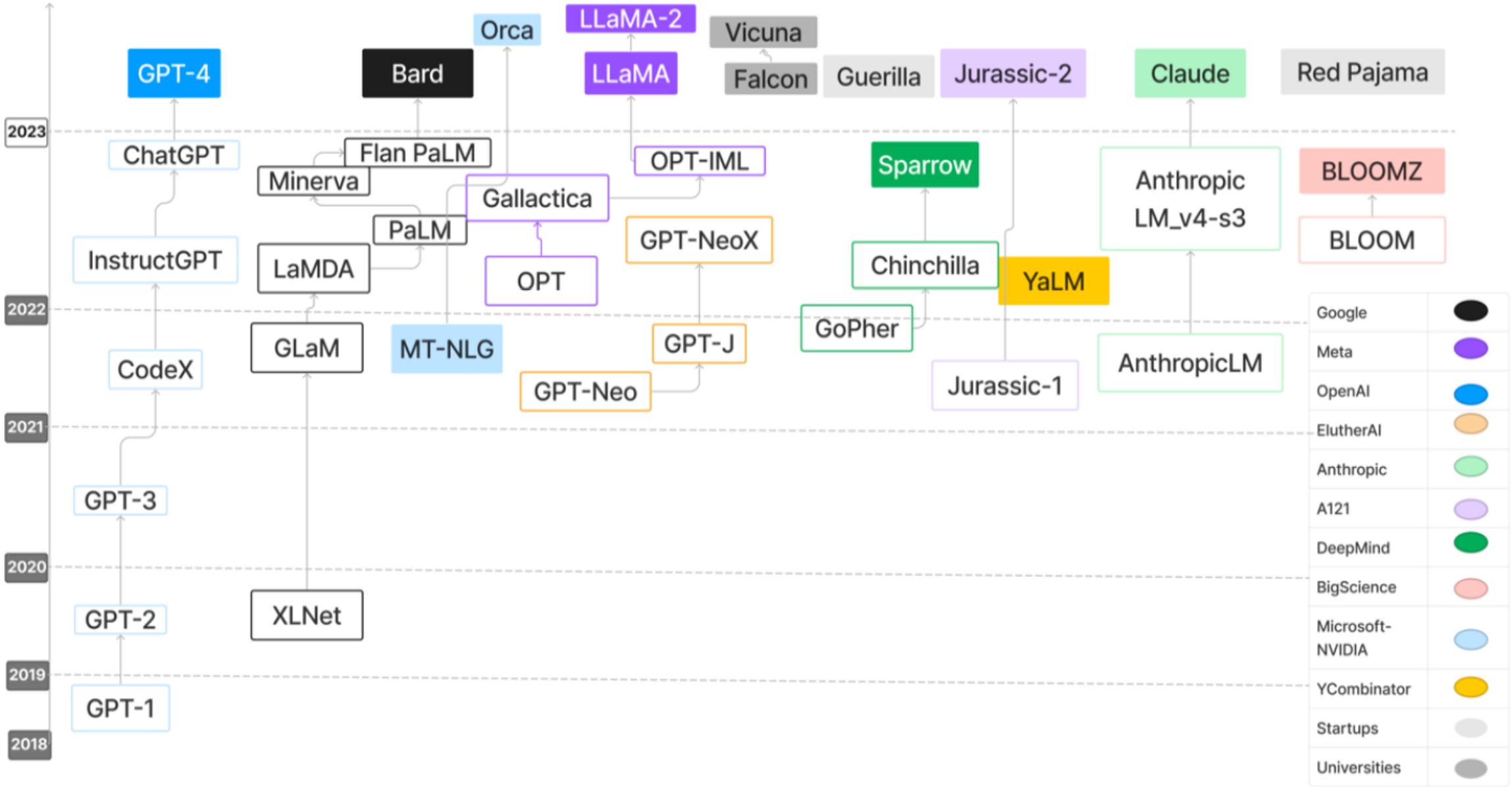
Source: https://www.softwarereviews.com/categories/environmental-social-and-governance-reporting

Transformer Models



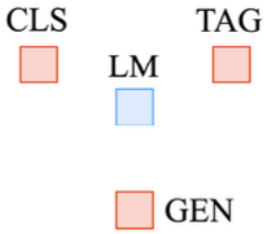
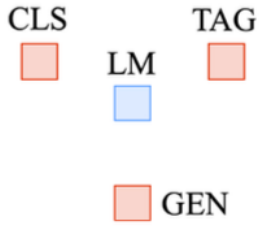
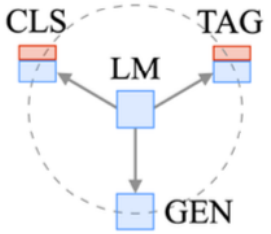
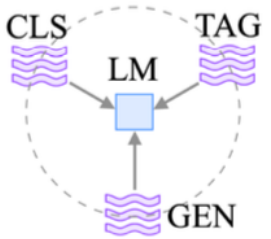
Source: Lewis Tunstall, Leandro von Werra, and Thomas Wolf (2022), Natural Language Processing with Transformers: Building Language Applications with Hugging Face, O'Reilly Media.

Large Language Models (LLMs)



Source: Hadi, Muhammad Usman, Rizwan Qureshi, Abbas Shah, Muhammad Irfan, Anas Zafar, Muhammad Bilal Shaikh, Naveed Akhtar, Jia Wu, and Seyedali Mirjalili. "Large language models: a comprehensive survey of its applications, challenges, limitations, and future prospects." Authorea Preprints (2023).

Four Paradigms in NLP (LM)

Paradigm	Engineering	Task Relation
a. Fully Supervised Learning (Non-Neural Network)	Feature (e.g. word identity, part-of-speech, sentence length)	
b. Fully Supervised Learning (Neural Network)	Architecture (e.g. convolutional, recurrent, self-attentional)	
Transfer Learning: Pre-training, Fine-Tuning (FT) c. Pre-train, Fine-tune	Objective (e.g. masked language modeling, next sentence prediction)	
GAI: Pre-train, Prompt, and Predict (Prompting) d. Pre-train, Prompt, Predict	Prompt (e.g. cloze, prefix)	

Source: Pengfei Liu, Weizhe Yuan, Jinlan Fu, Zhengbao Jiang, Hiroaki Hayashi, and Graham Neubig. (2023) "Pre-train, prompt, and predict: A systematic survey of prompting methods in natural language processing." ACM Computing Surveys 55, no. 9 (2023): 1-35.

Generative AI

Text, Image, Video, Audio Applications

Comparison of Generative AI and Traditional AI

Feature	Generative AI	Traditional AI
Output type	New content	Classification/Prediction
Creativity	High	Low
Interactivity	Usually more natural	Limited

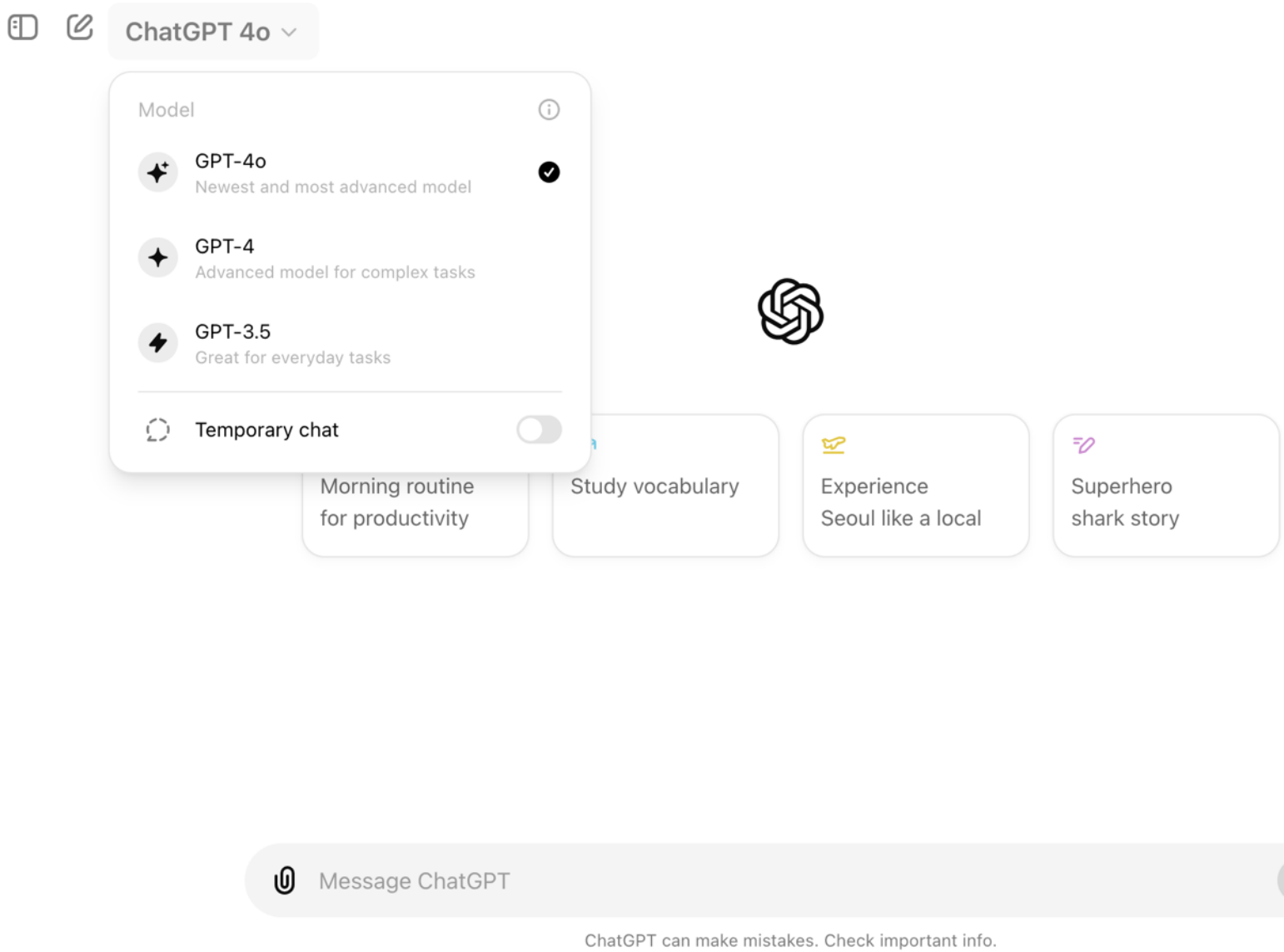
Generative AI

- **Generative AI: The Art of Creation**
- **Definition: AI systems capable of creating new content**
- **Characteristics: Creativity, interactivity**

Popular Generative AI

- OpenAI ChatGPT (GPT-4o, GPT-4)
- Claude.ai (Claude 3.5)
- Google Gemini
- Chat.LMSys.org
- Perplexity.ai
- ChatPDF
- Stable Diffusion
- Video: D-ID, Synthesia
- Audio: Speechify

OpenAI ChatGPT (GPT-4o, GPT-4)



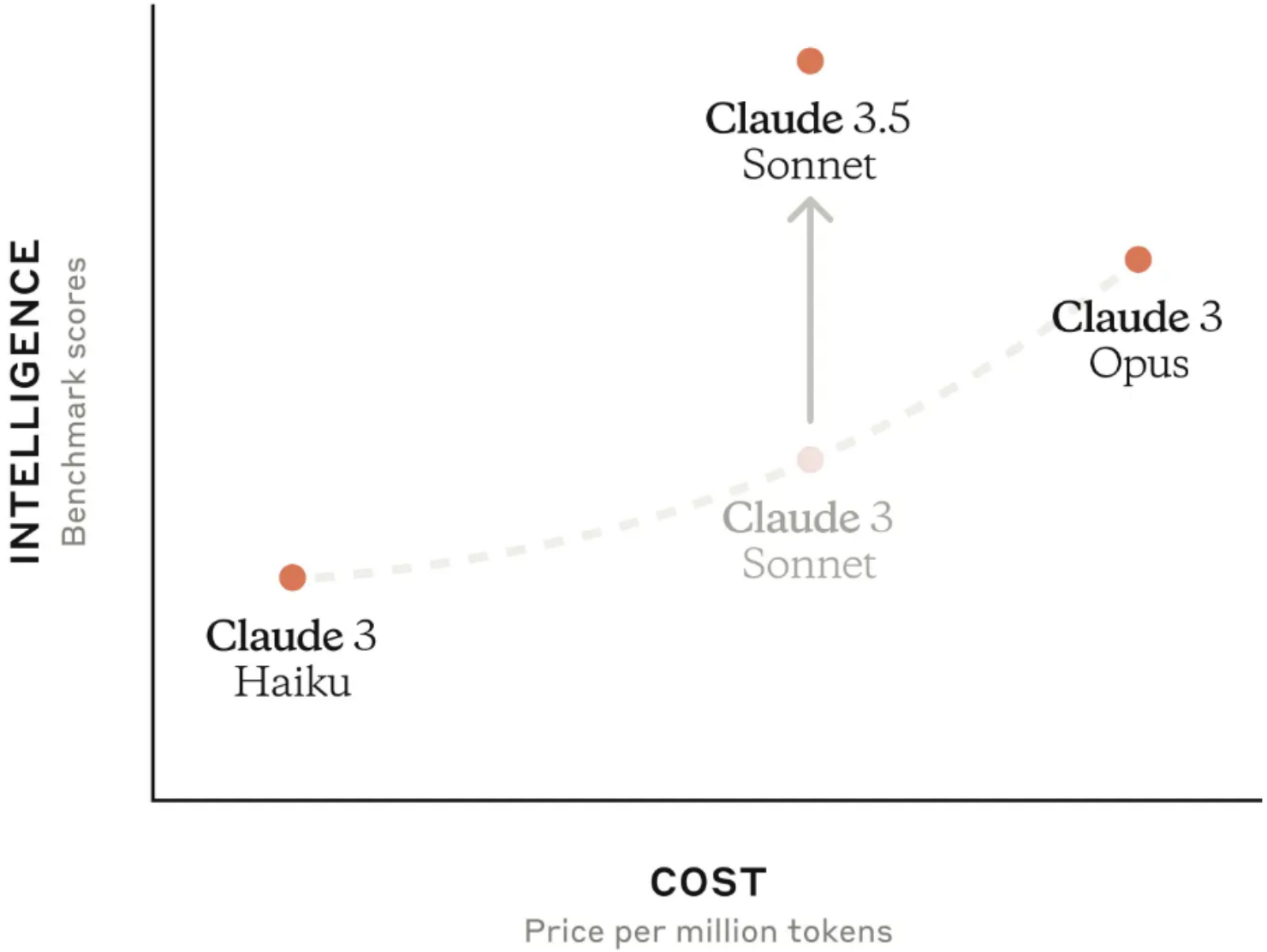
https://chat.openai.com/

OpenAI ChatGPT (GPT-4) DALL·E 3

Vector graphic of a flowchart depicting the integration of generative AI in the education process, from content creation to virtual experiments, personalized learning, and innovative learning.

https://chat.openai.com/

Claude 3.5 Sonnet



Source: https://www.anthropic.com/news/claude-3-5-sonnet

Claude 3.5, GPT-4o, Gemini 1.5 Pro

	Claude 3.5 Sonnet	Claude 3 Opus	GPT-4o	Gemini 1.5 Pro	Llama-400b (early snapshot)
Graduate level reasoning *GPQA, Diamond*	59.4%* 0-shot CoT	50.4% 0-shot CoT	53.6% 0-shot CoT	—	—
Undergraduate level knowledge *MMLU*	88.7%** 5-shot 88.3% 0-shot CoT	86.8% 5-shot 85.7% 0-shot CoT	— 88.7% 0-shot CoT	85.9% 5-shot —	86.1% 5-shot —
Code *HumanEval*	92.0% 0-shot	84.9% 0-shot	90.2% 0-shot	84.1% 0-shot	84.1% 0-shot
Multilingual math *MGSM*	91.6% 0-shot CoT	90.7% 0-shot CoT	90.5% 0-shot CoT	87.5% 8-shot	—
Reasoning over text *DROP, F1 score*	87.1 3-shot	83.1 3-shot	83.4 3-shot	74.9 Variable shots	83.5 3-shot Pre-trained model
Mixed evaluations *BIG-Bench-Hard*	93.1% 3-shot CoT	86.8% 3-shot CoT	—	89.2% 3-shot CoT	85.3% 3-shot CoT Pre-trained model
Math problem-solving *MATH*	71.1% 0-shot CoT	60.1% 0-shot CoT	76.6% 0-shot CoT	67.7% 4-shot	57.8% 4-shot CoT
Grade school math *GSM8K*	96.4% 0-shot CoT	95.0% 0-shot CoT	—	90.8% 11-shot	94.1% 8-shot CoT

* Claude 3.5 Sonnet scores 67.2% on 5-shot CoT GPQA with maj@32
** Claude 3.5 Sonnet scores 90.4% on MMLU with 5-shot CoT prompting

Source: https://www.anthropic.com/news/claude-3-5-sonnet

Claude 3.5 Sonnet State-of-the-art vision

	Claude 3.5 Sonnet	Claude 3 Opus	GPT-4o	Gemini 1.5 Pro
Visual math reasoning *MathVista (testmini)*	**67.7%** 0-shot CoT	**50.5%** 0-shot CoT	**63.8%** 0-shot CoT	**63.9%** 0-shot CoT
Science diagrams *AI2D, test*	**94.7%** 0-shot	**88.1%** 0-shot	**94.2%** 0-shot	**94.4%** 0-shot
Visual question answering *MMMU (val)*	**68.3%** 0-shot CoT	**59.4%** 0-shot CoT	**69.1%** 0-shot CoT	**62.2%** 0-shot CoT
Chart Q&A *Relaxed accuracy (test)*	**90.8%** 0-shot CoT	**80.8%** 0-shot CoT	**85.7%** 0-shot CoT	**87.2%** 0-shot CoT
Document visual Q&A *ANLS score, test*	**95.2%** 0-shot	**89.3%** 0-shot	**92.8%** 0-shot	**93.1%** 0-shot

Source: https://www.anthropic.com/news/claude-3-5-sonnet

Google Gemini

Largest and most capable AI model
Making AI more helpful for everyone

Source: https://blog.google/technology/ai/google-gemini-ai

LMSYS Chatbot Arena Leaderboard

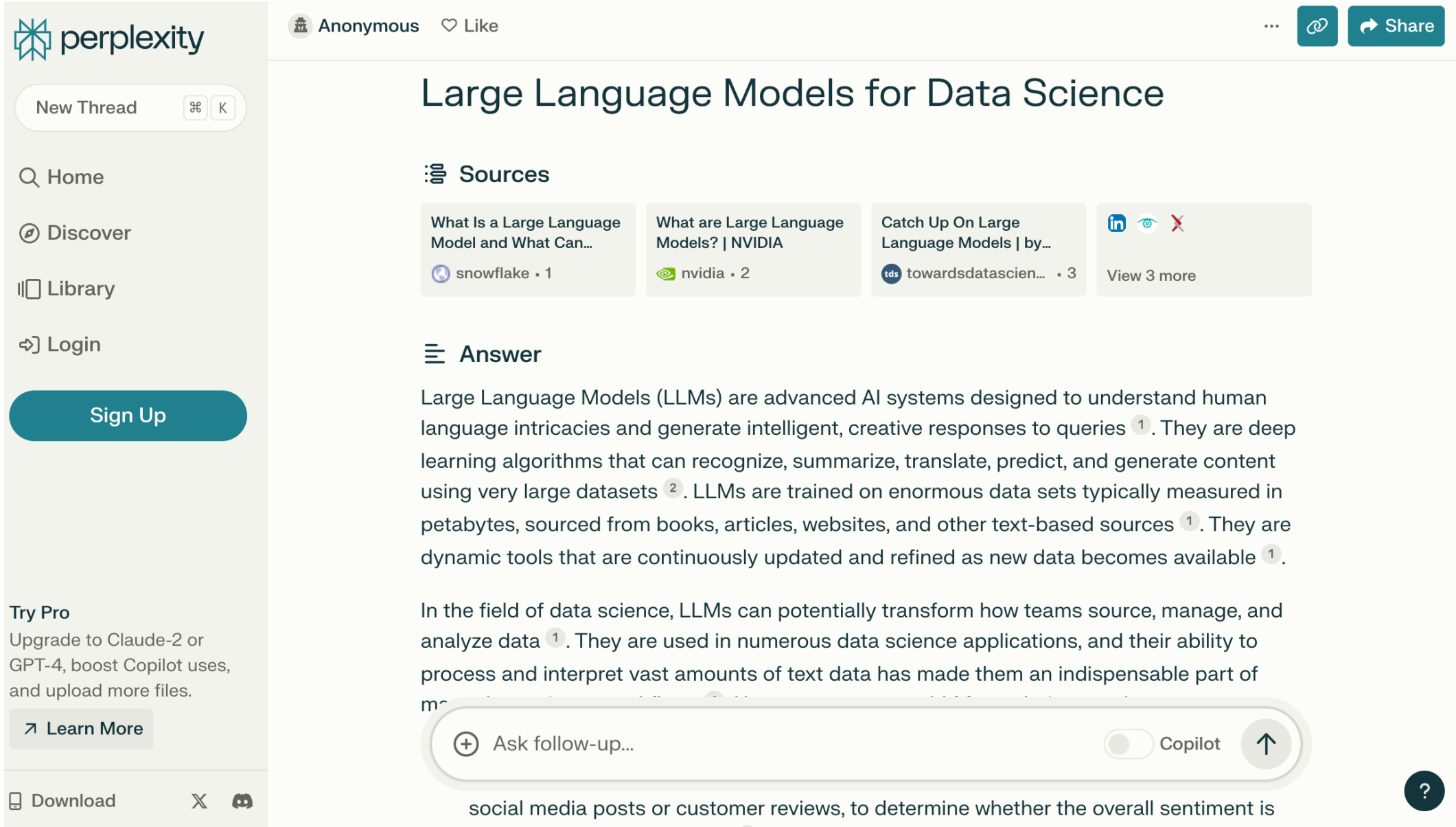
GPT-4o

Claude 3.5

Rank* (UB)	Model	Arena Score	95% CI	Votes	Organization	License	Knowledge Cutoff
1	ChatGPT-4o-latest (2024-08-08)	1316	+4/-4	24358	OpenAI	Proprietary	2023/10
2	Gemini-1.5-Pro-Exp-0827	1301	+5/-5	19976	Google	Proprietary	2023/11
2	Gemini-1.5-Pro-Exp-0801	1298	+4/-3	25471	Google	Proprietary	2023/11
2	Grok-2-08-13	1295	+4/-6	10170	xAI	Proprietary	2024/3
5	GPT-4o-2024-05-13	1286	+3/-3	83181	OpenAI	Proprietary	2023/10
6	GPT-4o-mini-2024-07-18	1274	+4/-4	23318	OpenAI	Proprietary	2023/10
6	Gemini-1.5-Flash-Exp-0827	1270	+7/-6	6610	Google	Proprietary	2023/11
6	Claude 3.5 Sonnet	1270	+3/-3	53610	Anthropic	Proprietary	2024/4
6	Gemini Advanced App (2024-05-14)	1266	+3/-3	52225	Google	Proprietary	Online
6	Grok-2-Mini-08-13	1266	+6/-6	10939	xAI	Proprietary	2024/3
7	Meta-Llama-3.1-405b-Instruct	1266	+3/-4	24855	Meta	Llama 3.1 Community	2023/12
7	GPT-4o-2024-08-06	1262	+7/-5	14960	OpenAI	Proprietary	2023/10
10	Gemini-1.5-Pro-001	1259	+3/-3	74909	Google	Proprietary	2023/11

https://lmarena.ai/

Perplexity.ai

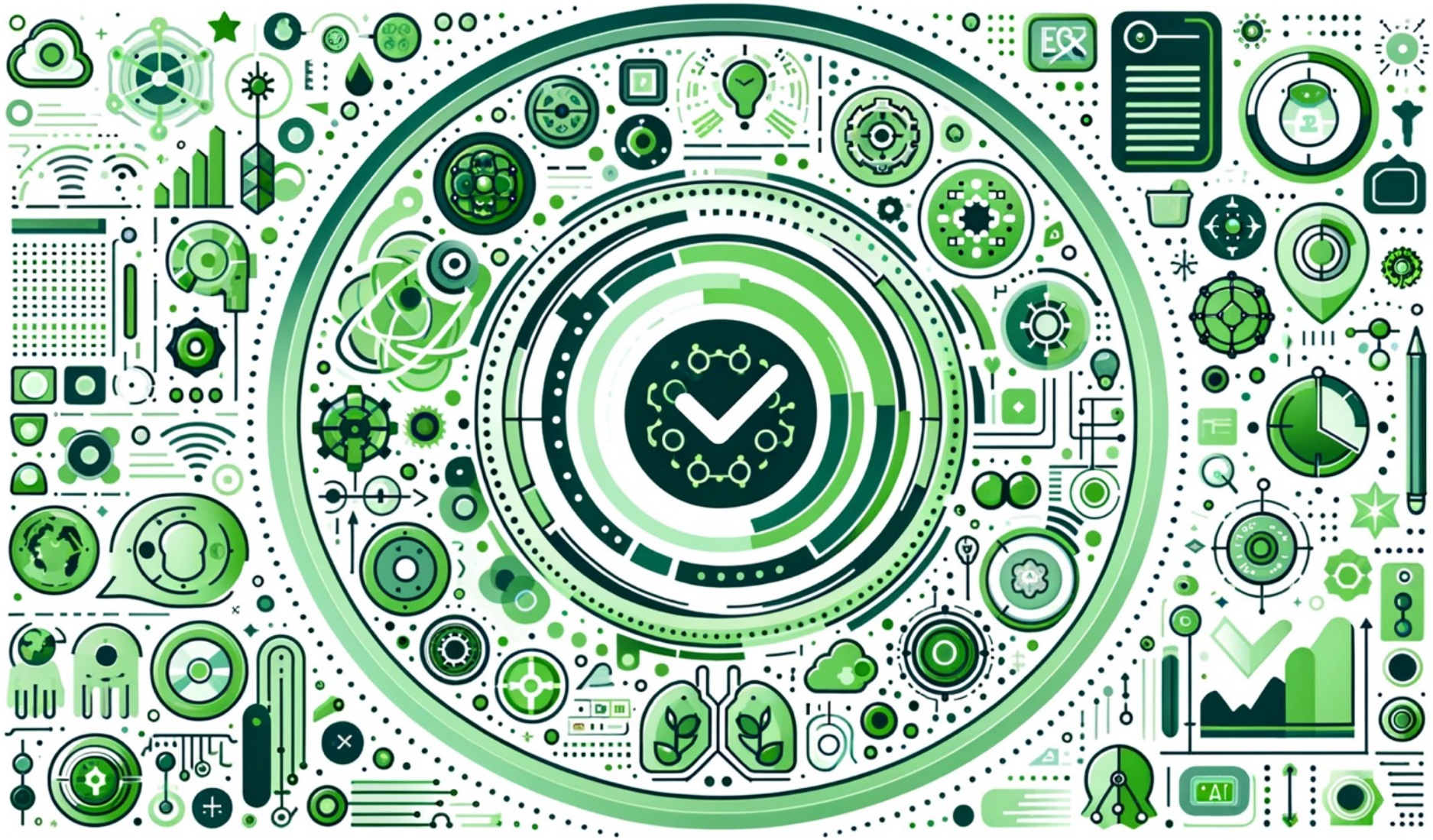


https://www.perplexity.ai/

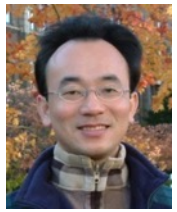
Generative AI and LLMs for Sustainability and ESG Data Analytics

Sustainability and ESG Data Analytics

Generative AI for ESG Rating and Reporting Generation



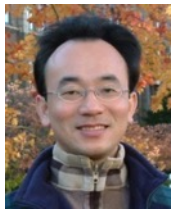
Teaching



- **Artificial Intelligence**
  - Spring 2021, Fall 2022, Fall 2024
- **Sustainability and ESG Data Analytics**
  - Spring 2024, Fall 2024
- **Big Data Analytics**
  - Fall 2020, Spring 2023, Spring 2024
- **Software Engineering**
  - Fall 2020, Fall, 2021, Spring 2022, Spring 2023, Spring 2024
- **Artificial Intelligence in Finance and Quantitative**
  - Fall 2021, Fall 2022, Fall 2023
- **Artificial Intelligence for Text Analytics**
  - Spring 2022, Fall 2023
- **Python for Accounting Applications**
  - Fall 2023, Fall 2024
- **Foundation of Business Cloud Computing**
  - Spring 2021, Spring 2022, Spring 2023, Spring 2024

https://web.ntpu.edu.tw/~myday/teaching.htm

Research Projects



1. **Fintech Green Finance for Carbon Market Index, Corporate Finance, and Environmental Policies.**
   Carbon Emission Sentiment Index with AI Text Analytics
   - NTPU, 113-NTPU_ORDA-F-003, 2023/01/01~2024/12/31
2. **Digital Support, Unimpeded Communication: The Development, Support and Promotion of AI-assisted Communication Assistive Devices for Speech Impairment (2/3).**
   Multimodal Cross-lingual Task-Oriented Dialogue System for Inclusive Communication Support
   - NSTC 113-2425-H-305-002-, 3 Years (2023/05/01-2026/04/30) Year 1: 2024/05/01~2025/04/30
3. **Research on speech processing, synthesis, recognition, and sentence construction of people with language disabilities.** Multimodal Cross-lingual Task-Oriented Dialogue System
   - NTPU, 113-NTPU_ORDA-F-004, 2023/01/01~2025/12/31
4. Metaverse AI Multimodal Cross-Language Task-Oriented Dialogue System
   - ATEC Group, Fintech and Green Finance Center (FGFC, NTPU), NTPU-112A413E01, 3 Years (2023/05/01~2026/04/30)
5. Generative AI-Driven ESG Report Generation Technology
   - Industrial Technology Research Institute (ITRI), Fintech and Green Finance Center (FGFC, NTPU), NTPU-113A513E01, 2024/03/01~2024/12/31
6. **Establishment and Implement of Smart Assistive Technology for Dementia Care and Its Socio-Economic Impacts (3/3).** Intelligent, individualized and precise care with smart AT and system integration
   - NSTC, 113-2627-M-038-001-, 2024/08/01~2025/07/31
7. Prospective longitudinal study on peri-implant bone loss associated with peri-implantitis
   - USTP (NTPU, TMU), USTP-NTPU-TMU-113-03, 2024/01/01~2024/12/31

https://web.ntpu.edu.tw/~myday/cindex.htm#projects

Summary

- This course introduces the fundamental concepts and hands-on practices of Sustainability and ESG Data Analytics.
- Topics include
  1. Introduction Sustainability and ESG Data Analytics
  2. Environmental, Social, and Governance (ESG) in Net-Zero Digital Transformation
  3. Data Science for Sustainability and ESG
  4. Web 3.0 and Big Data Analysis in Fintech, Green Finance, Sustainable Finance
  5. Task Force on Climate-Related Financial Disclosures (TCFD) and En-Roads Interactive
  6. ESG Data Gathering, Analysis, and Visualization
  7. ESG Data Reporting, Corporate Sustainability Reports
  8. ESG Data Verification
  9. Energy Star Reporting and Data Disclosure
  10. Artificial Intelligence of things (AIoT) in ESG and Sustainability Applications
  11. Generative AI for ESG Rating and Reporting Generation
  12. Case Study on Sustainability and ESG Data Analytics

Sustainability and ESG Data Analytics

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National Taipei University

aws educate | Cloud Ambassador
2020 Cohort

aws academy
Accredited Educator

aws certified
Solutions Architect
Associate

aws certified
Cloud Practitioner

Contact Information

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