

永續數據分析

(Sustainability and ESG Data Analytics)

環境、社會與治理 (ESG) 淨零數位轉型 (Environmental, Social, and Governance (ESG) in Net-Zero Digital Transformation)

1122ESGDA02

DM4, NTPU (N4084) (Spring 2024)

Fri, 10, 11, 12 (18:30-21:15) (臺北大學民生校區 305)

戴敏育

Min-Yuh Day, Ph.D,
Associate Professor

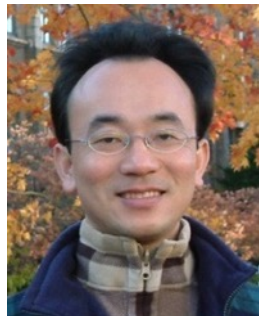
Institute of Information Management, National Taipei University

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

2024-03-01



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



課程大綱 (Syllabus)

- | 週次 (Week) | 日期 (Date) | 內容 (Subject/Topics) |
|-----------|------------|-----------------------------------------------------------------------------------------------------------|
| 1 | 2024/02/23 | 永續數據分析概論
(Introduction Sustainability and ESG Data Analytics) |
| 2 | 2024/03/01 | 環境、社會與治理 (ESG) 淨零數位轉型
(Environmental, Social, and Governance (ESG) in Net-Zero Digital Transformation) |
| 3 | 2024/03/08 | 永續與ESG 資料科學
(Data Science for Sustainability and ESG) |
| 4 | 2024/03/15 | 永續數據分析個案研究 I
(Case Study on Sustainability and ESG Data Analytics I) |
| 5 | 2024/03/22 | Web 3.0 和大數據分析在金融科技、綠色永續金融
(Web 3.0 and Big Data Analysis in Fintech, Green and Sustainable Finance) |

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
6	2024/03/29	TCFD 氣候相關財務揭露與En-ROADS 氣候變遷模擬 (Task Force on Climate-Related Financial Disclosures (TCFD) and En-Roads Interactive)
7	2024/04/05	放假 (No Classes)
8	2024/04/12	期中報告 (Midterm Project Report)
9	2024/04/19	ESG數據的收集、分析和視覺化 (ESG Data Gathering, Analysis, and Visualization)
10	2024/04/26	ESG數據報告 (ESG Data Reporting); 企業永續報告書 (Corporate Sustainability Reports)

課程大綱 (Syllabus)

- | 週次 (Week) | 日期 (Date) | 內容 (Subject/Topics) |
|-----------|------------|------------------------------------------------------------------------------------------------------|
| 11 | 2024/05/03 | ESG數據驗證 (ESG Data Verification) |
| 12 | 2024/05/10 | 永續數據分析個案研究 II
(Case Study on Sustainability and ESG Data Analytics II) |
| 13 | 2024/05/17 | 能源之星報告與數據揭露
(Energy Star Reporting and Data Disclosure) |
| 14 | 2024/05/24 | 人工智慧物聯網在ESG永續應用
(Artificial Intelligence of things (AIoT) in ESG and Sustainability Applications) |
| 15 | 2024/05/31 | 生成式AI於永續評等和報告生成
(Generative AI for ESG Rating and Reporting Generation) |
| 16 | 2024/06/07 | 期末報告 (Final Project Report) |

**Environmental, Social, and
Governance (ESG)
in Net-Zero Digital Transformation**

Outline

- **Environmental, Social, and Governance (ESG)**
- **Net-Zero Digital Transformation**
 - **Net-Zero Transformation**
 - **Digital Transformation**

衡量企業永續關鍵指標

臺北大學獨創ESG永續評鑑系統

社會(S)	經濟(E)	環境(E)	揭露(D)
<ul style="list-style-type: none"> 1.人權 2.員工溝通與福利 3.人力資本發展 4.多元組成與包容性 5.供應鏈社會面向控管 6.客戶關係管理 7.產品安全 8.企業公民與慈善 	<ul style="list-style-type: none"> 1.股東權益 2.董事會結構與運作 3.行為準則與內控 4.風險及危機管理 5.永續金融 6.ESG創新 	<ul style="list-style-type: none"> 1.環境系統與治理 2.空氣管理 3.能源與氣候變遷 4.水管理 5.原物料與廢棄物管理/ 資源與廢棄物管理 6.生物多樣性 7.供應商及產品生命週期管理/ 供應鏈環境面向管理 	<ul style="list-style-type: none"> 1.ESG 揭露

Sustainability and ESG Data Analytics



ESG:

Environmental

Social

Governance

CSR:
Corporate
Social
Responsibility

ESG in Net-Zero Digital Transformation: Foundations and Frameworks

- **Environmental, Social, and Governance (ESG)**
- **Net-Zero Transformation**
- **Digital Transformation**
- **Opportunities and responsibilities**

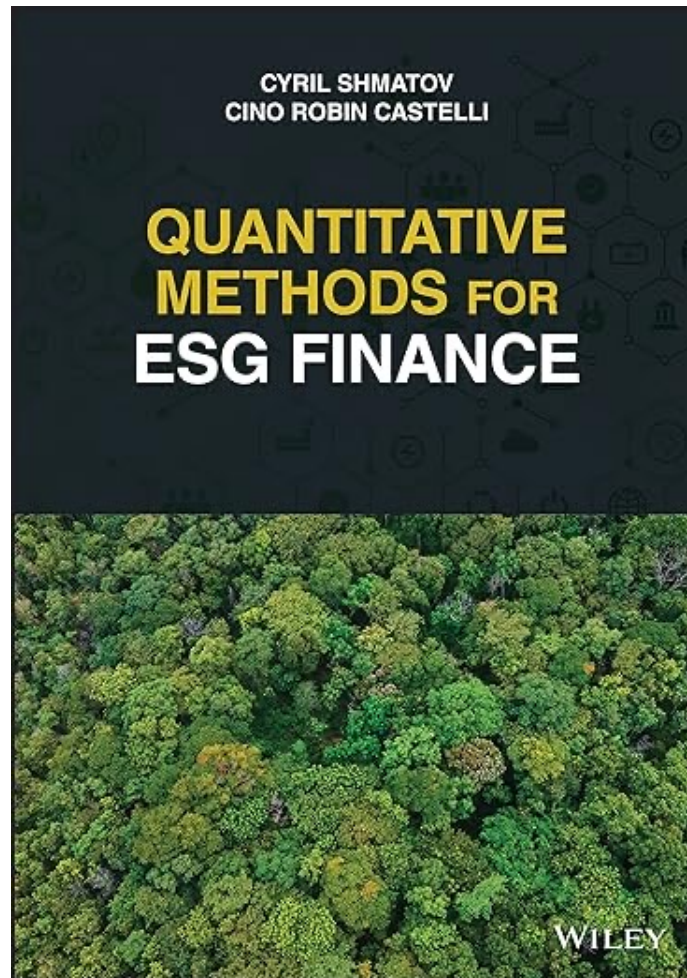


Tech for Good – Your Solutions!

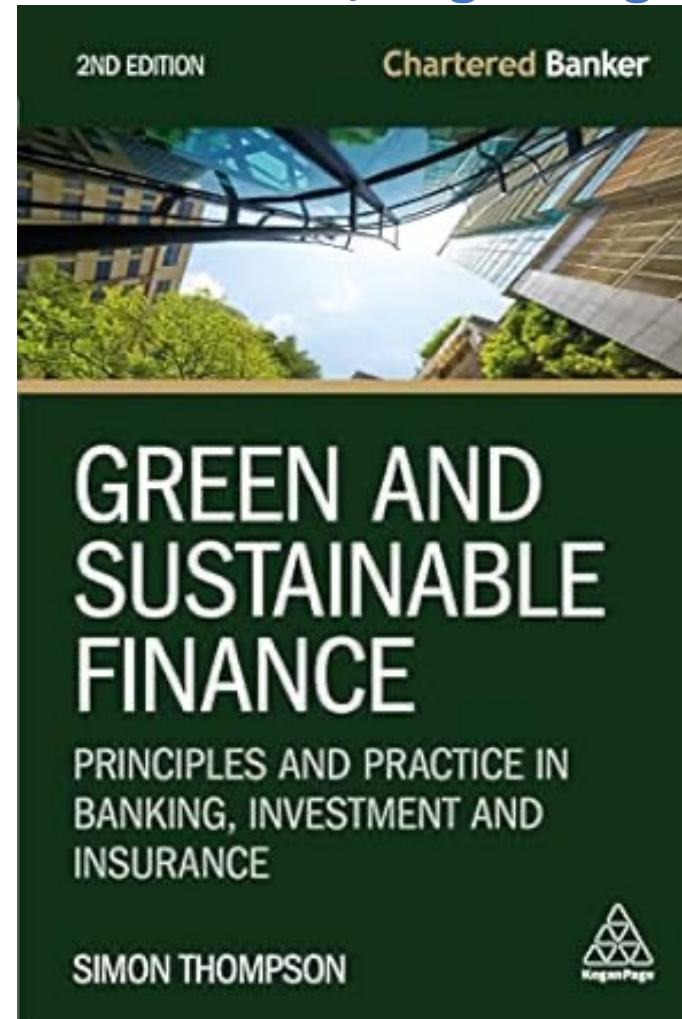
- **Challenge:**
**Most innovative tech solution
to an environmental OR
social problem**



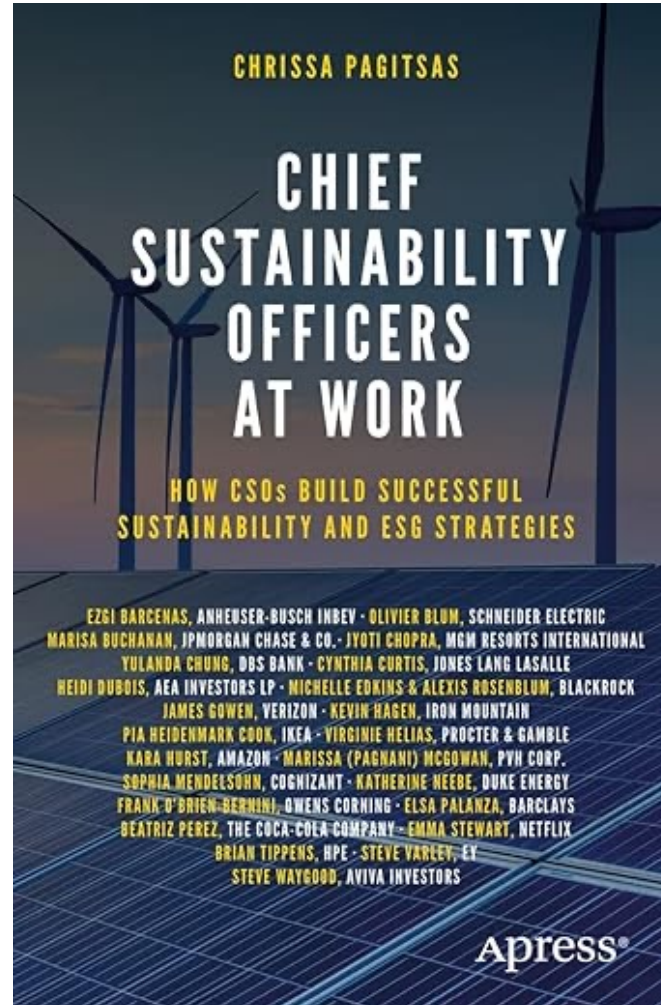
**Cino Robin Castelli, Cyril Shmatov (2022),
Quantitative Methods for ESG Finance,
Wiley**



Simon Thompson (2023),
Green and Sustainable Finance:
Principles and Practice in Banking, Investment and Insurance,
2nd Edition, Kogan Page.



Chrissa Pagitsas (2023),
**Chief Sustainability Officers At Work:
How CSOs Build Successful Sustainability and ESG Strategies,**
Apress.



ESG and Net-Zero: The Essentials

- **Environmental**
 - **Climate impact, resource use, pollution, biodiversity**
- **Social**
 - **Labor practices, human rights, community impact, diversity & inclusion**
- **Governance**
 - **Transparency, ethics, board structure, risk management**
- **Net-Zero**
 - **Balancing emissions produced with emissions removed globally**

Net-Zero Transformation

- **Ambition**

- Aligned to achieving global net zero by no later than 2050 & to limit warming to 1.5° C

- **Governance**

- Accountability driven from the top

- **Strategy**

- Embedded and aligned net zero into company strategy

- **Enterprise**

- Key operating model changes in support of transformation

- **Supply chains**

- Transformed net zero supply chains

- **Innovation**

- Developed innovation and technologies to deliver net zero

- **Finance**

- Financing the net zero transformation

- **Transparency**

- Communicating action

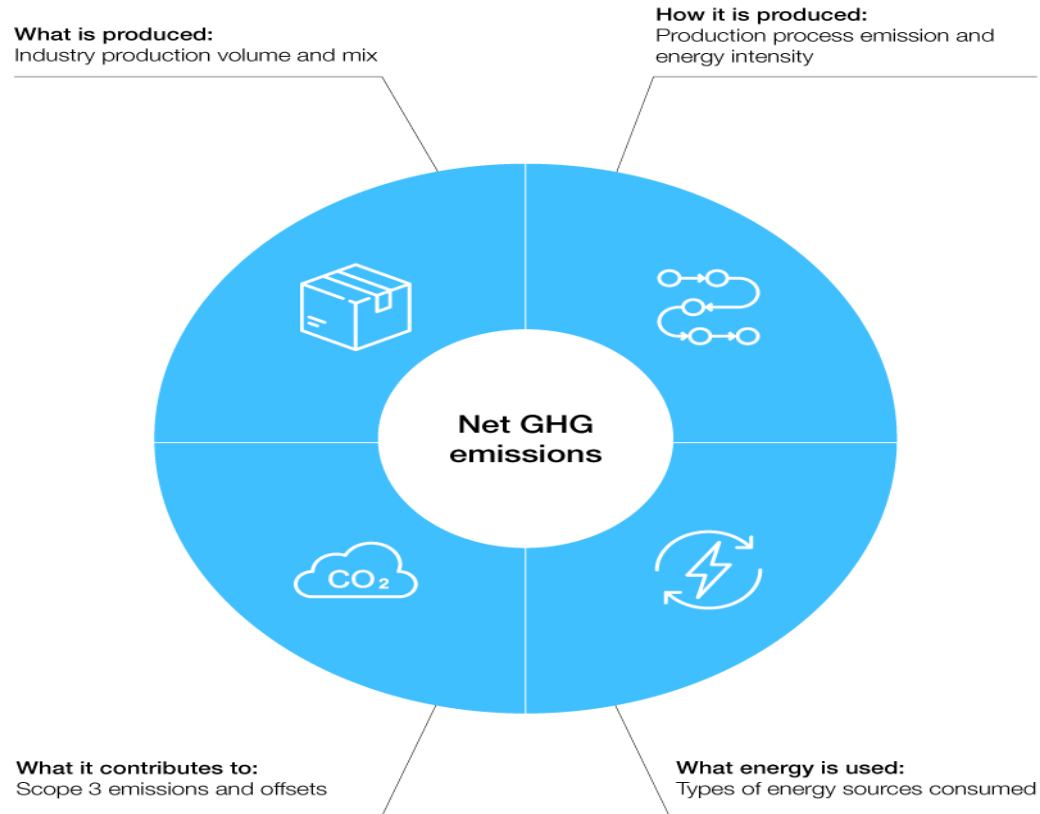
- **Engagement**

- Enhancing the pace and scale of net zero action

Net-Zero Transformation Enablers

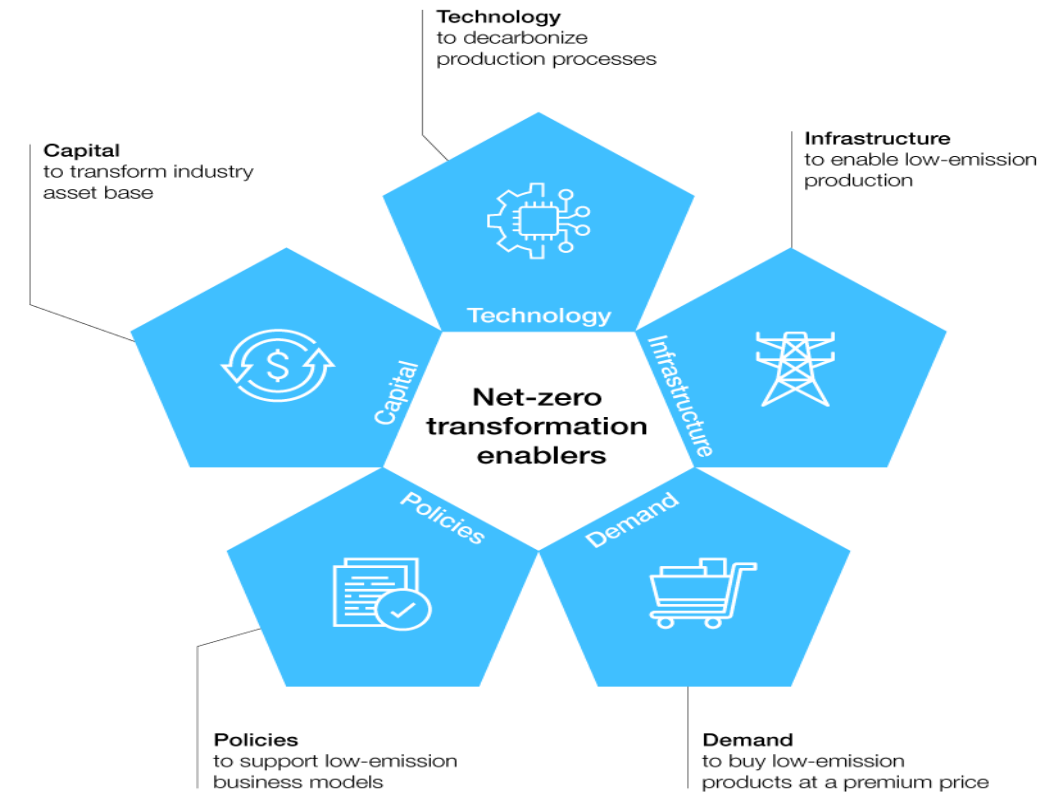
Net-zero industry performance

The four drivers of industry net greenhouse gas (GHG) emissions:

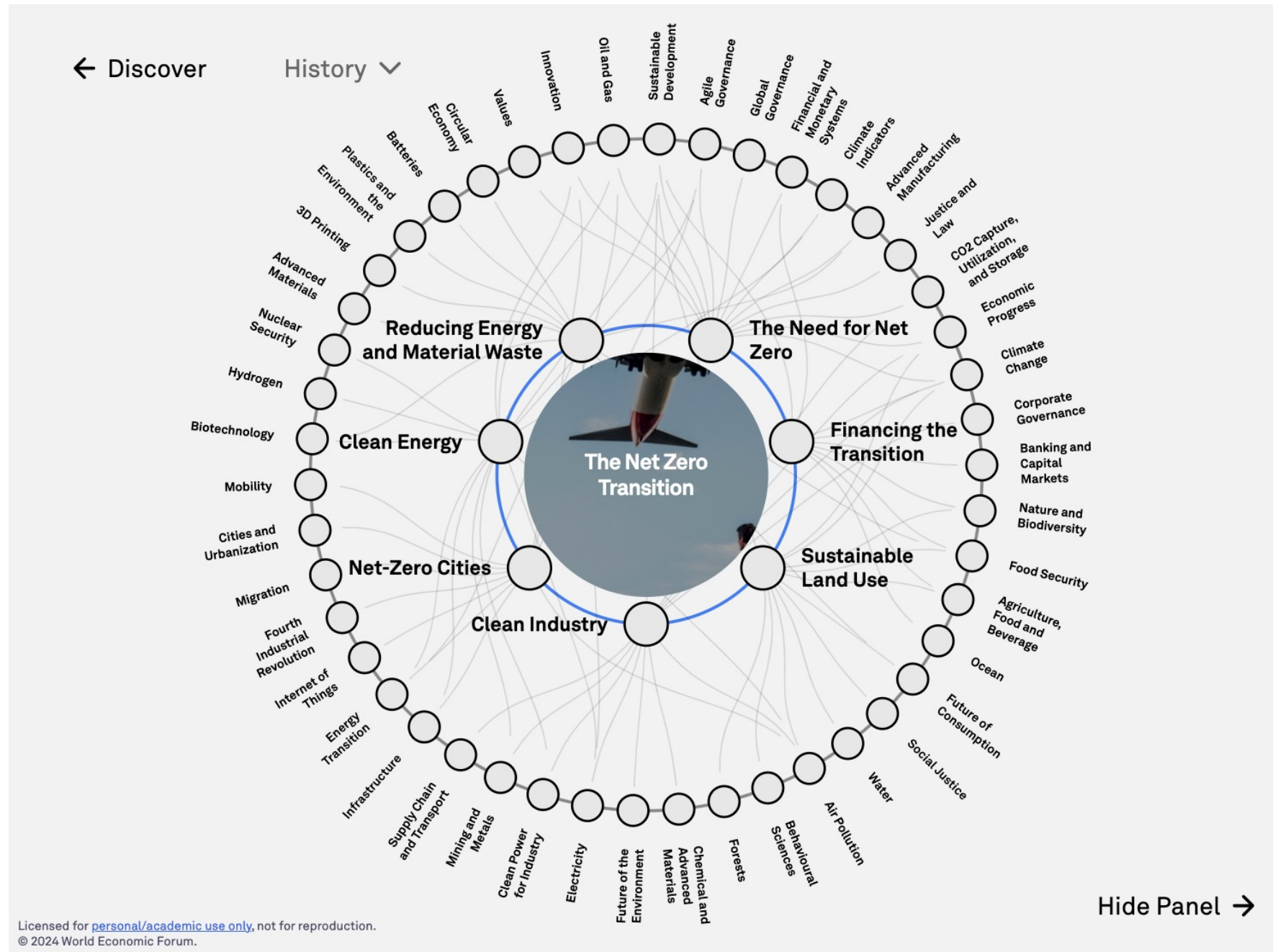


Net-zero industry readiness

The five enabling dimensions of industry net-zero transformation:

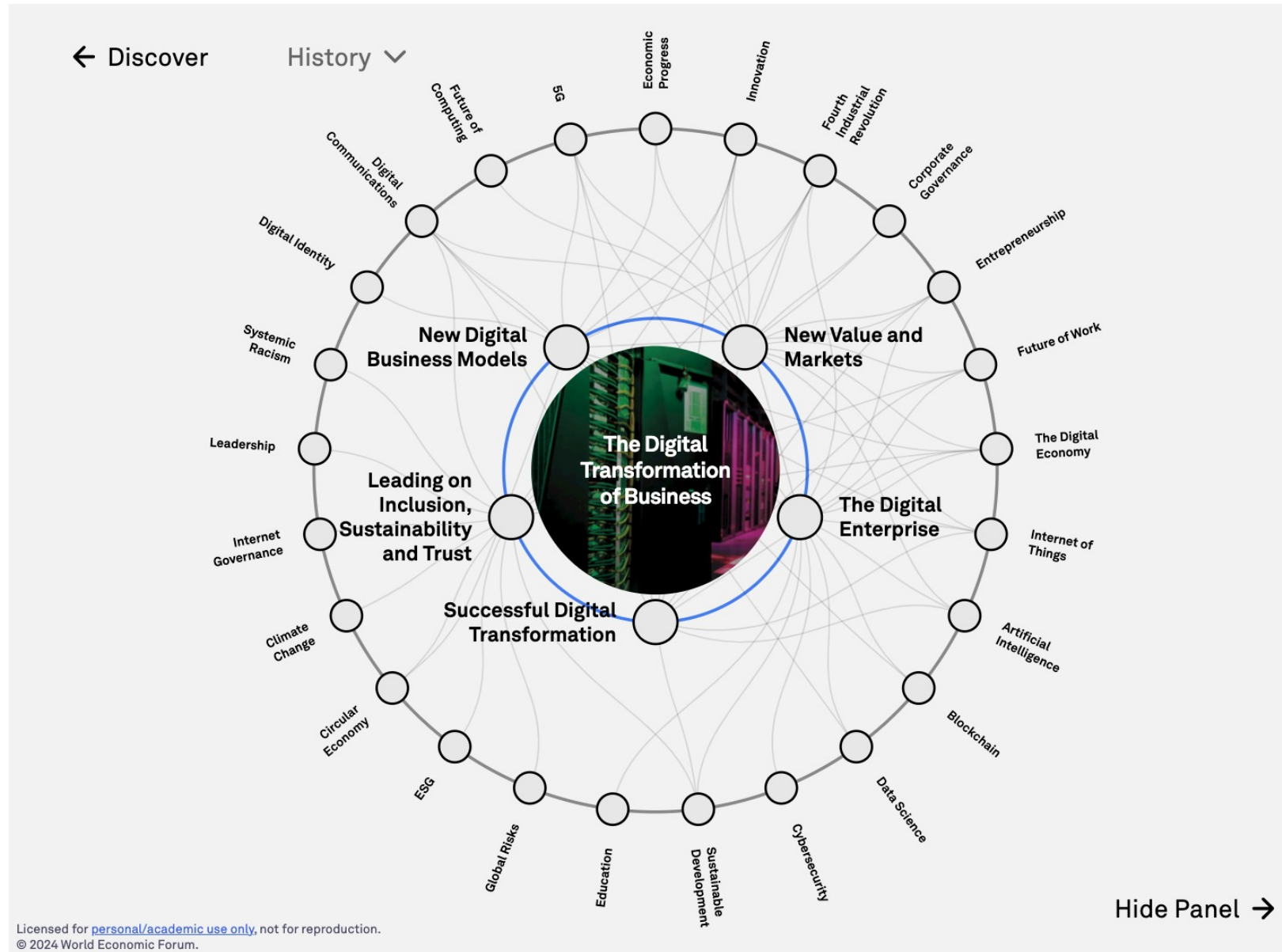


The Net Zero Transition



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The Digital Transformation of Business



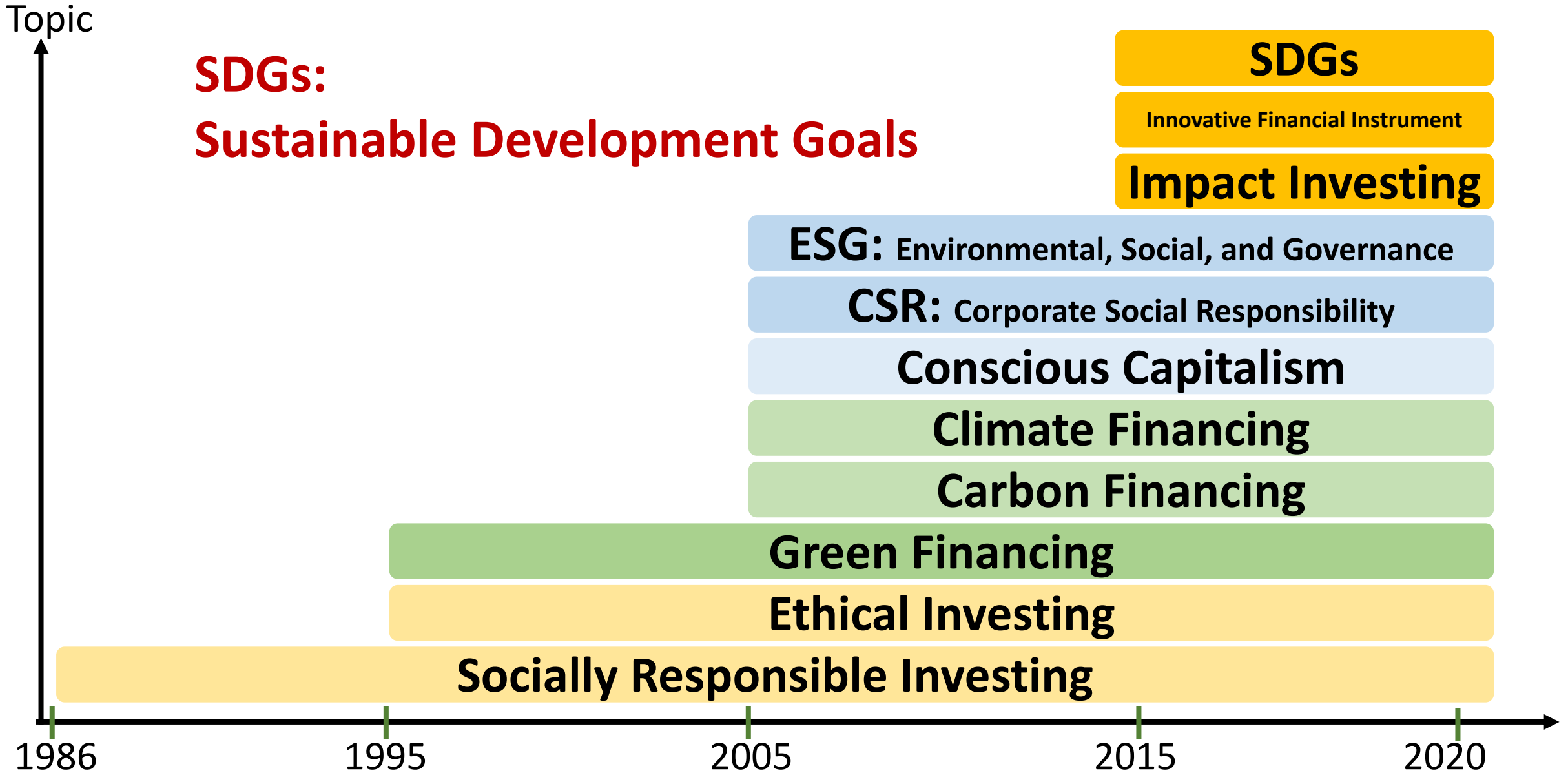
Digital Transformation

Dimensions	Categories
A. BUSINESS MODELS	Business Process Innovation Business Strategy
B. DIGITAL BUSINESS	Digital Culture, Literacy and Skills Digital Economy Innovation and Socio-technical Shared Values
C. TECHNOLOGIES	Technology and Innovation Management Artificial Intelligence Big Data Internet of Things Industry 4.0
D. SUSTAINABILITY	Sustainable Business Sustainable Competitive Advantage Sustainable Development Sustainable Innovation
E. HUMAN RESOURCES	Employee Experience Career Dynamics
F. SMART CITIES	Sustainable Smart Manufacturing Digital Manufacturing

Sustainable Development Goals (SDGs)



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



ESG to 17 SDGs

ENVIRONMENT



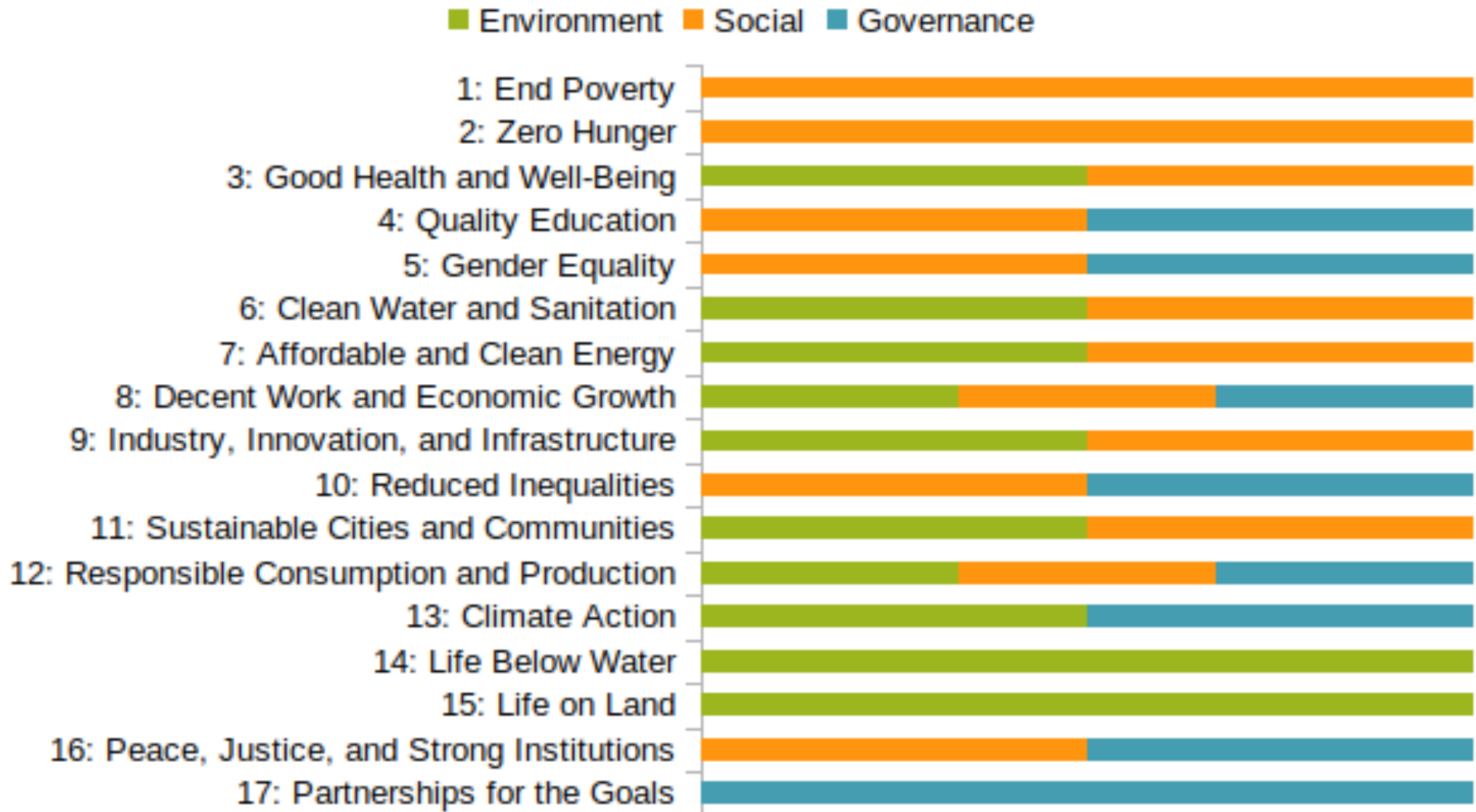
SOCIAL



GOVERNANCE



ESG to 17 SDGs



Where ESG Meets – It's All Connected

- **Environmental Justice**
 - **Underserved communities disproportionately impacted by pollution, climate hazards**
- **Responsible Tech Supply Chains**
 - **Resource extraction, e-waste, labor rights across the tech lifecycle**
- **Inclusive Product Design**
 - **Accessibility, addressing digital divides, social impacts of technology.**

Digital Transformation: Enabler and Challenge

- **Enabler**

- **Data-driven decision-making, efficiency gains, new business models, collaboration**
- **AI optimizing renewable energy**

- **Challenge**

- **Energy consumption, e-waste, planned obsolescence, AI ethics**
- **AI servers representing increased energy use**

Mapping the ESG Standards Landscape

- **The most prevalent ESG reporting frameworks**
 - **GRI (Global Report Initiative)**
 - **CDP (Carbon Disclosure Project)**
 - **SASB (Sustainability Accounting Standards Board)**
 - **ISSB (International Sustainability Standards Board)**
 - **TCFD (Task Force on Climate-related Financial Disclosures)**
- **How companies choose**
 - **Materiality, industry-specific standards, investor alignment**

GRI (Global Report Initiative)



Standards ▾

How to use the GRI Standards ▾

Reporting support ▾

Public policy & partnerships ▾

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Goals and targets database

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The global leader for impact reporting

Welcome to GRI. For over 25 years, we have developed and delivered the global best practice for how organizations communicate and demonstrate accountability for their impacts on the environment, economy and people.

We provide the world's most widely used sustainability reporting standards, which cover topics that range from biodiversity to tax, waste to emissions, diversity and equality to health and safety. As such, GRI reporting is the enabler for transparency and dialogue between companies and their stakeholders.

[Access the GRI Standards →](#)

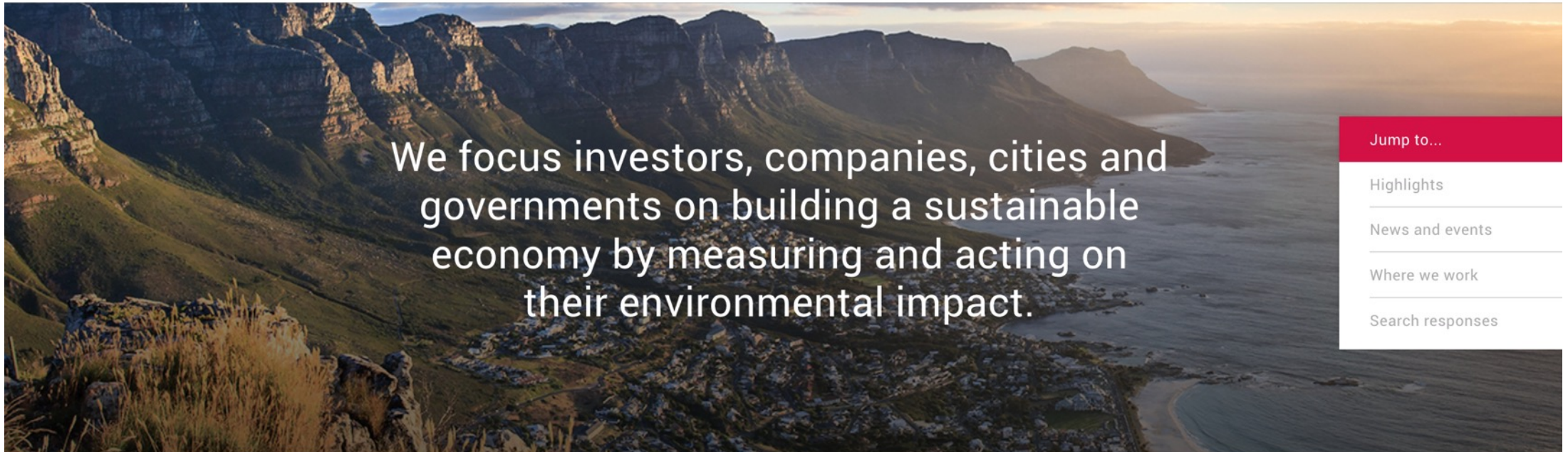
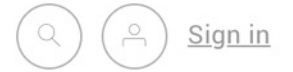
Feedback

CDP (Carbon Disclosure Project)



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We focus investors, companies, cities and governments on building a sustainable economy by measuring and acting on their environmental impact.

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- Search responses

CDP is a not-for-profit charity that runs the global disclosure system for [investors](#), [companies](#), [cities](#), [states and regions](#) to manage their environmental impacts. Over the past 20 years we have created a system that has resulted in unparalleled engagement on environmental issues worldwide. Find out more about [how we work](#).

<https://www.cdp.net/>

SASB (Sustainability Accounting Standards Board)

IFRS Foundation

Other Resources: [The ISSB](#) [Integrated Reporting Framework](#)



[✉ Subscribe](#) [↓ Download Standards](#)

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An aerial photograph of a landscape featuring a winding river, green agricultural fields, and a dense forest of trees with some autumn-colored foliage.

SASB Standards: Your pathway to ISSB

[Learn more](#)

<https://sasb.org/>

ISSB (International Sustainability Standards Board)



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Home > International Sustainability Standards Board

International Sustainability Standards Board

ABOUT

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MEETINGS

RESOURCES

NEWS

About the International Sustainability Standards Board

The Trustees of the IFRS Foundation announced the formation of the International Sustainability Standards Board (ISSB) on 3 November 2021 at COP26 in Glasgow, following strong market demand for its establishment. The ISSB is developing—in the public interest—standards that will result in a high-quality, comprehensive global baseline of sustainability disclosures focused on the needs of investors and the financial markets.

Sustainability factors are becoming a mainstream part of investment decision-making. There are increasing calls for companies to provide high-quality, globally comparable information on sustainability-related risks and opportunities, as indicated by feedback from many consultations with market

Related information

[Sustainability FAQs](#)

[General Sustainability-related Disclosures project](#)

[Climate-related Disclosures project](#)

[Consolidated organisations](#)

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

TCFD

(Task Force on Climate-related Financial Disclosures)



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



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Home > ISSB and TCFD

ISSB and TCFD

The Financial Stability Board has announced that the work of the TCFD has been completed, with the ISSB's Standards marking the '**culmination of the work of the TCFD**'.

Companies applying IFRS S1 *General Requirements for Disclosure of Sustainability-related Financial Information* and IFRS S2 *Climate-related Disclosures* will meet the TCFD recommendations as the recommendations are fully incorporated into the ISSB's Standards.

Companies can continue to use the **TCFD recommendations** should they choose to do so, and some companies may still be required to use the TCFD recommendations. Using the recommendations is a good entry point for companies as they move to use the ISSB's Standards.

The IFRS Foundation has **published a comparison** of the requirements in IFRS S2 and the TCFD recommendations.

Related Information

[IFRS Foundation welcomes culmination of TCFD work and transfer of TCFD monitoring responsibilities to ISSB from 2024](#)

[Comparison: IFRS S2 Climate-related Disclosures with the TCFD Recommendations](#)

[Resource: Making the transition from TCFD to ISSB](#)

[IFRS Sustainability Standards Navigator](#)

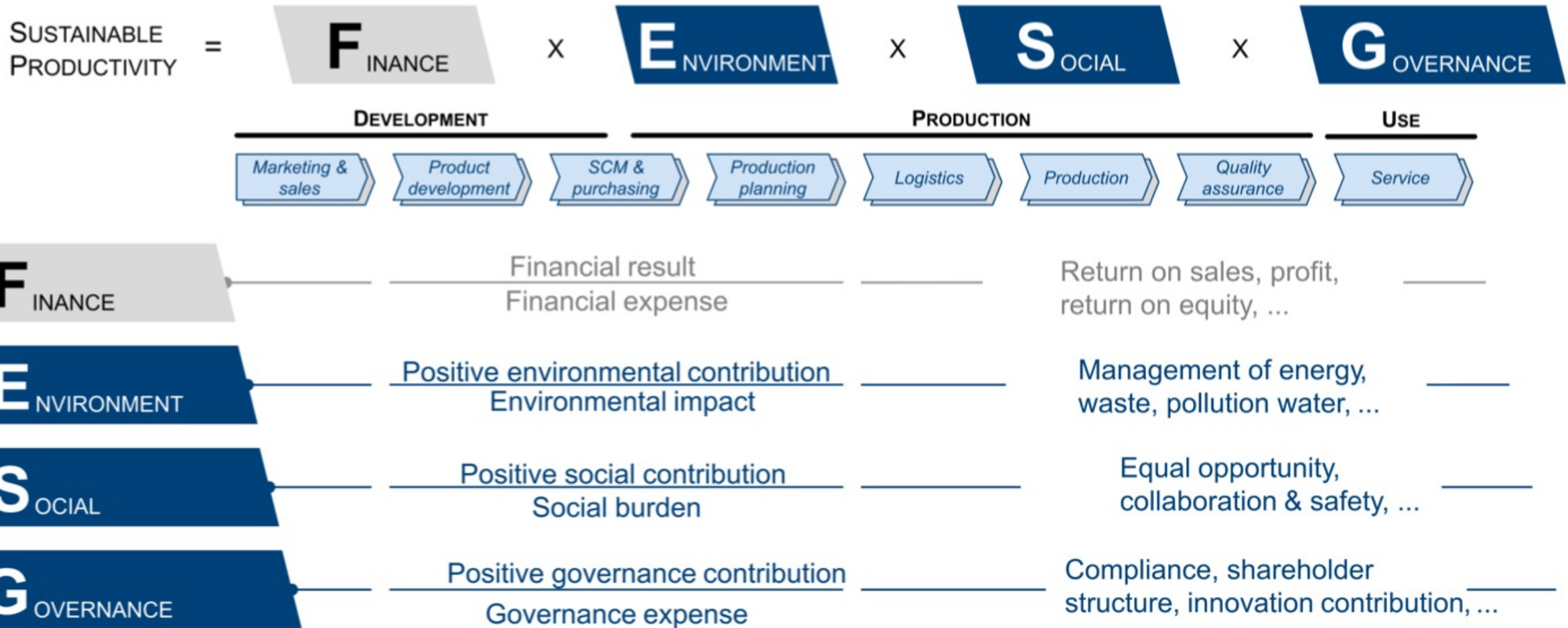
<https://www.fsb-tcfd.org/>

The Human Impact of ESG Choices

- Digital Initiatives
- This isn't abstract, it's about improving lives
- Positive potential when ESG is prioritized

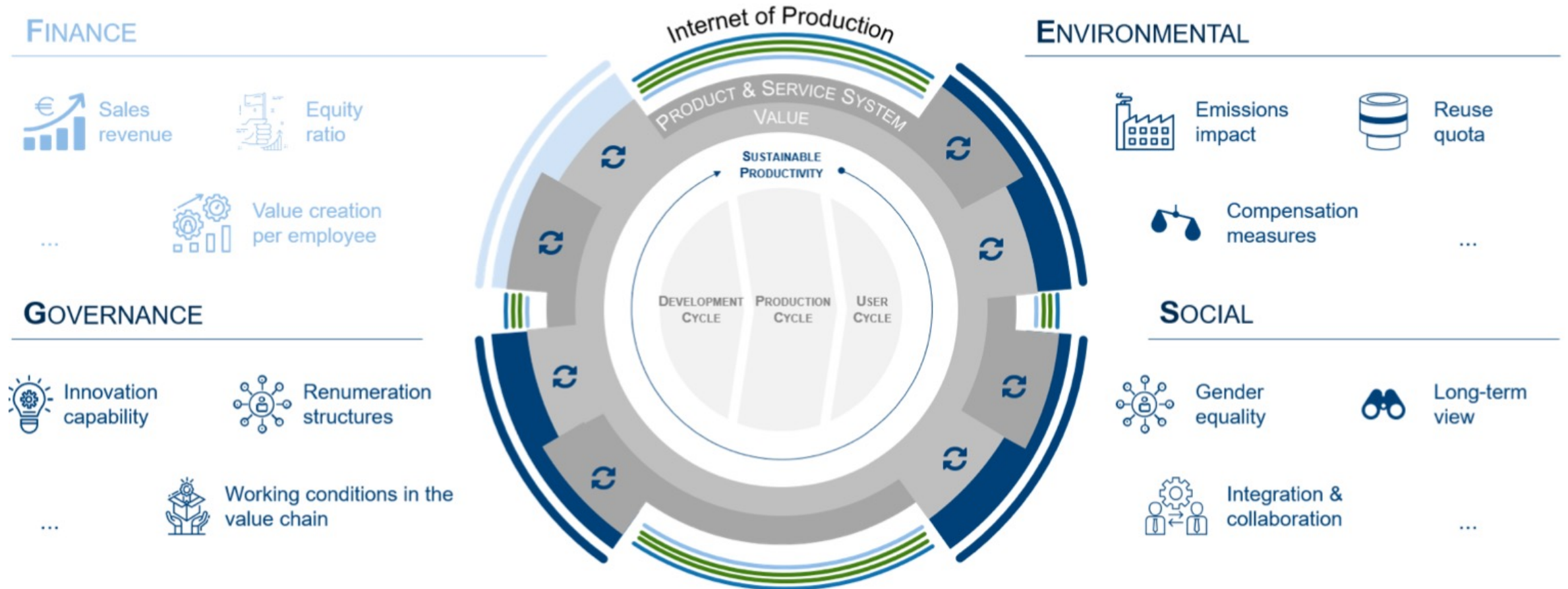


Sustainable Productivity: Finance ESG



Sustainable Resilient Manufacturing

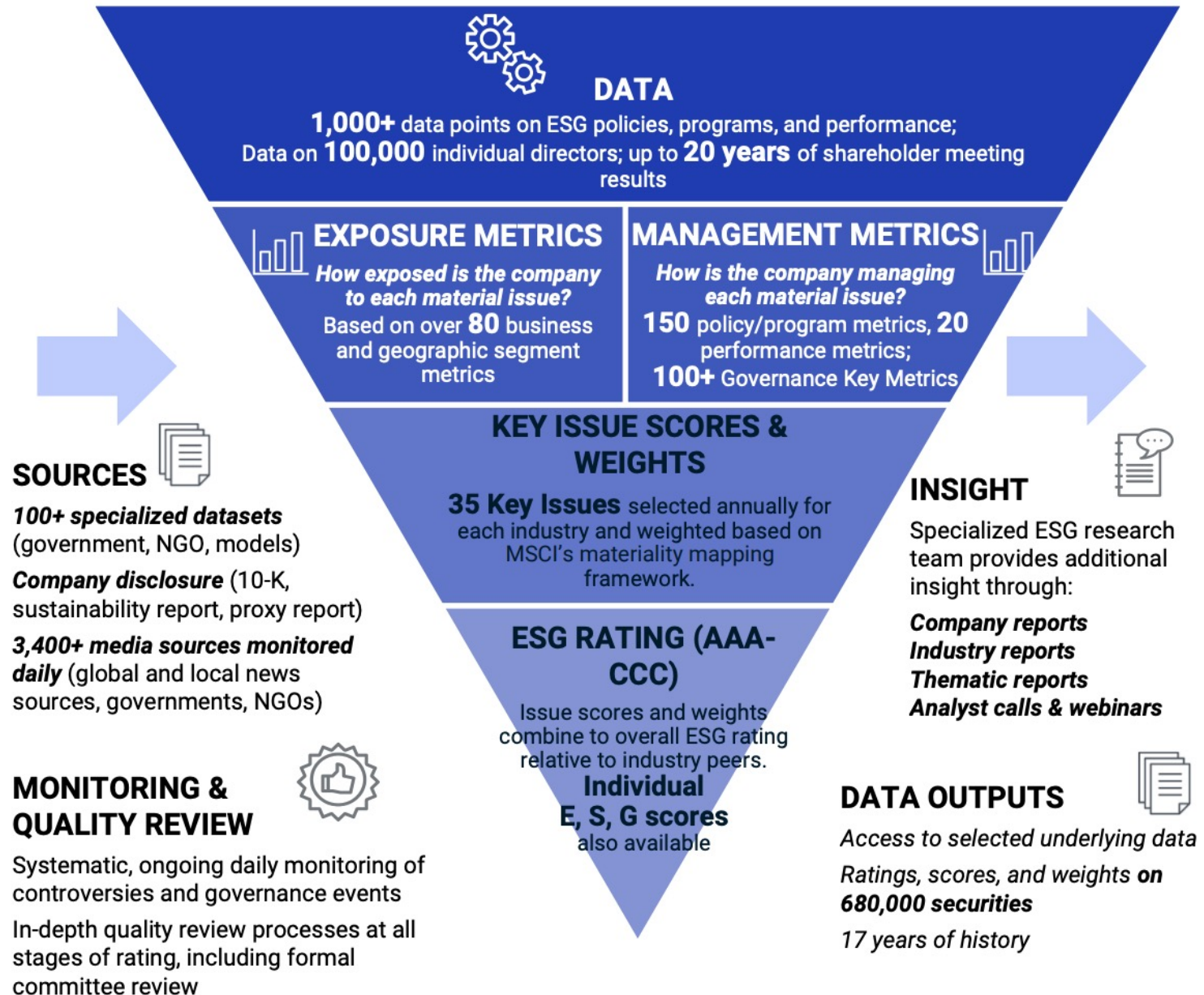
ESG



ESG Indexes

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

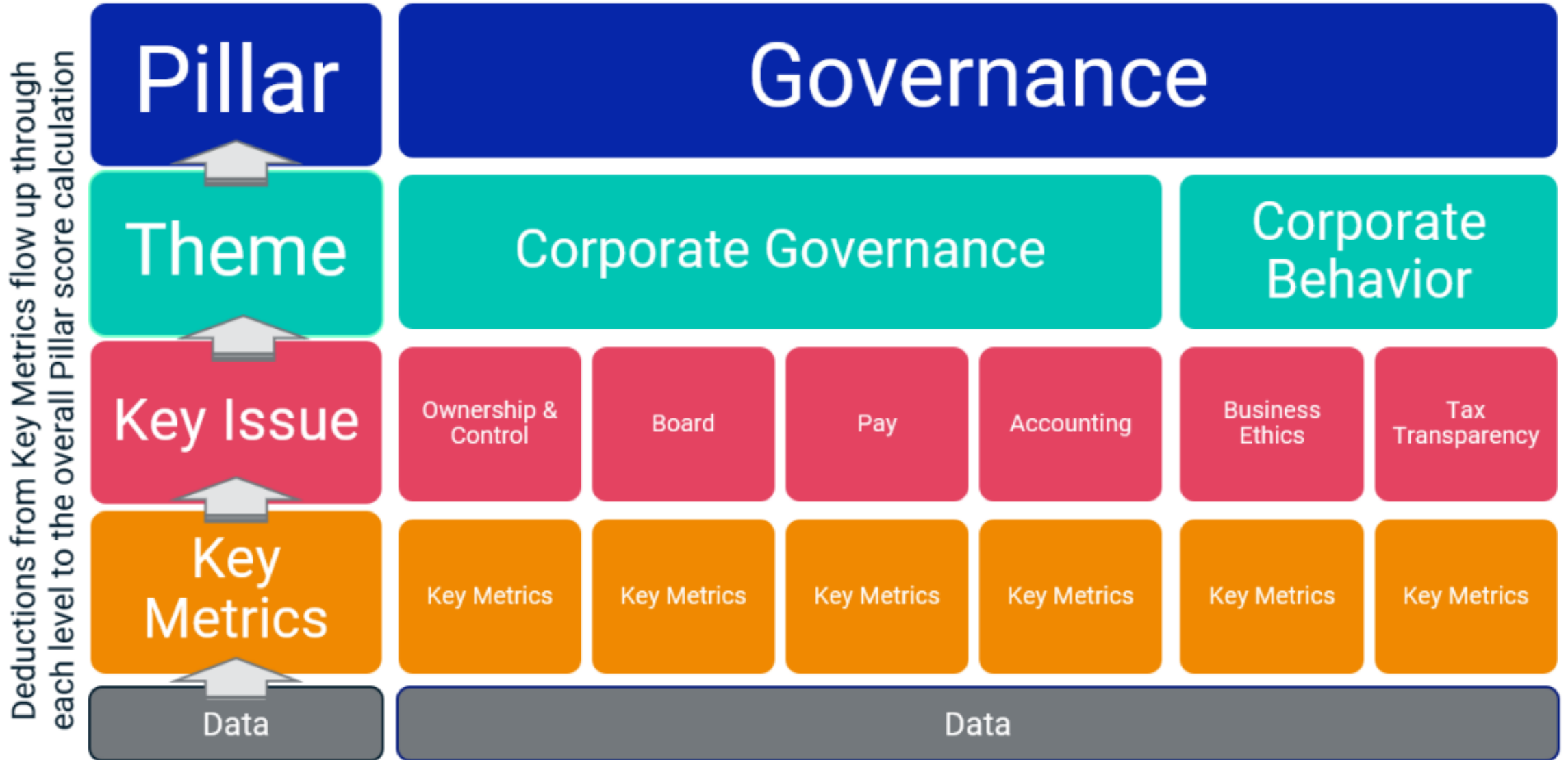
MSCI ESG Rating Framework



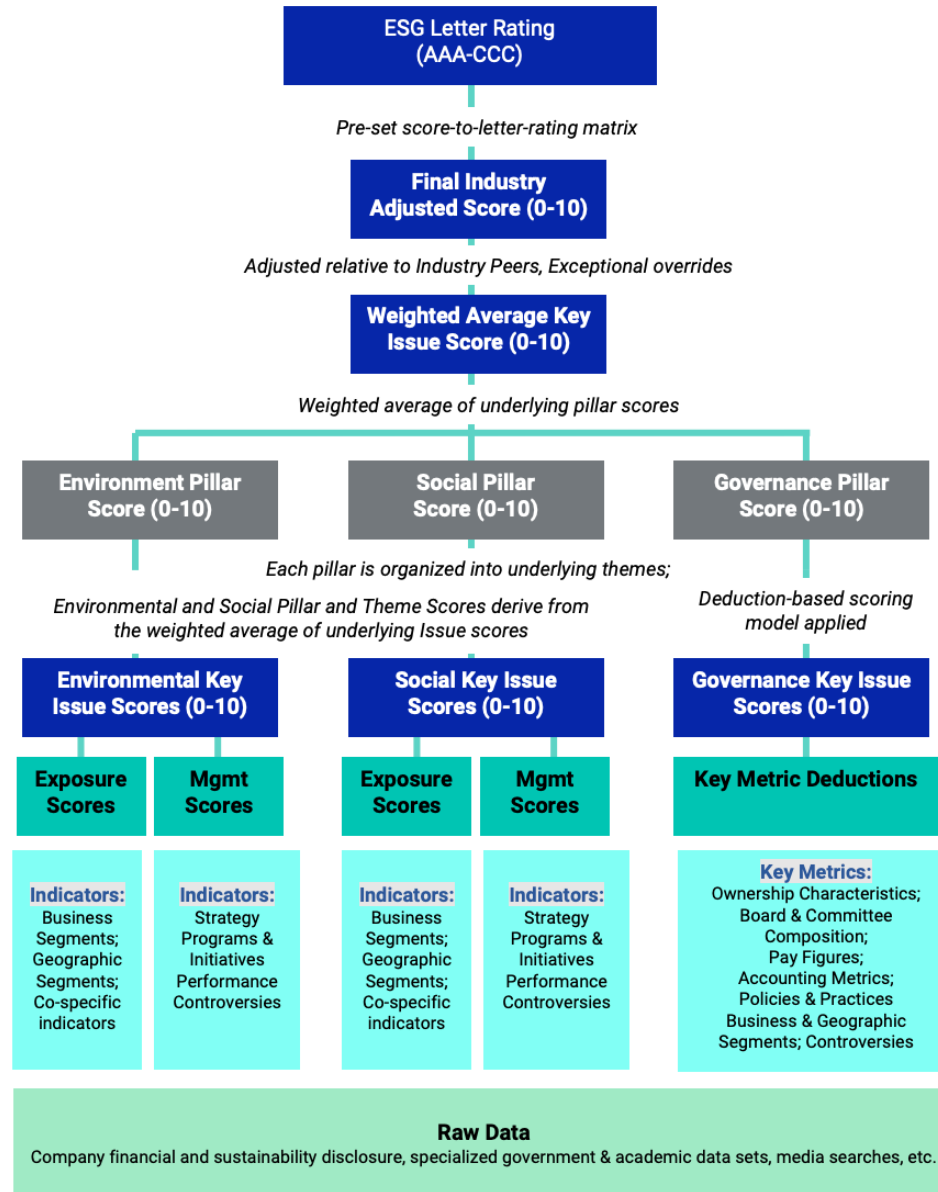
MSCI ESG Key Issue Hierarchy

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

MSCI Governance Model Structure



MSCI Hierarchy of ESG Scores

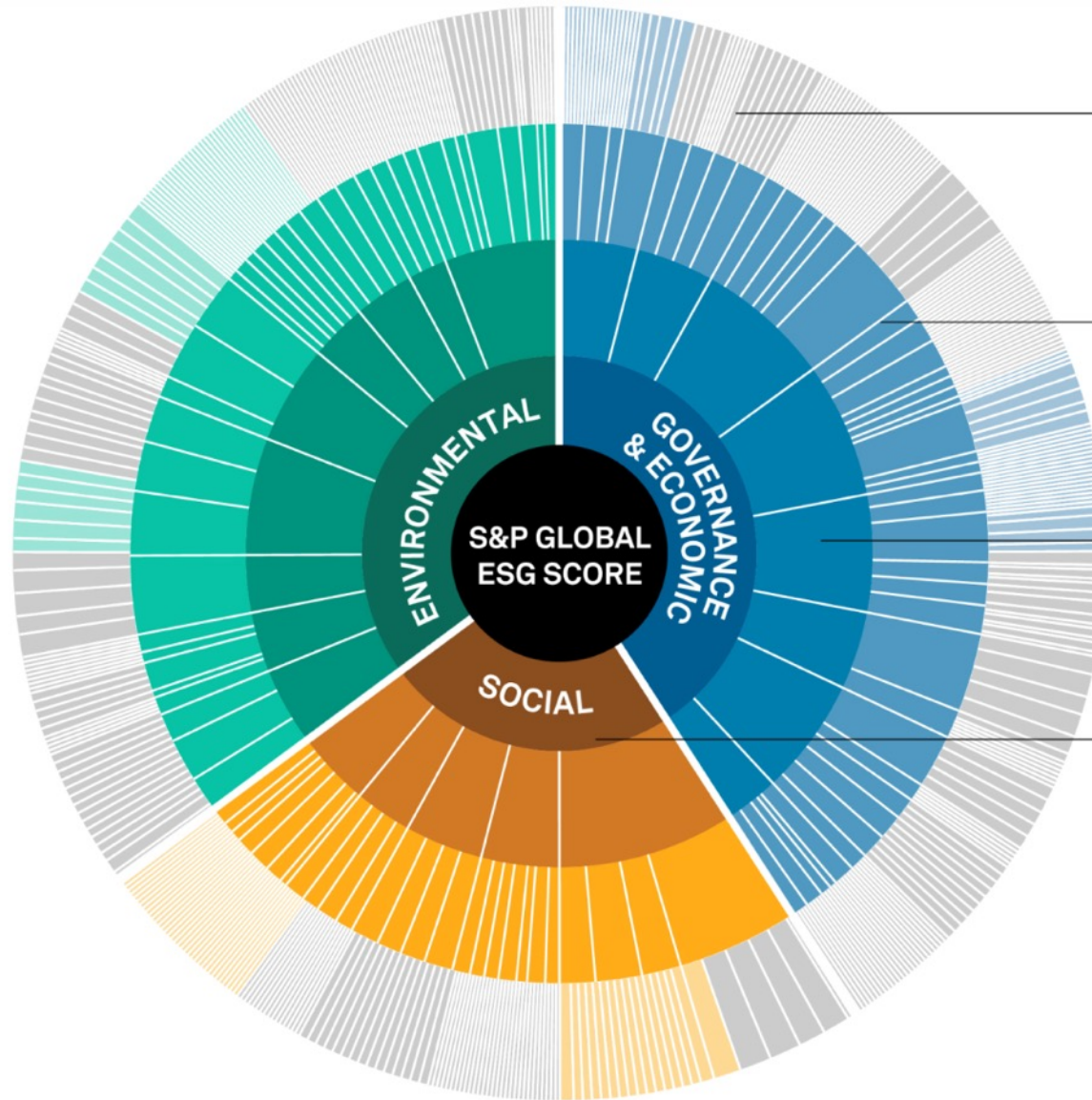


DJSI S&P Global ESG Score

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

FTSE Russell ESG Ratings



Sustainalytics

ESG Risk Ratings

Analyst-based
approach

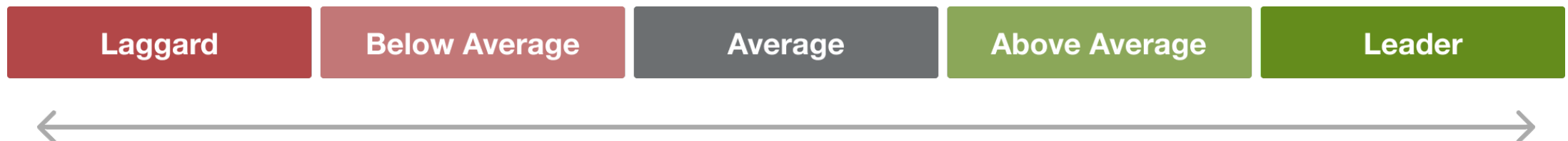
Sustainalytics' ESG Risk Ratings measure a company's exposure to industry-specific material ESG risks and how well a company is managing those risks.

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

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.



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

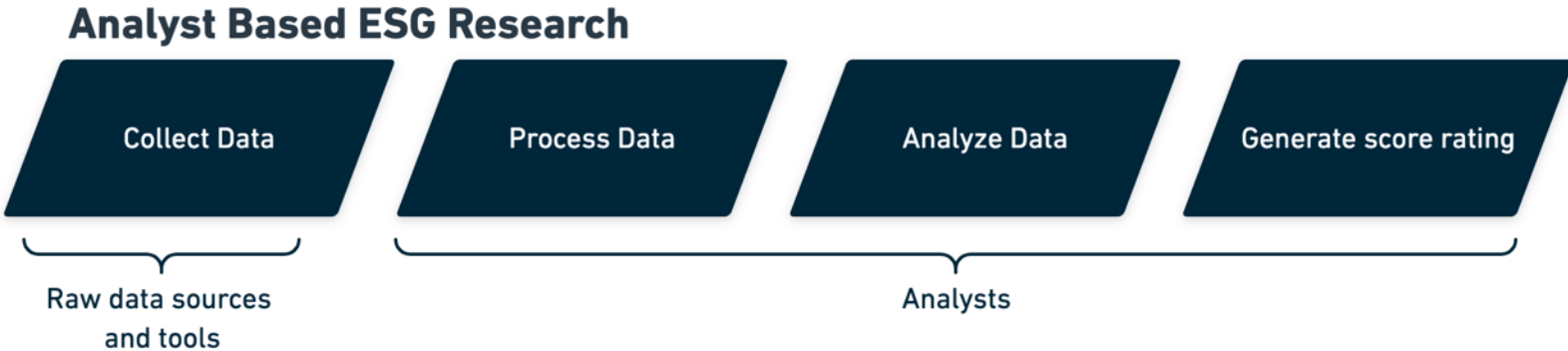
Derives signals from unstructured data

Truvalue Labs

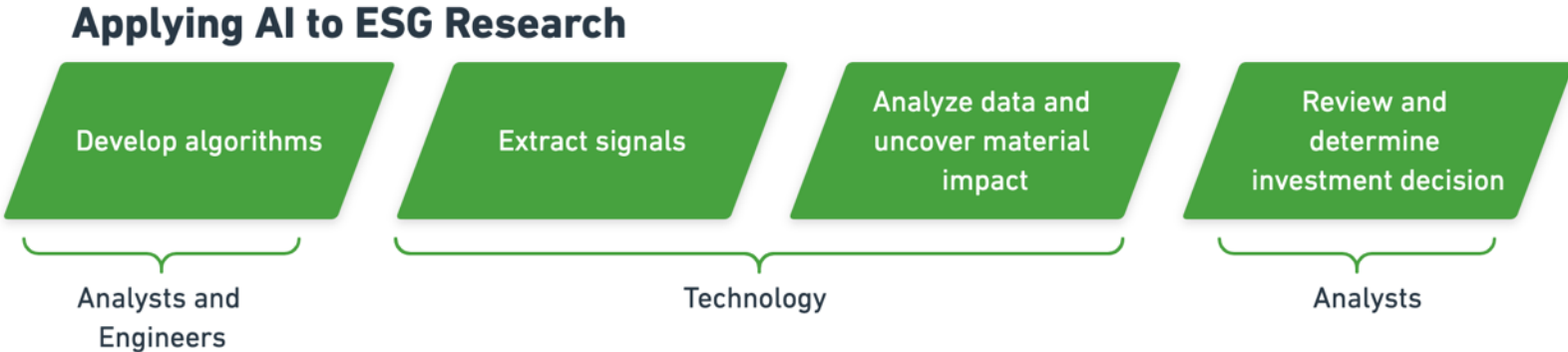


Analyst expertise at the beginning of the process produces consistent results

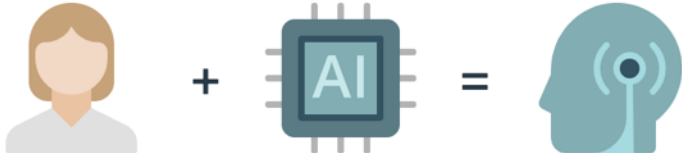
Analyst based ESG Research



AI based ESG Research

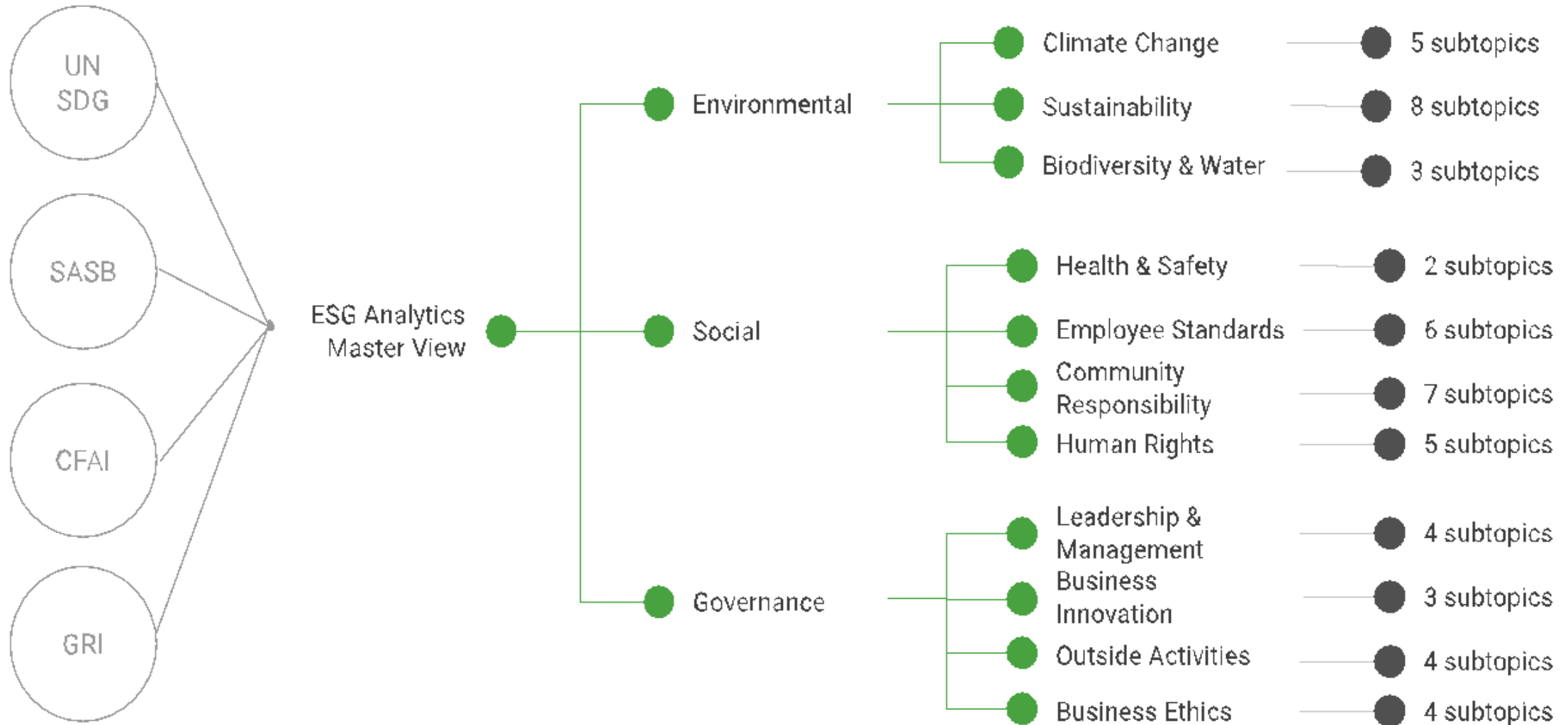


It would take an analyst over 5 years to do what our AI can in 1 week
Combining analysts with AI creates gives you the full picture



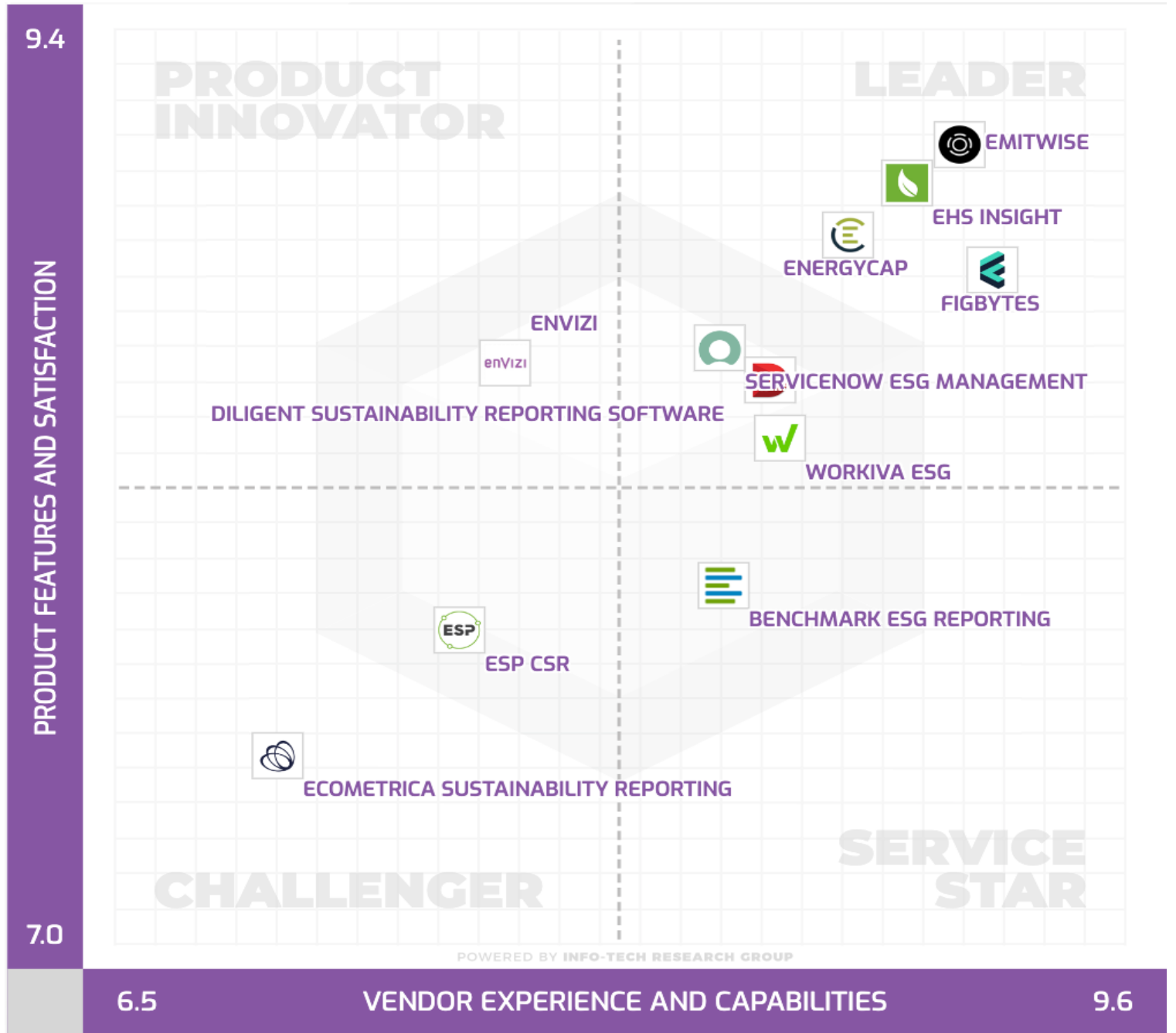
ESG ANALYTICS
Invest where it matters.

ESG Analytics: NLP Taxonomy



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.



Generative AI and LLMs for Sustainability and ESG Data Analytics



Google Gemini

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

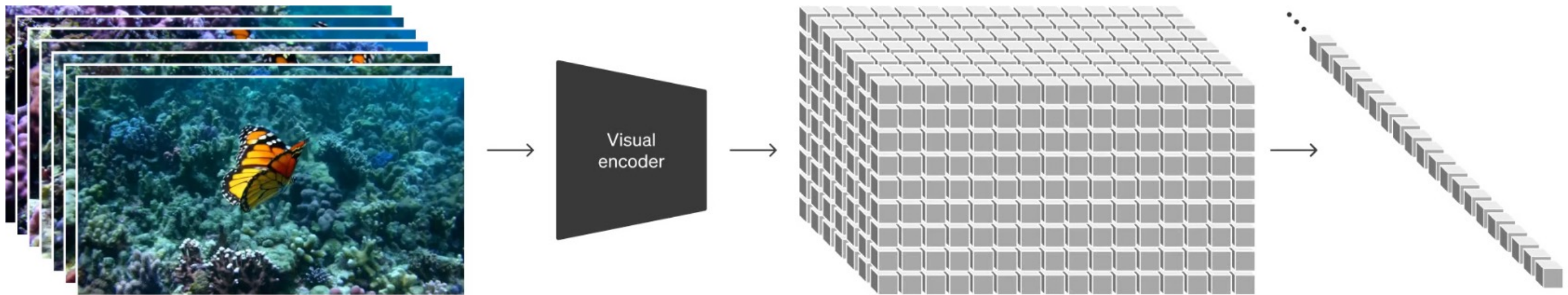


OpenAI Sora

Text-to-Video



Video generation models as world simulators



Turning visual data into patches
LLMs have text tokens, Sora has visual patches

Summary

- **Environmental, Social, and Governance (ESG)**
- **Net-Zero Digital Transformation**
 - **Net-Zero Transformation**
 - **Digital Transformation**

References

- Cino Robin Castelli, Cyril Shmatov (2022), Quantitative Methods for ESG Finance, Wiley
- Simon Thompson (2023), Green and Sustainable Finance: Principles and Practice in Banking, Investment and Insurance, 2nd Edition, Kogan Page.
- Chrissa Pagitsas (2023), Chief Sustainability Officers At Work: How CSOs Build Successful Sustainability and ESG Strategies, Apress.
- GRI (Global Report Initiative):
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<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.fsb-tcfd.org/>
- Min-Yuh Day (2024), Python 101, <https://tinyurl.com/aintpupython101>