

AI技術在永續議題下的應用

(AI Technology Applications in Sustainability)

Time: 2025/9/22 (一) 13:30-16:30

Place: 21館200-2, 新竹縣竹東鎮中興路4段195號21館

Host: 薛雅寧, 工業技術研究院 產業學院 策略及跨域訓練部



戴敏育 教授 (Prof. Min-Yuh Day)

國立臺北大學 資訊管理研究所 所長

金融科技暨綠色金融研究中心 主任

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

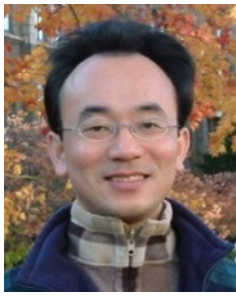




國立臺北大學
National Taipei University



2020 Cohort



戴敏育 教授

Prof. Min-Yuh Day



Director, Information Management, NTPU

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

Director, Fintech and Green Finance Center (FGFC), NTPU

Division Director, Sustainable Development, Sustainability Office, NTPU

Visiting Scholar, IIS, Academia Sinica

Ph.D., Information Management, NTU

Artificial Intelligence, Agentic AI, ESG and Green Financial Technology,
Big Data Analytics, Electronic Commerce



Outline

1. 永續AI導入介紹 (Introduction to Sustainable AI)
2. AI在智慧能源管理的應用
(AI in Smart Energy Management)
3. AI在氣候變遷與環境監測的應用
(AI in Climate Change and Environmental Monitoring)
4. AI在循環經濟的應用案例
(AI in the Circular Economy)
5. AI永續技術專案小組討論與應用構想設計
(Sustainable AI Project Team Discussion and Application Design)
6. 綜合討論 (Open Discussion)

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)
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	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	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	1.ESG 揭露

台灣永續評鑑

國立臺北大學商學院企業永續發展研究團隊

透過 AI SEED 提升評鑑效率

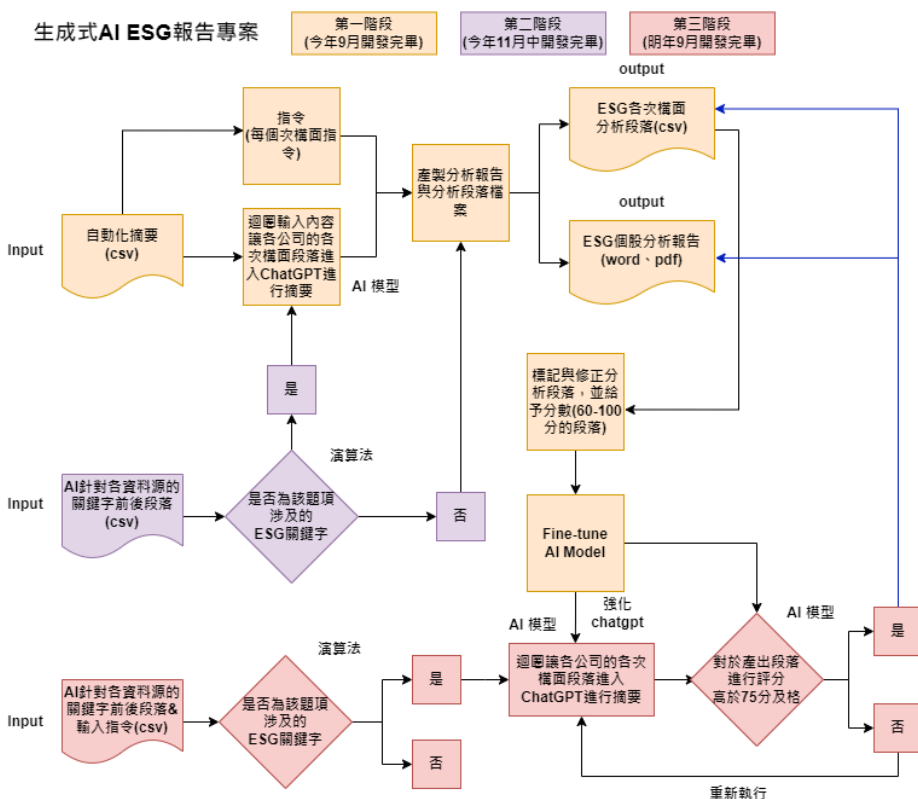


國立臺北大學
National Taipei University



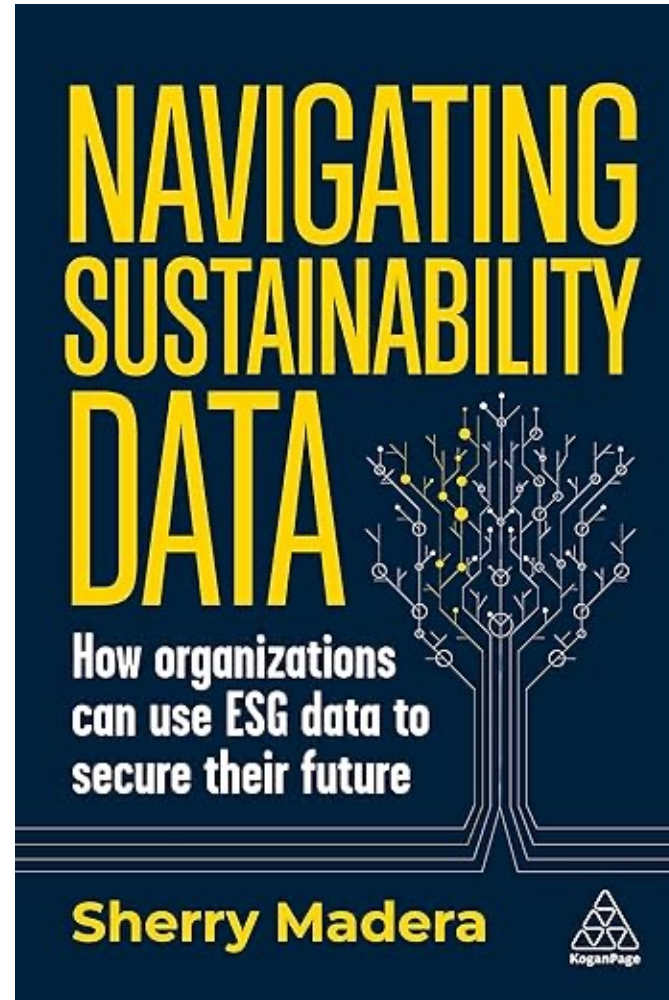
國立臺北大學商學院
企業永續發展研究中心
Center for Corporate Sustainability

為使評鑑效率提升，與國立臺北大學資管所及資工所合作，開發相關程式，已有25%題項自動或半自動化，大幅提升評鑑效率，並持續開發機械學習，持續透過AI 輔助評鑑進行。另也透過AI SEED團隊持續將部分流程自動化，提升評鑑正確性，減少人力出錯可能。

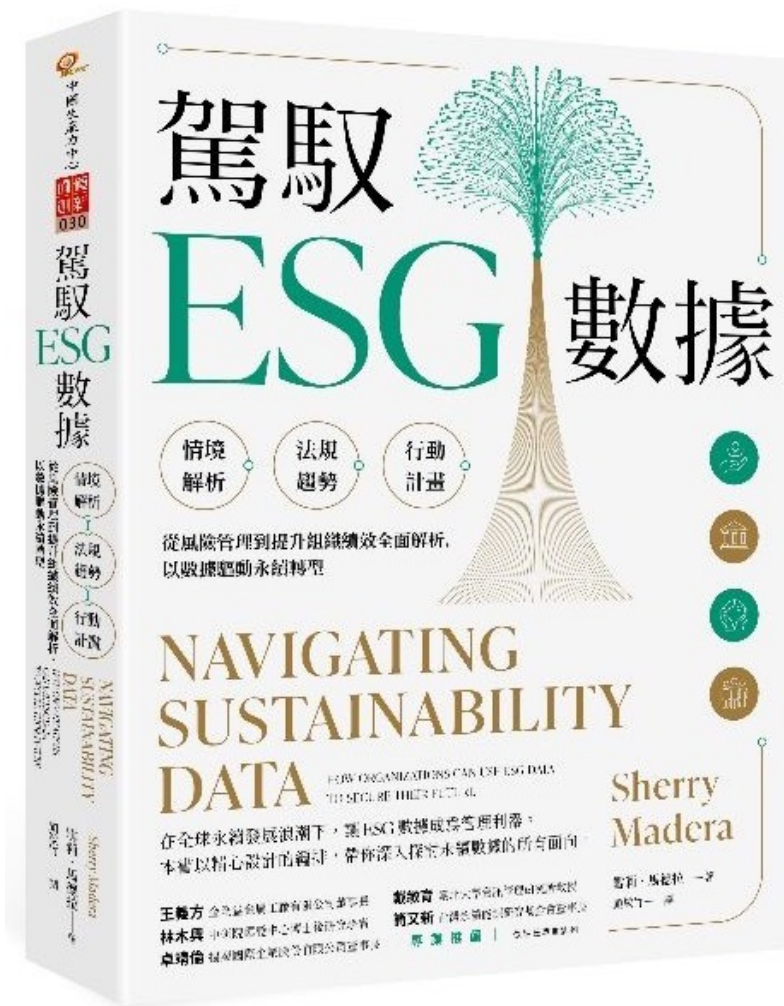
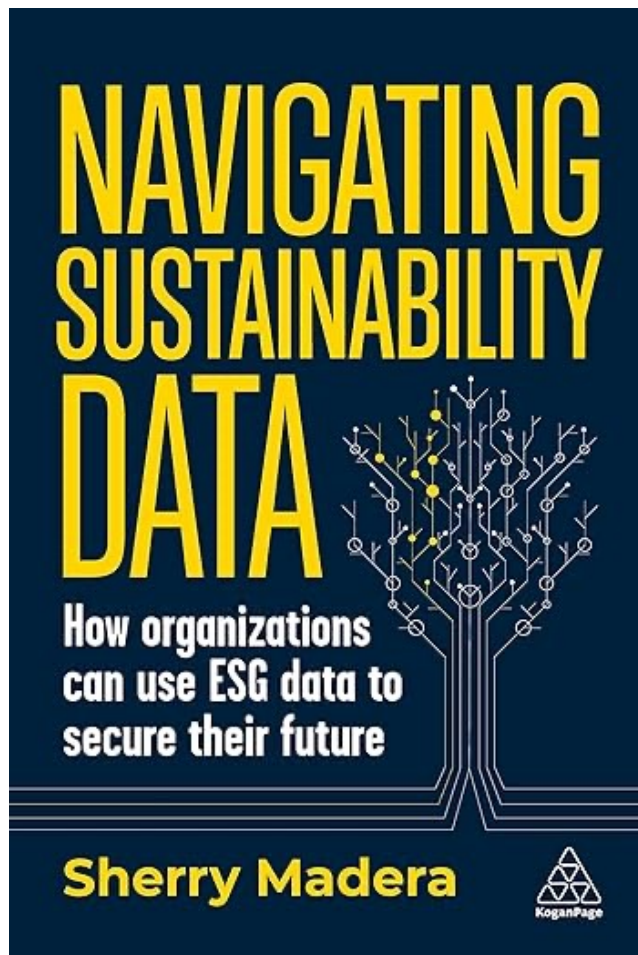


題號	題目關鍵字	完成度
2-1-15	僅分派董監酬勞未分派股利	100%
2-2-3	獨董達董事席次1/2以上	100%
2-2-4	至少兩名獨董任期不超過9年	100%
2-2-14	設提名委員會且半數以上為獨董	100%
2-2-30	董事長兼任總經理	100%
2-2-31	1/3以上董事任期超過15年	100%
2-3-8	破產 / 面臨下市	100%
2-3-15	資安長或資訊安全委員會	100%
2-4-7	無保留意見	100%

Sherry Madera (2024),
Navigating Sustainability Data: How Organizations can use ESG
Data to Secure Their Future, Kogan Page



雪莉·馬德拉 (Sherry Madera) (顏敏竹 譯) (2024),
駕馭ESG數據 (Navigating Sustainability Data),
財團法人中國生產力中心



專業推薦：

王義方

(金全益金屬工廠有限公司董事長)

林木興

(中研院環變中心博士後研究學者)

卓靖倫

(揚秦國際企業股份有限公司董事長)

戴敏育

(國立臺北大學資訊管理研究所教授)

簡又新

(台灣永續能源研究基金會董事長)

Innovative Agentic AI Technology for Autonomous ESG Report Generation

Industrial Technology Research Institute (ITRI),
Fintech and Green Finance Center (FGFC, NTPU),
NTPU-114A513E01, 2025/03/01~2025/12/31

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

AI Technology Applications in Sustainability

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Generative AI

Powering

Digital Sustainability

Transformation

Agentic AI for ESG Applications

Generative AI, Agentic AI, Physical AI

Physical AI

Self-driving cars
General robotics

Agentic AI

Coding assistants
Customer service
Patient care

Generative AI

Digital marketing
Content creation

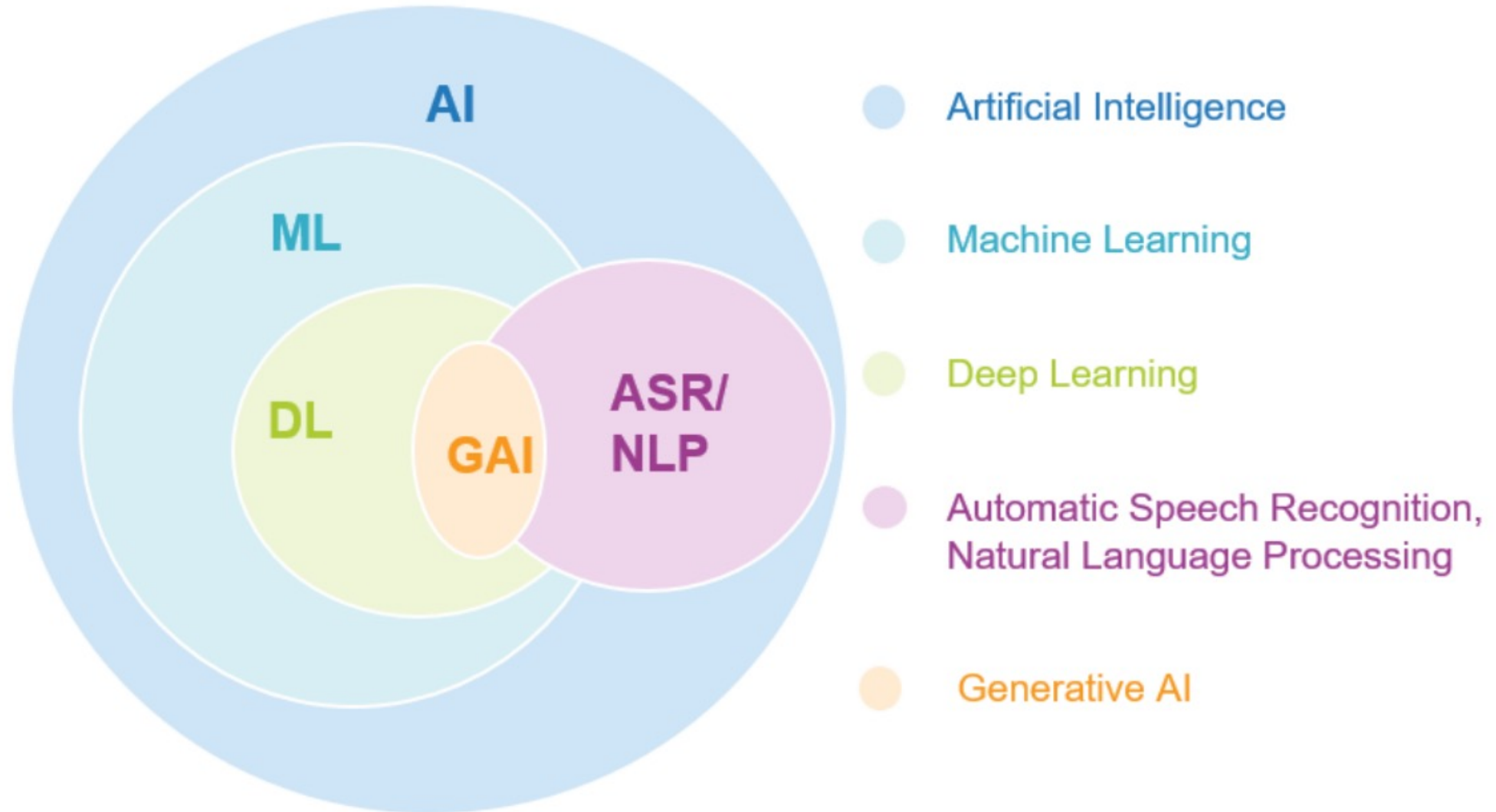
Perception AI

Speech recognition
Deep recommender systems
Medical imaging

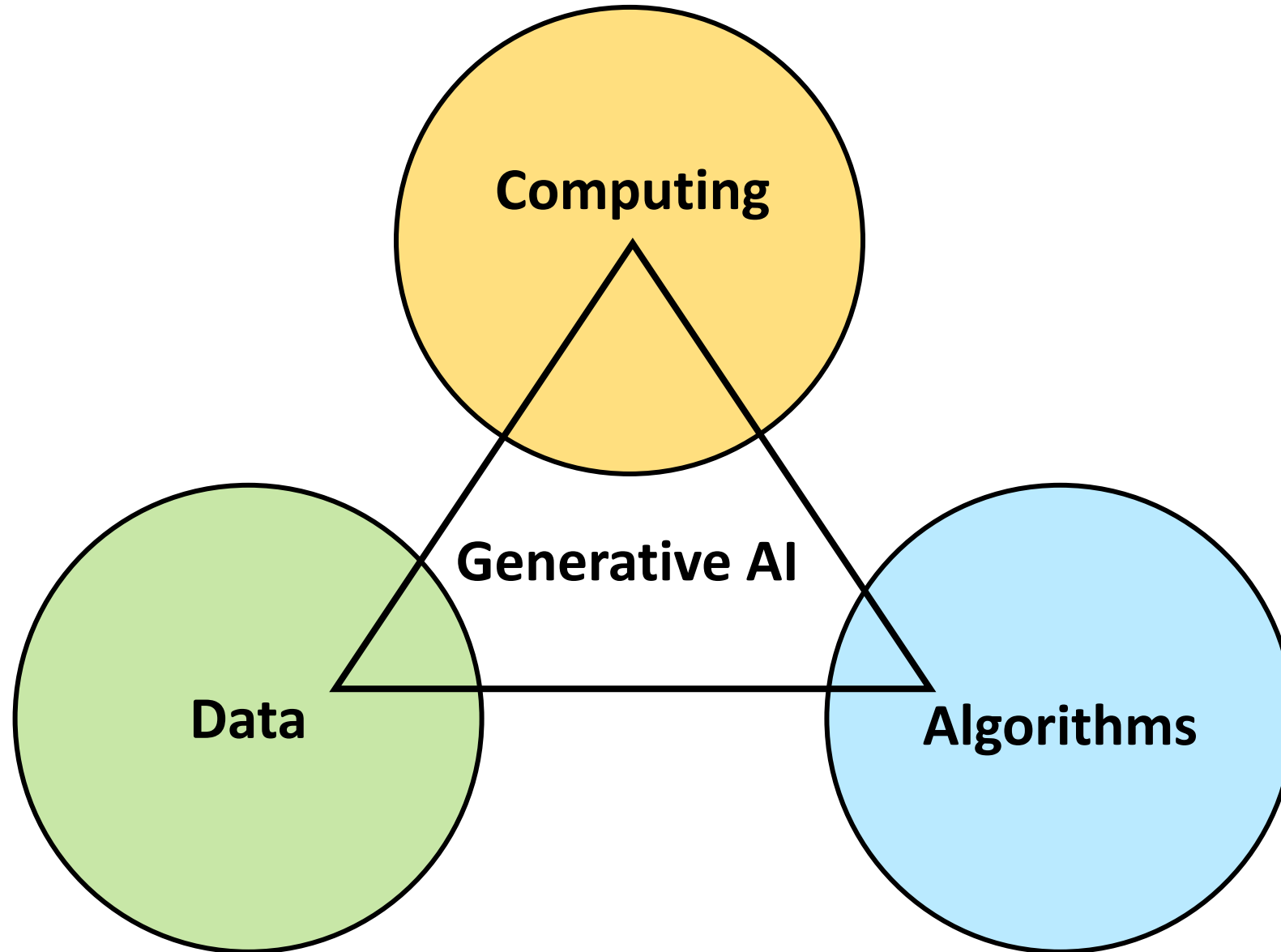
2012 AlexNet

Deep learning breakthrough

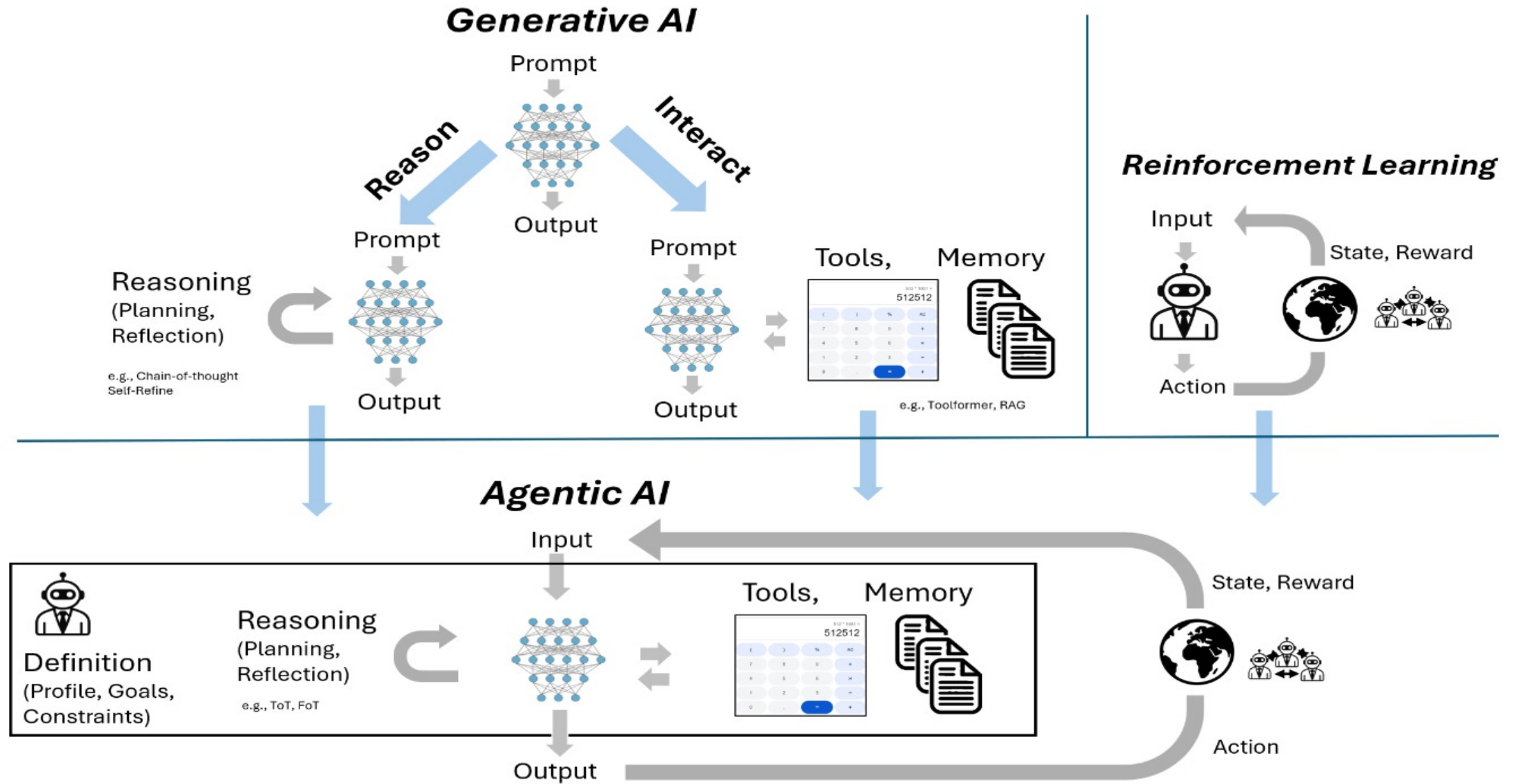
AI, ML, DL, Generative AI



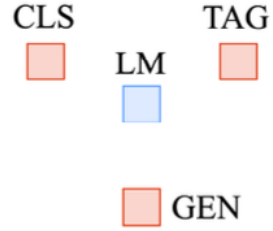
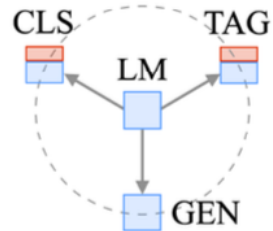
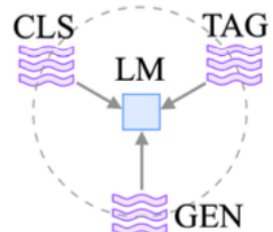
Generative AI



From Generative AI to Agentic AI



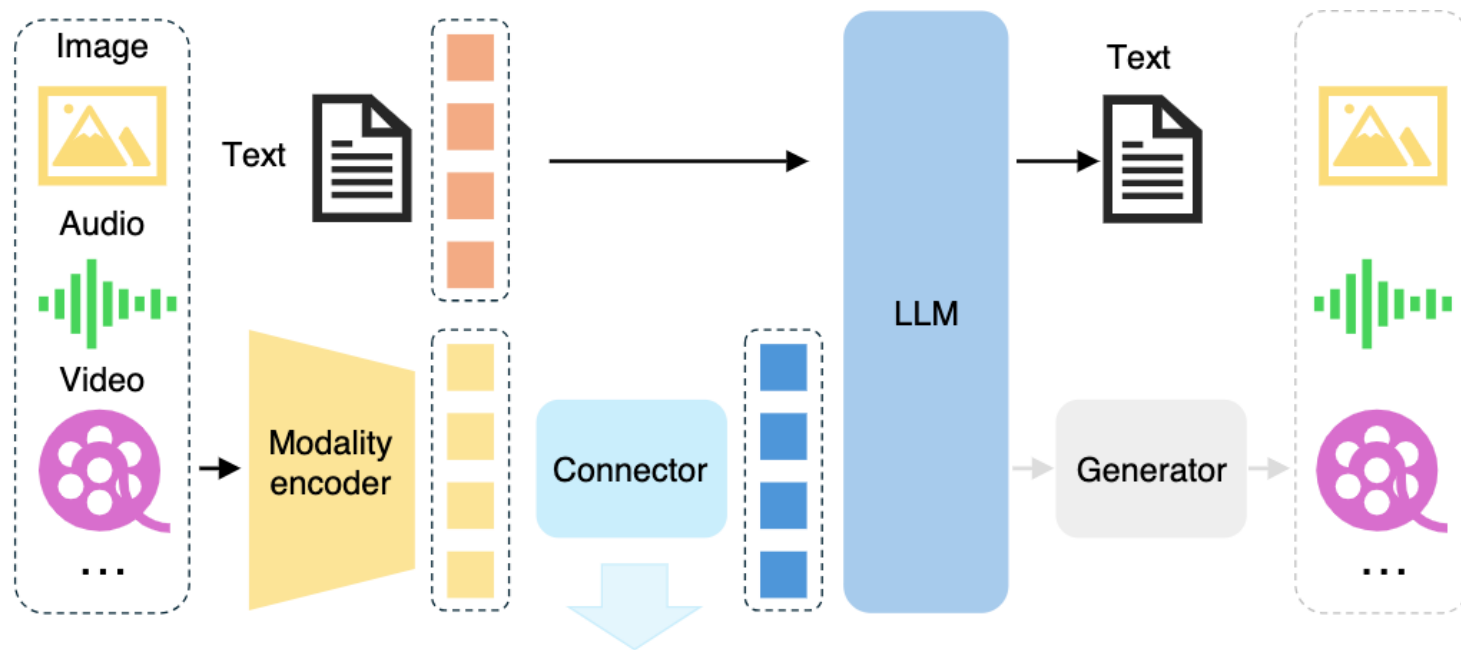
Four Paradigms in NLP (LM)

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)	

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

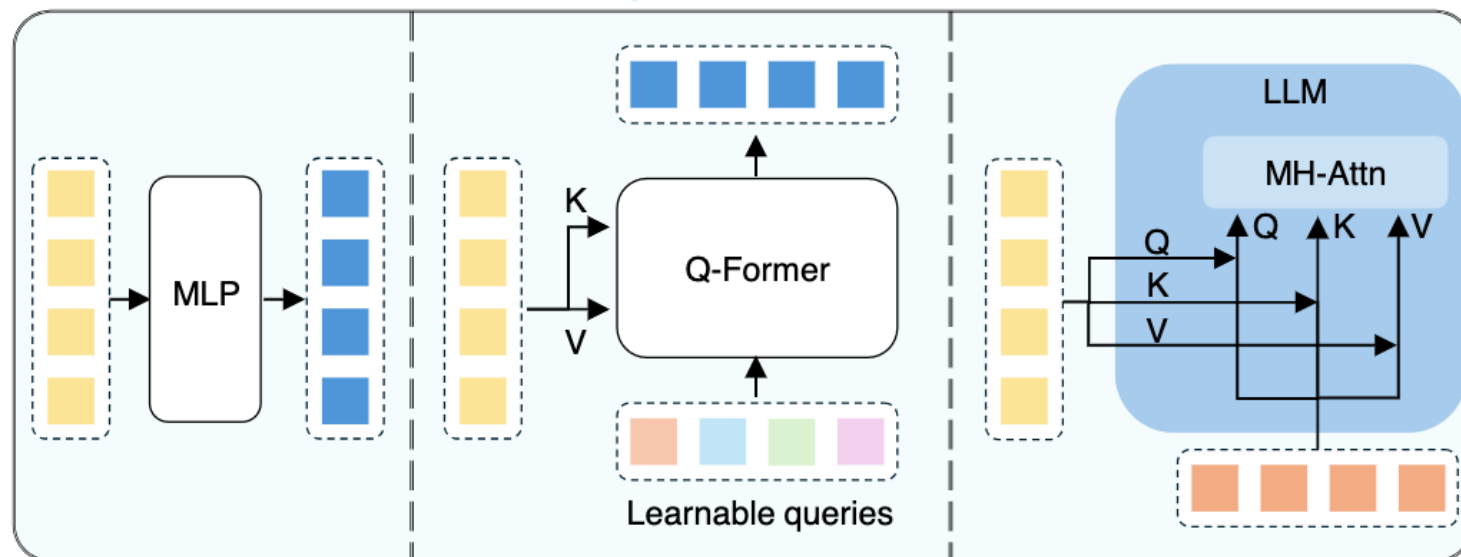
Multimodal Large Language Models (MLLM)



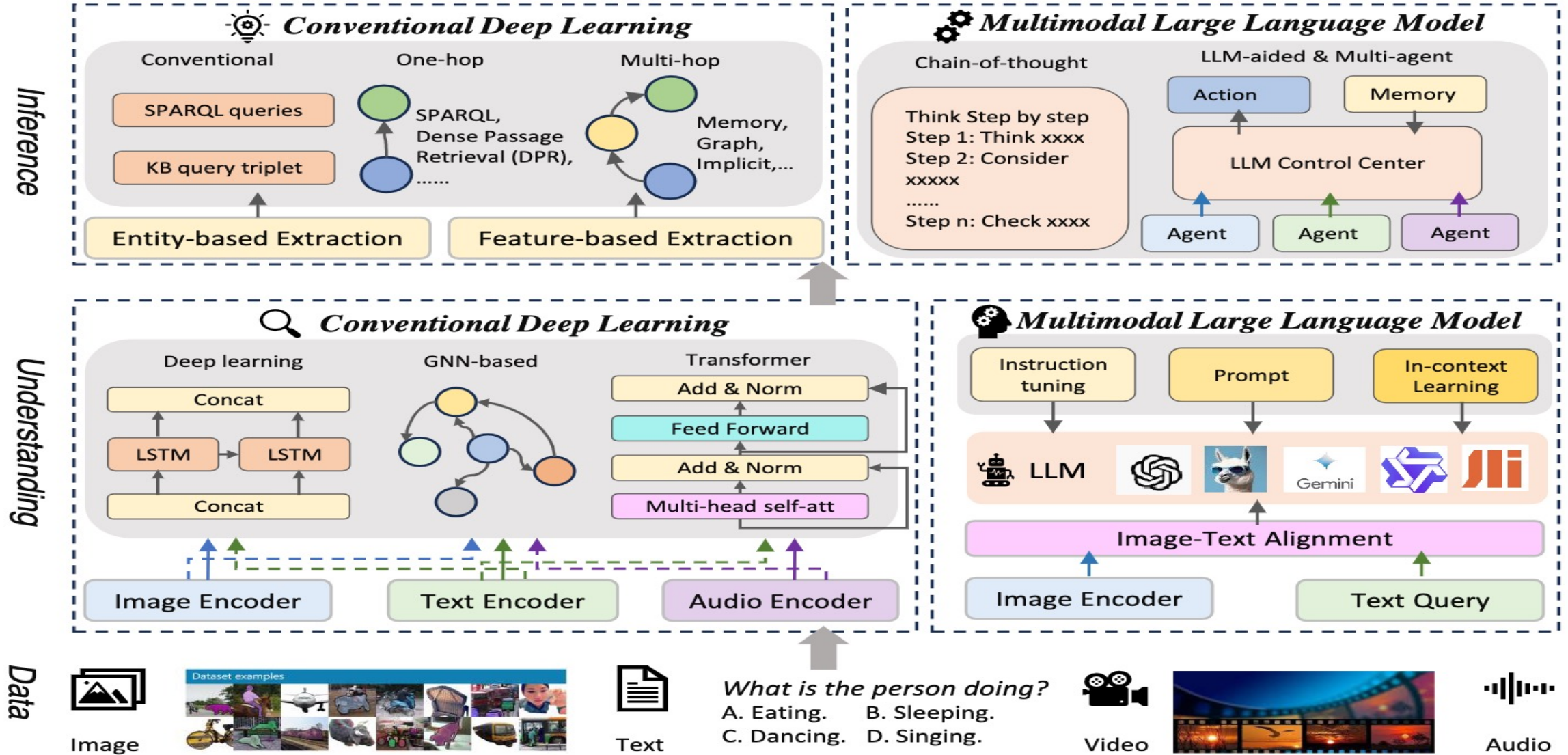
Multimodal LLM

Three types of connectors:

1. projection-based
2. query-based
3. fusion-based connectors

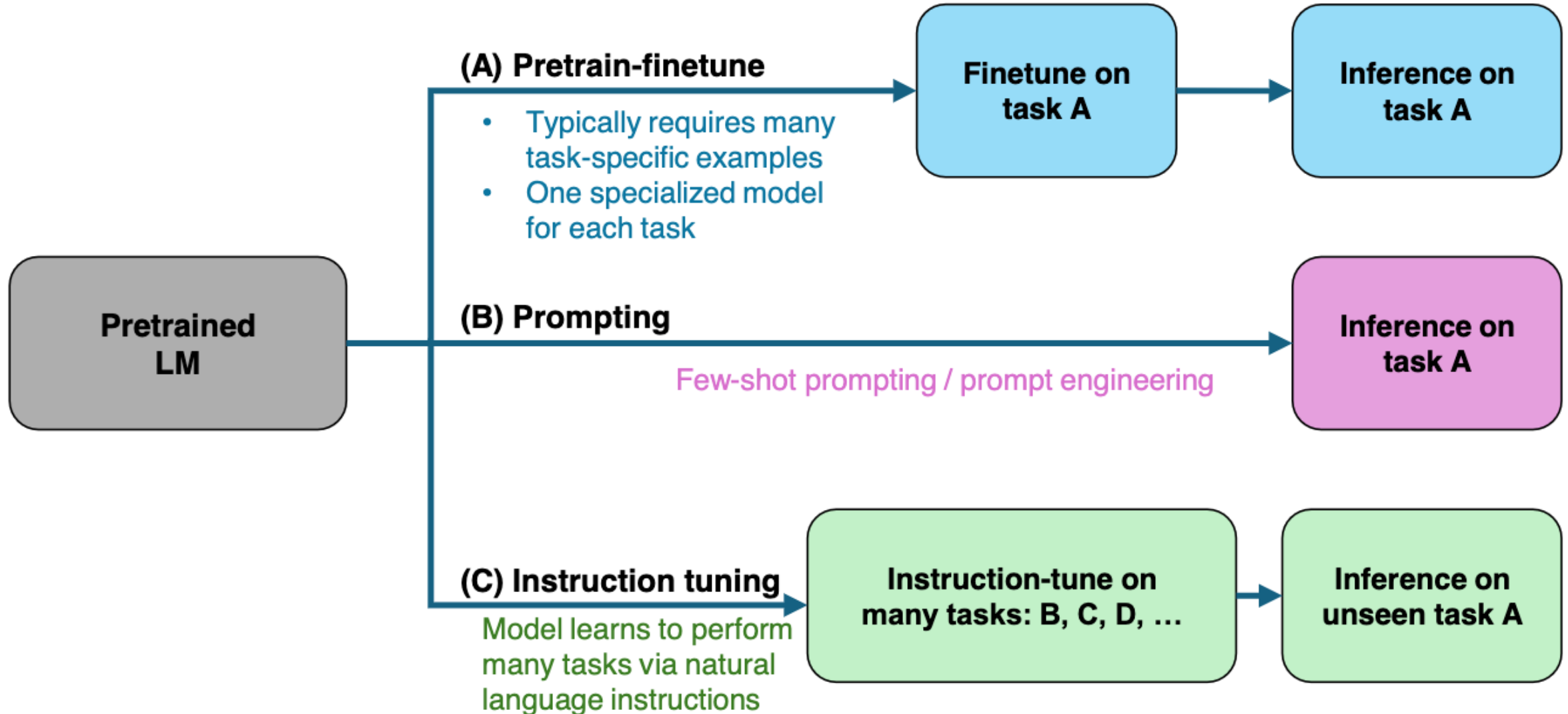


Multimodal Large Language Model (MLLM) for Vision Question Answering



Large Language Models (LLM)

Three typical learning paradigms



LMarena Leaderboard

Rank (UB) ↑	Model ↑↓	Score ↑↓	95% CI (±) ↑↓	Votes ↑↓	Organization ↑↓	License ↑↓
1	 gemini-2.5-pro	1455	±5	41,731	Google	Proprietary
1	 claude-opus-4-1-20250805-thinking-16k	1451	±6	11,750	Anthropic	Proprietary
2	 o3-2025-04-16	1444	±4	43,898	OpenAI	Proprietary
2	 gpt-5-high	1442	±6	15,076	OpenAI	Proprietary
2	 chatgpt-4o-latest-20250326	1441	±4	36,426	OpenAI	Proprietary
3	 gpt-4.5-preview-2025-02-27	1439	±6	15,271	OpenAI	Proprietary
3	 claude-opus-4-1-20250805	1438	±6	18,341	Anthropic	Proprietary
5	 gpt-5-chat	1430	±6	11,808	OpenAI	Proprietary
6	 qwen3-max-preview	1428	±7	8,781	Alibaba	Proprietary
8	 grok-4-0709	1422	±5	21,446	xAI	Proprietary

<https://lmarena.ai/>

LMarena Leaderboard

Model 239 / 239	Overall ↑↓	Hard Prompts ↑↓	Coding ↑↓	Math ↑↓	Creative Writing ↑↓	Instruction Following	Longer Query ↑↓	Multi-Turn ↑↓
 claude-opus-4-1-...	1	1	1	1	1	1	1	1
 gemini-2.5-pro	1	2	3	1	1	1	1	1
 chatgpt-4o-lates...	2	4	3	13	2	5	4	1
 gpt-5-high	2	2	3	1	7	5	11	6
 o3-2025-04-16	2	4	3	1	8	6	13	7
 claude-opus-4-1-...	3	2	1	1	1	1	1	1
 gpt-4.5-preview-...	3	5	4	8	1	4	3	1
 gpt-5-chat	5	3	3	8	3	5	3	1
 qwen3-max-preview	6	4	2	1	7	4	4	3
 claude-opus-4-20...	8	4	3	6	2	2	2	7
 deepseek-r1-0528	8	8	4	10	8	15	13	14
 deepseek-v3.1	8	6	4	1	7	6	5	9
 deepseek-v3.1-th...	8	4	3	1	2	4	1	7
 grok-4-0709	8	10	12	1	4	6	8	7
 kimi-k2-0711-pre...	8	10	7	13	16	24	22	7
 kimi-k2-0905-pre...	8	5	3	-	6	16	12	7
 qwen3-235b-a22b-...	8	4	3	2	9	6	4	7
 glm-4.5	10	7	4	7	14	7	8	10

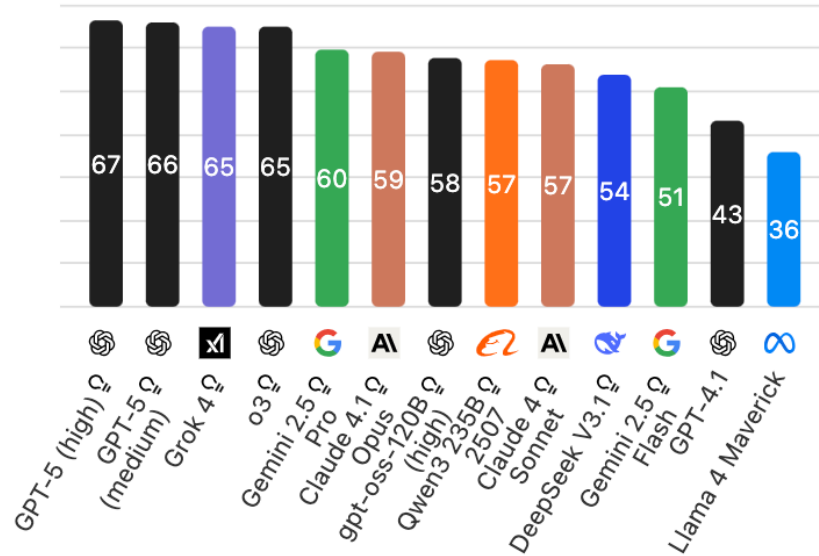
<https://huggingface.co/spaces/lmarena-ai/lmarena-leaderboard>

Artificial Analysis Intelligence Index

Intelligence, Speed, Price

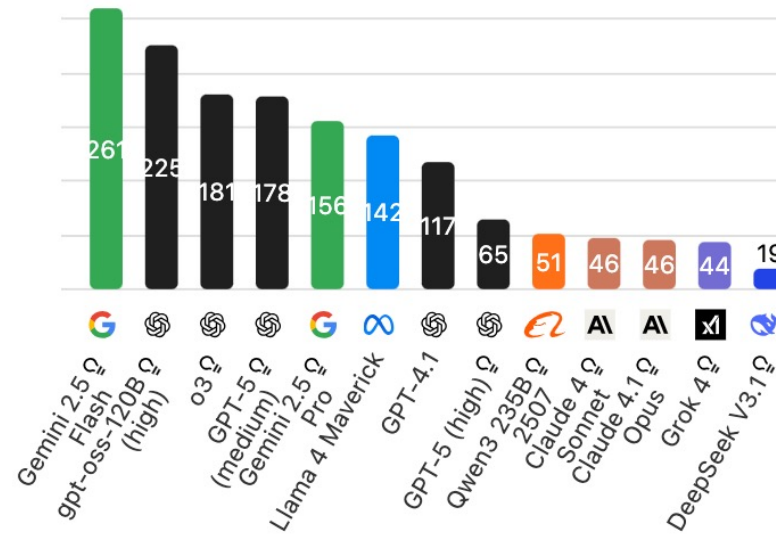
INTELLIGENCE

Artificial Analysis Intelligence Index; Higher is better



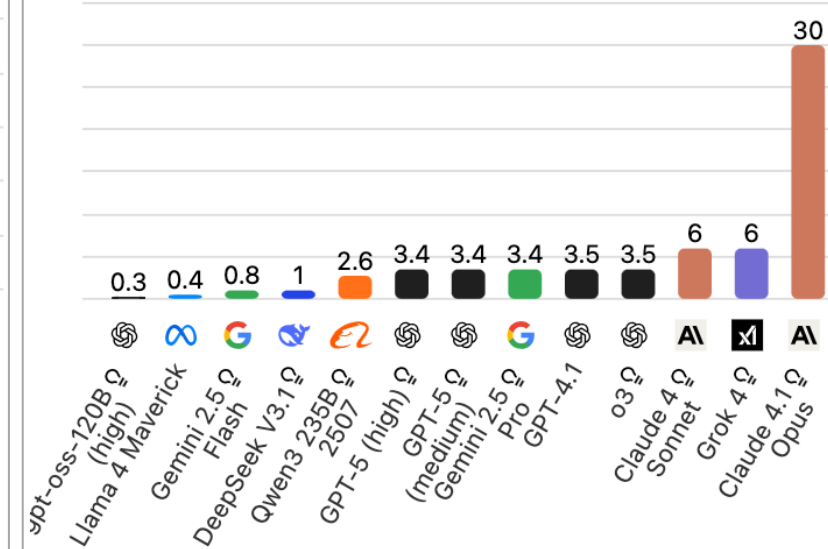
SPEED

Output Tokens per Second; Higher is better



PRICE

USD per 1M Tokens; Lower is better

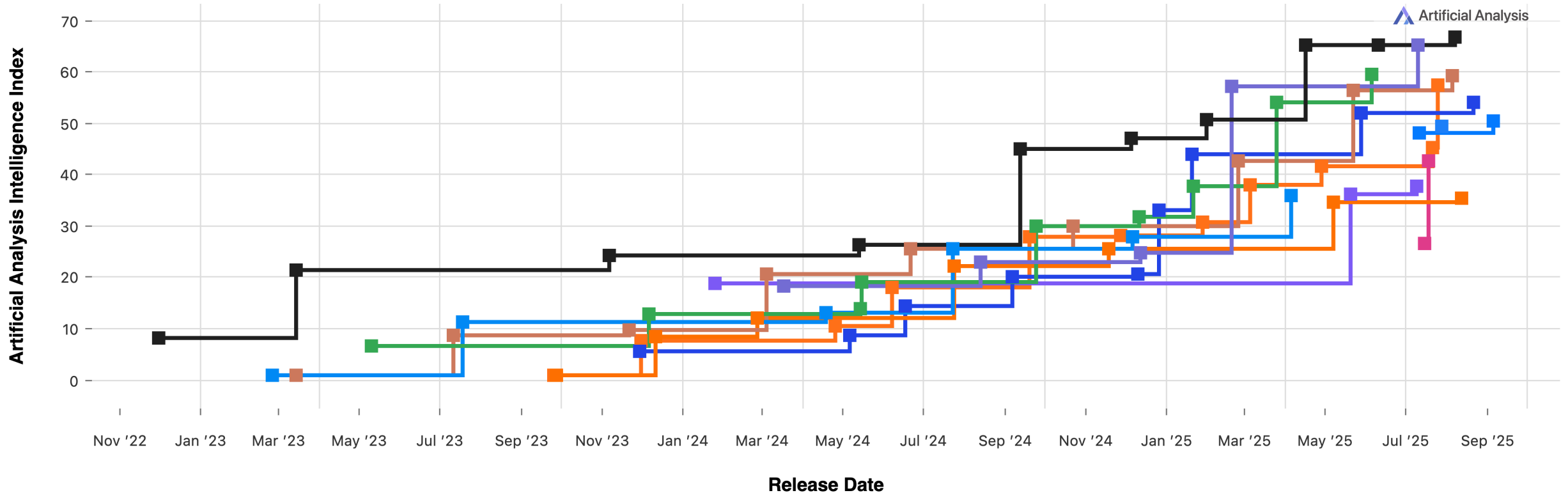


Artificial Analysis Intelligence Index 2022-2025

Frontier Language Model Intelligence, Over Time

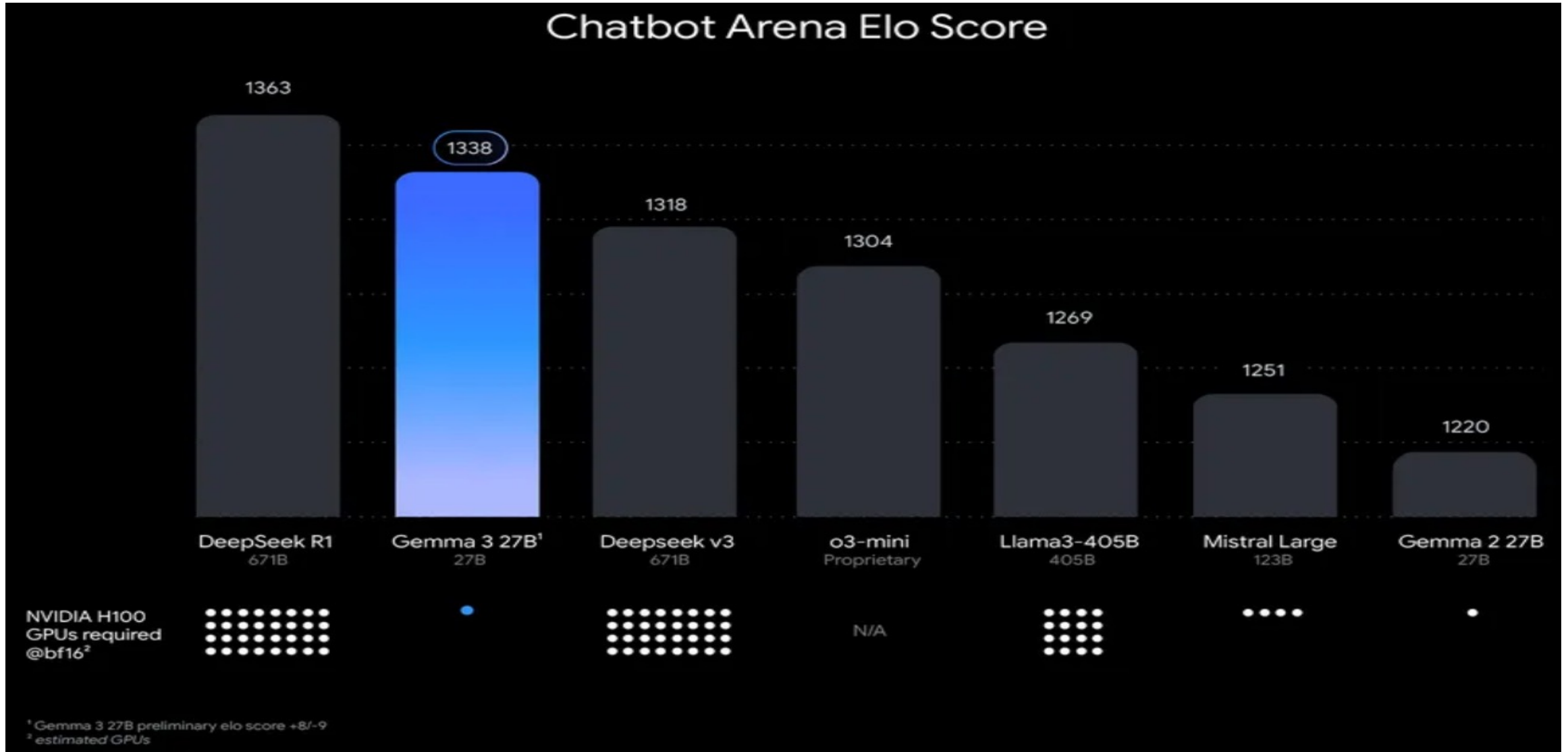
Artificial Analysis Intelligence Index v3.0 incorporates 10 evaluations: MMLU-Pro, GPQA Diamond, Humanity's Last Exam, LiveCodeBench, SciCode, AIME 2025, IFBench, AA-
LCR, Terminal-Bench Hard, τ^2 -Bench Telecom

Alibaba Anthropic DeepSeek Google LG AI Research Meta Mistral Moonshot AI OpenAI Upstage xAI Z AI



Google Gemma 3 27B

The most capable model you can run on a single GPU or TPU



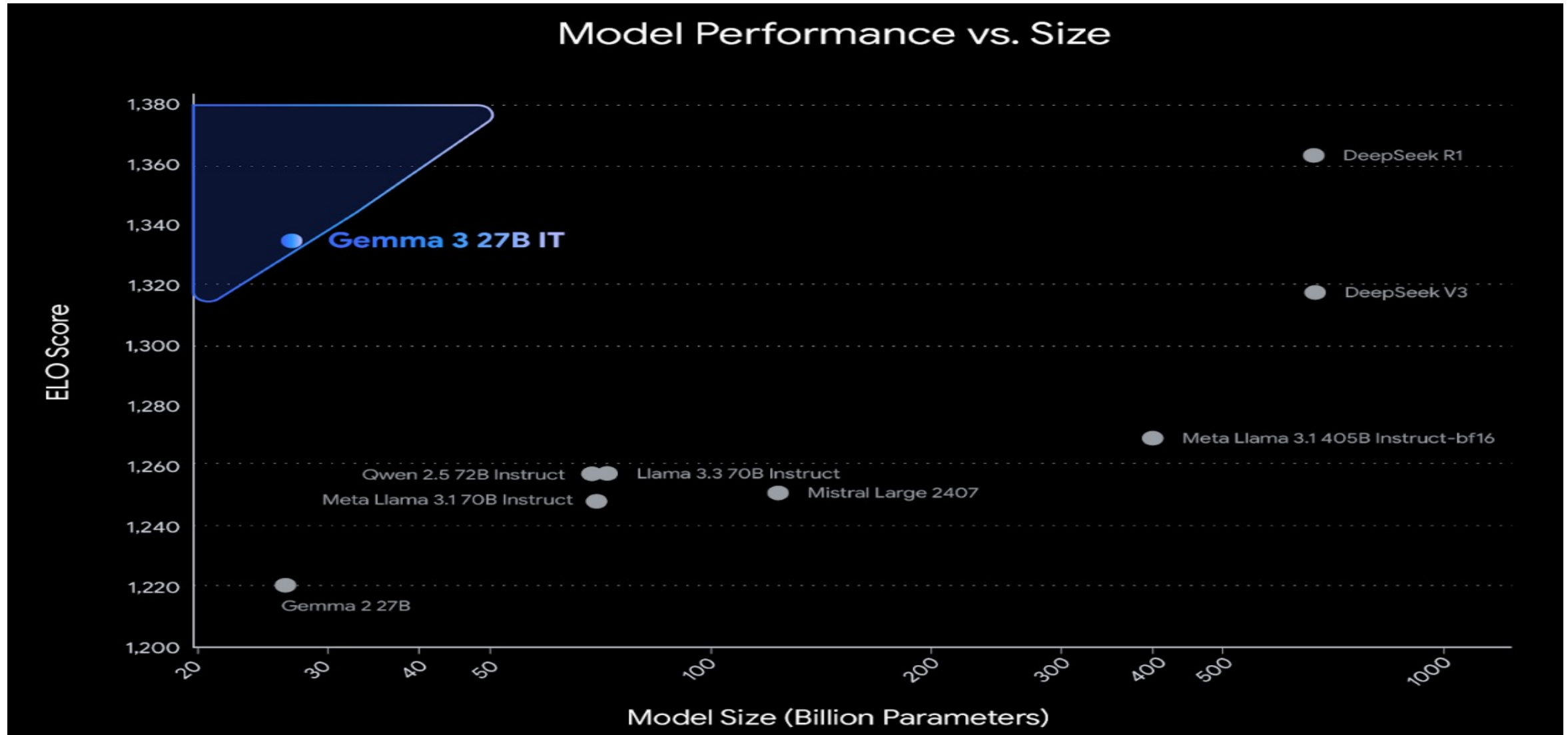
Google Gemma 3 Multimodality

(vision-language input and text outputs)

MODEL	SIZE (in billion parameter)	CONTEXT LENGTH	LANGUAGES	INPUT MODALITIES
Gemma 3 1B (IT)	1B	32k	English	Input: Text Output: Text
Gemma 3 4B (IT)	4B	128k	+140 Languages	Input: Text, Image Output: Text
Gemma 3 12B (IT)	12B	128k	+140 Languages	Input: Text, Image Output: Text
Gemma 3 27B (IT)	27B	128k	+140 Languages	Input: Text, Image Output: Text
Shield Gemma 2	4B	8k	+140 Languages	Input: Text, Image Output: Text

Source: <https://developers.googleblog.com/en/introducing-gemma3/>

Google Gemma 3: Pre-training and Post-training (distillation, reinforcement learning, and model merging)



Source: <https://developers.googleblog.com/en/introducing-gemma3/>

Google AI Studio (Gemma 3 27B)

The screenshot displays the Google AI Studio web interface. The top navigation bar includes the 'Google AI Studio' logo, a title 'Generative AI: A Comprehensive Overview...', and several utility links: 'Enable Autosave', 'Compare', 'Open in Kaggle', and 'Open in Vertex AI'. A user profile icon is in the top right corner.

The left sidebar contains a 'Get API key' button and a list of navigation options: 'Create Prompt', 'Stream Realtime', 'Starter Apps', 'Tune a Model', 'Library', 'Enable chat history', 'Prompt Gallery', 'Developer documentation', 'Developer forum', 'Changelog', and 'Settings'.

The main content area features an article titled 'Generative AI: A Deep Dive'. The article text states: 'Generative AI is one of the most exciting and rapidly evolving fields in artificial intelligence right now. Here's a comprehensive overview, covering what it is, how it works, its types, applications, limitations, and future trends:'. The first section, '1. What is Generative AI?', defines it as a category of machine learning models that 'create new content' (text, images, audio, video, code, etc.) that resembles training data. It contrasts this with traditional AI that 'analyzes or acts on existing data'. A 'Key Characteristics' section lists four points: 'Learns Patterns', 'Generates Novel Content', 'Probabilistic' generation, and the requirement for 'Large Datasets'.

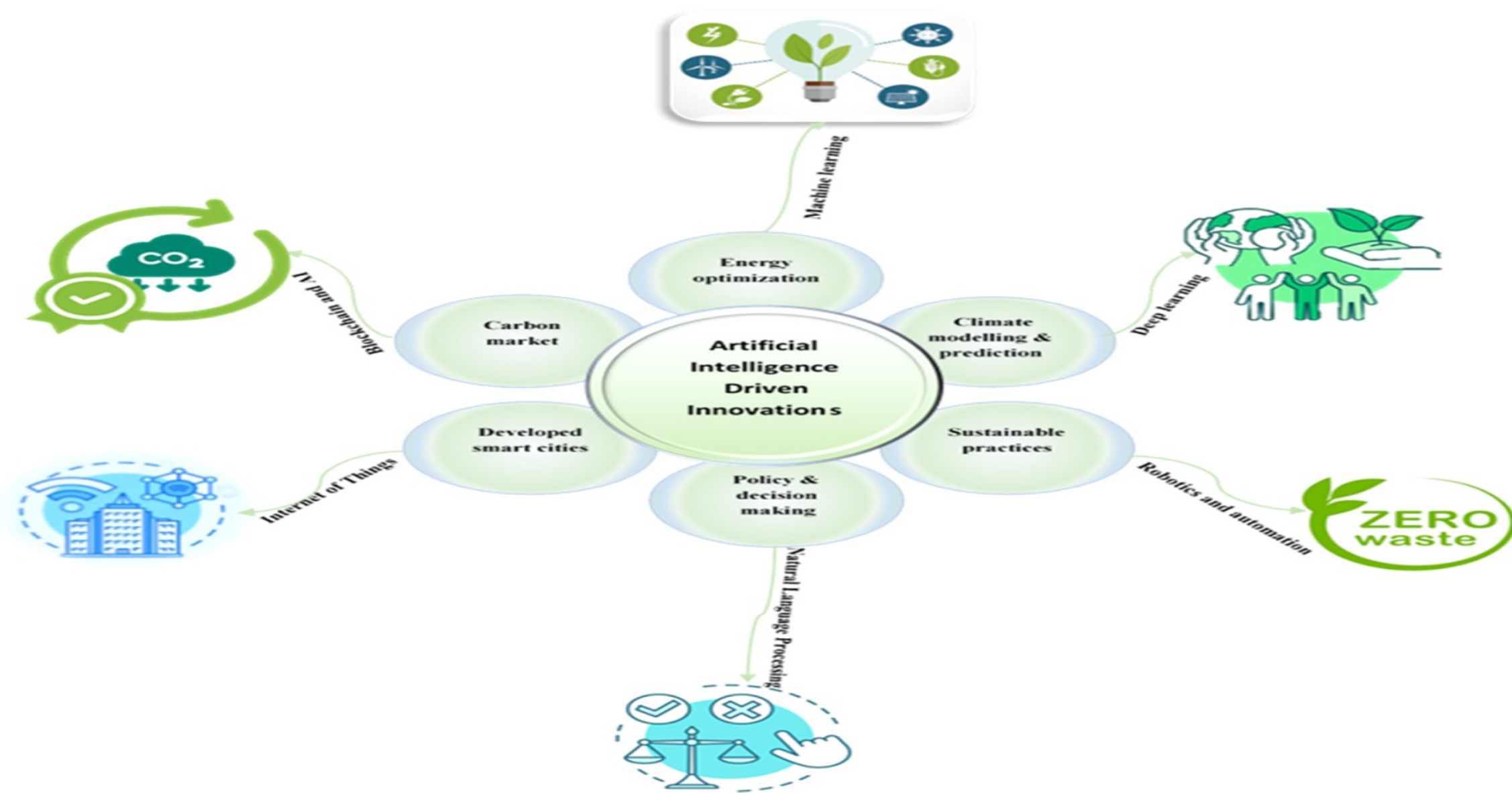
On the right, the 'Run settings' panel is visible, showing the 'Model' set to 'Gemma 3 27B', a 'Token count' of 1,760 / 131,072, and 'Temperature' set to 1. Other settings like 'Advanced settings', 'Safety settings', and 'Add stop sequence' are also present.

At the bottom, there is a text input field with the placeholder 'Type something' and a 'Run' button.

AI Technology Applications in Sustainability

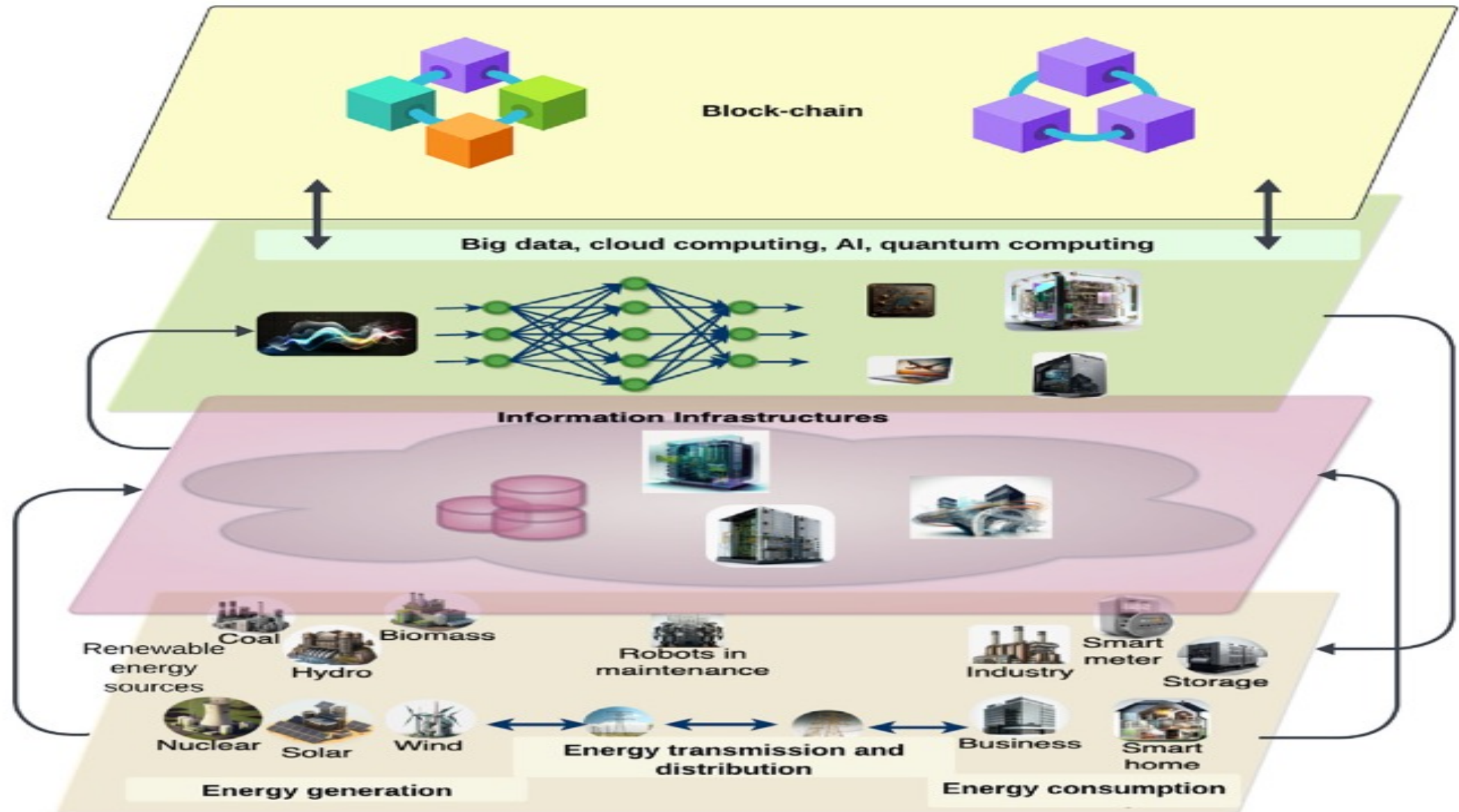
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AI Innovations for Net-Zero Transformation

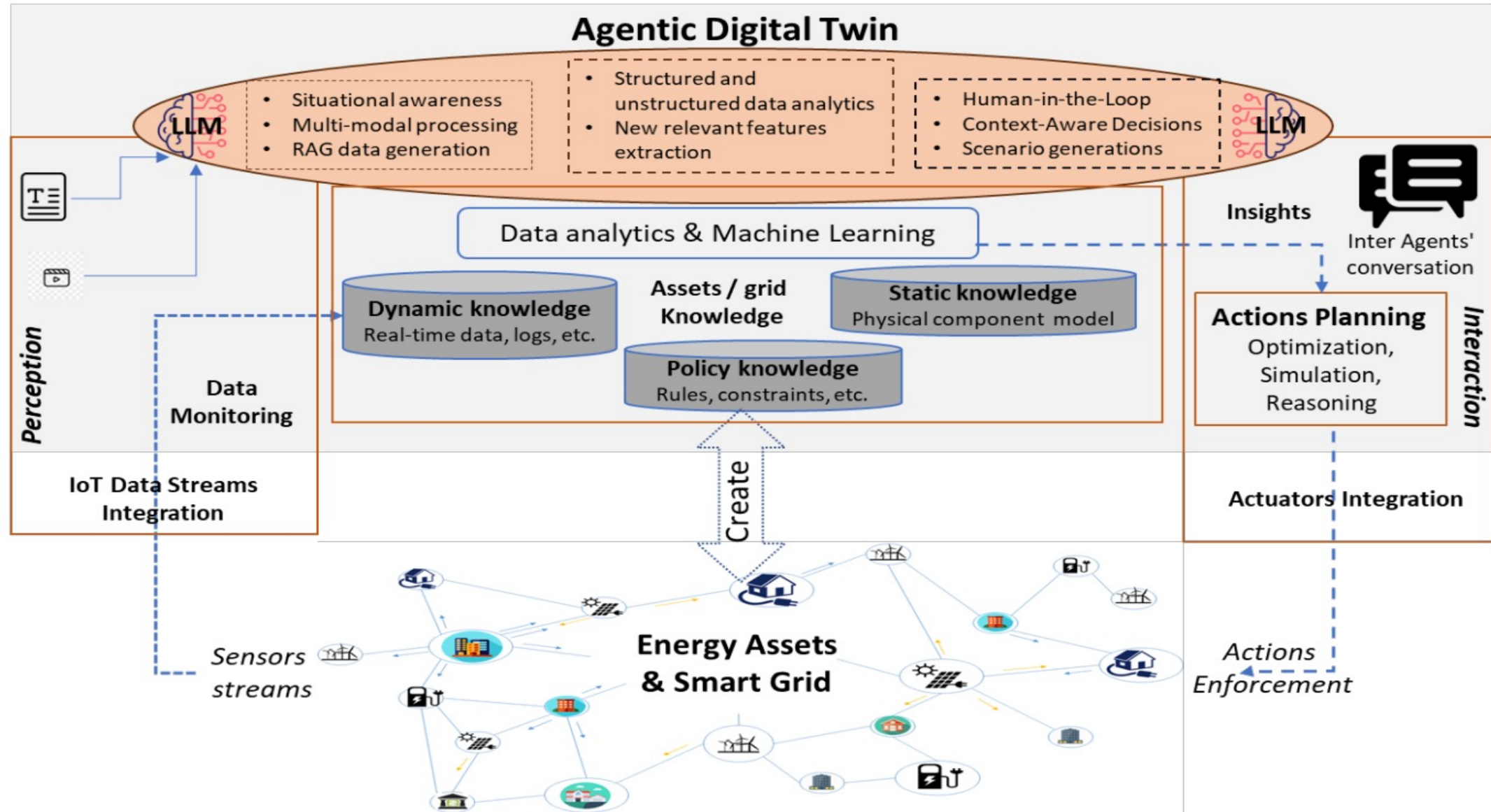


Source: Olawade, D. B., Wada, O. Z., David-Olawade, A. C., Fapohunda, O., Ige, A. O., & Ling, J. (2024). Artificial intelligence potential for net zero sustainability: Current evidence and prospects. Next Sustainability, 4, 100041.

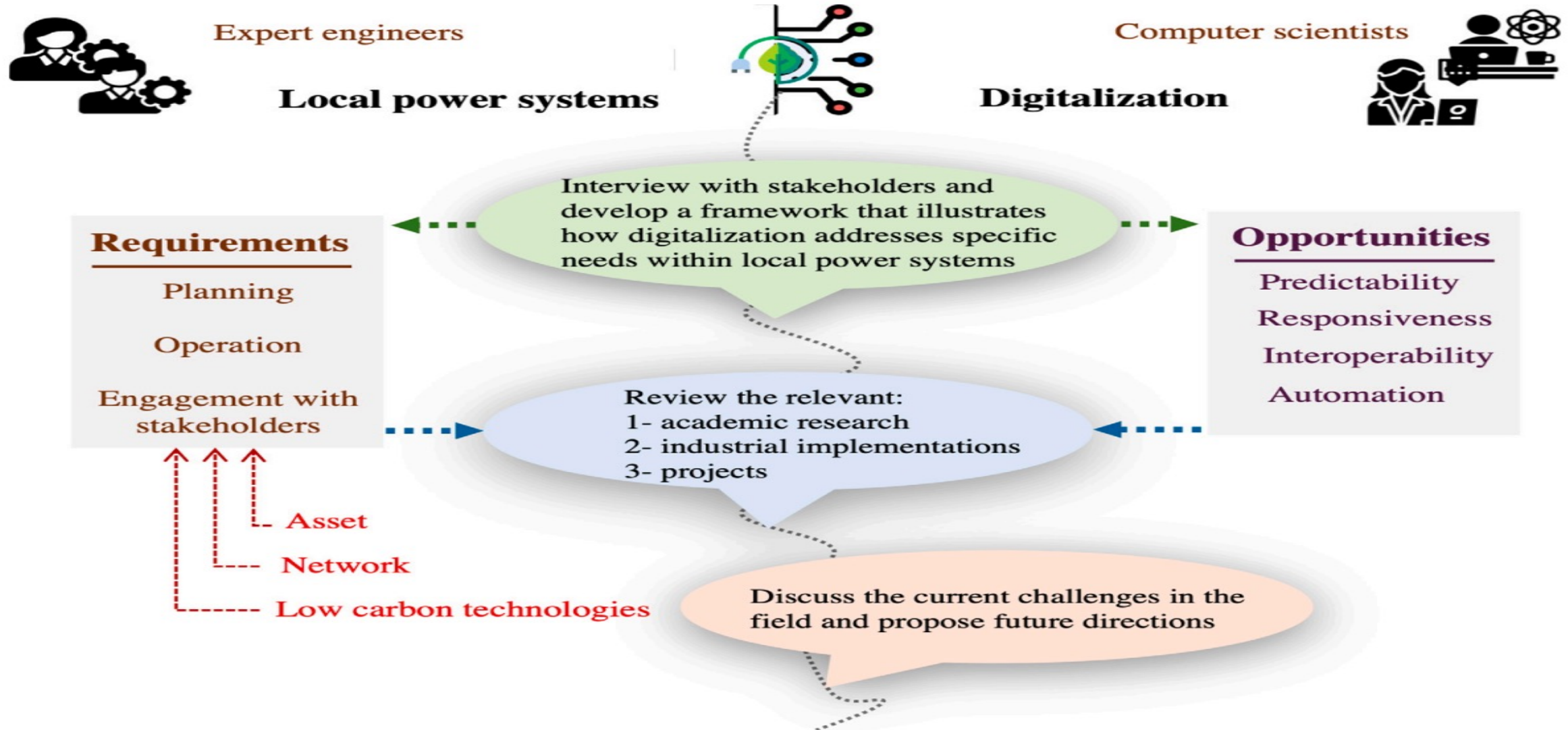
AI Technology for Net-Zero Energy Transition



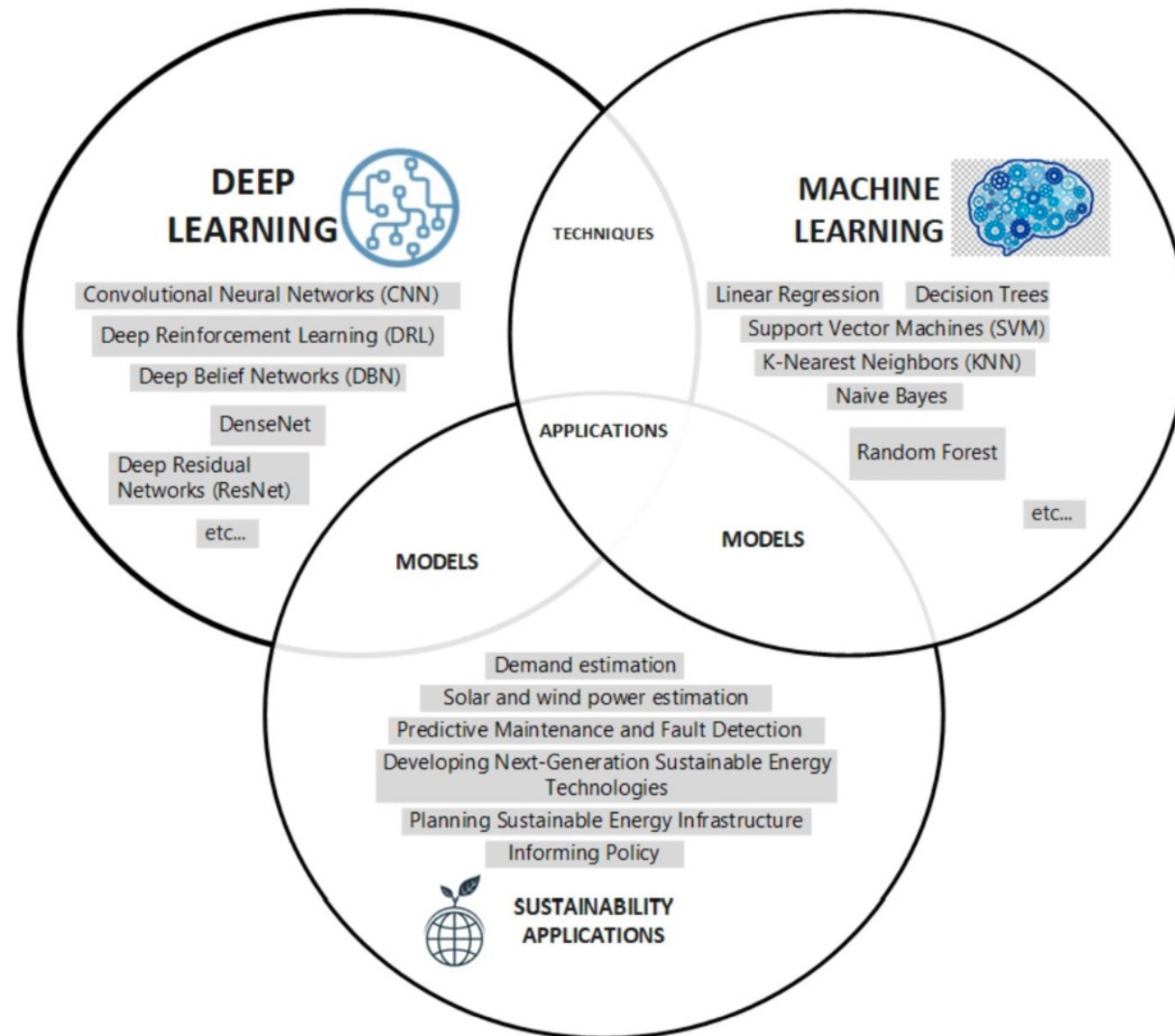
AI for Energy Systems and Agentic Digital Twins



Local Power System Digitalization Transition to Net-Zero

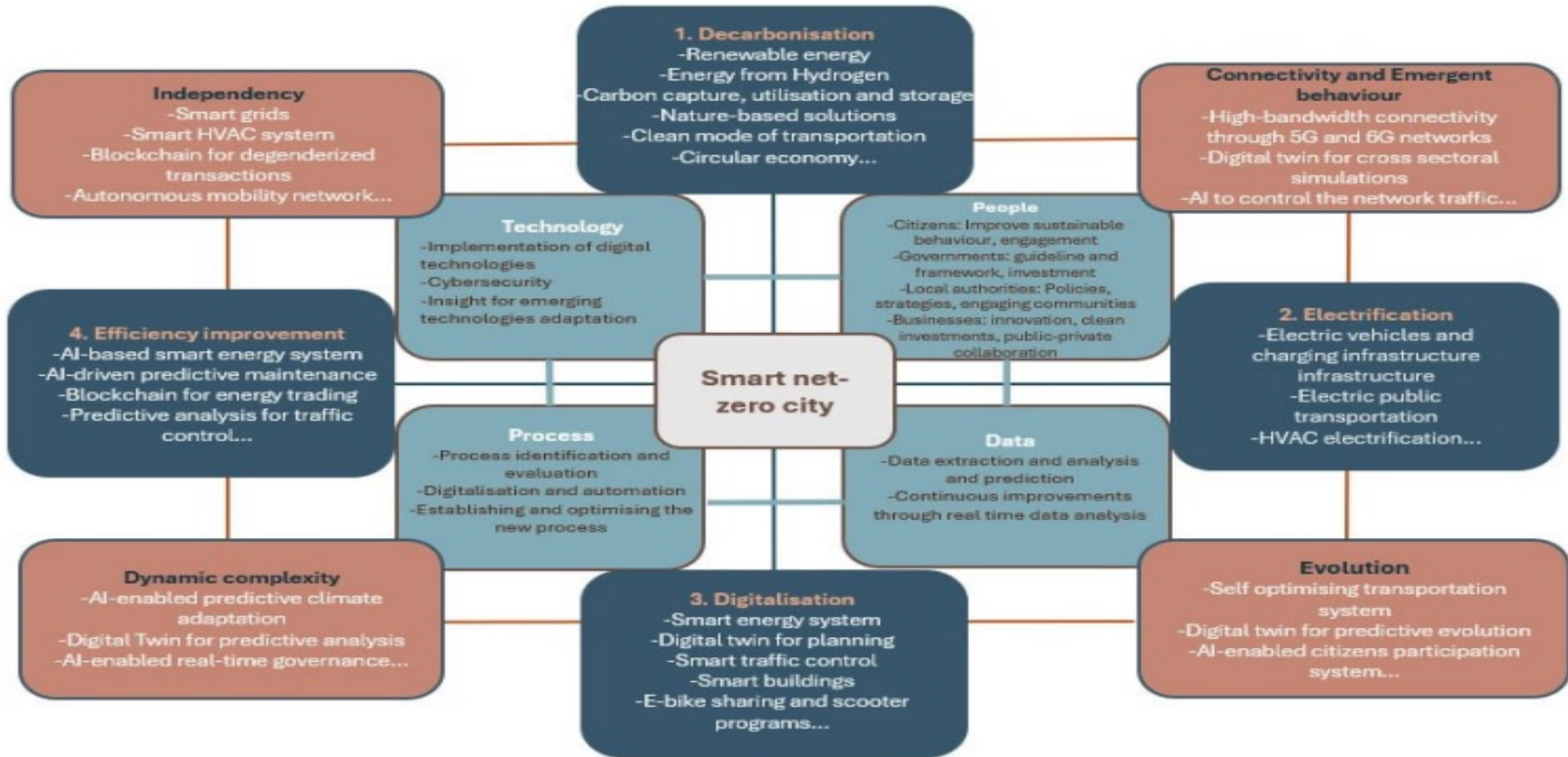


ML and DL for Sustainability Applications

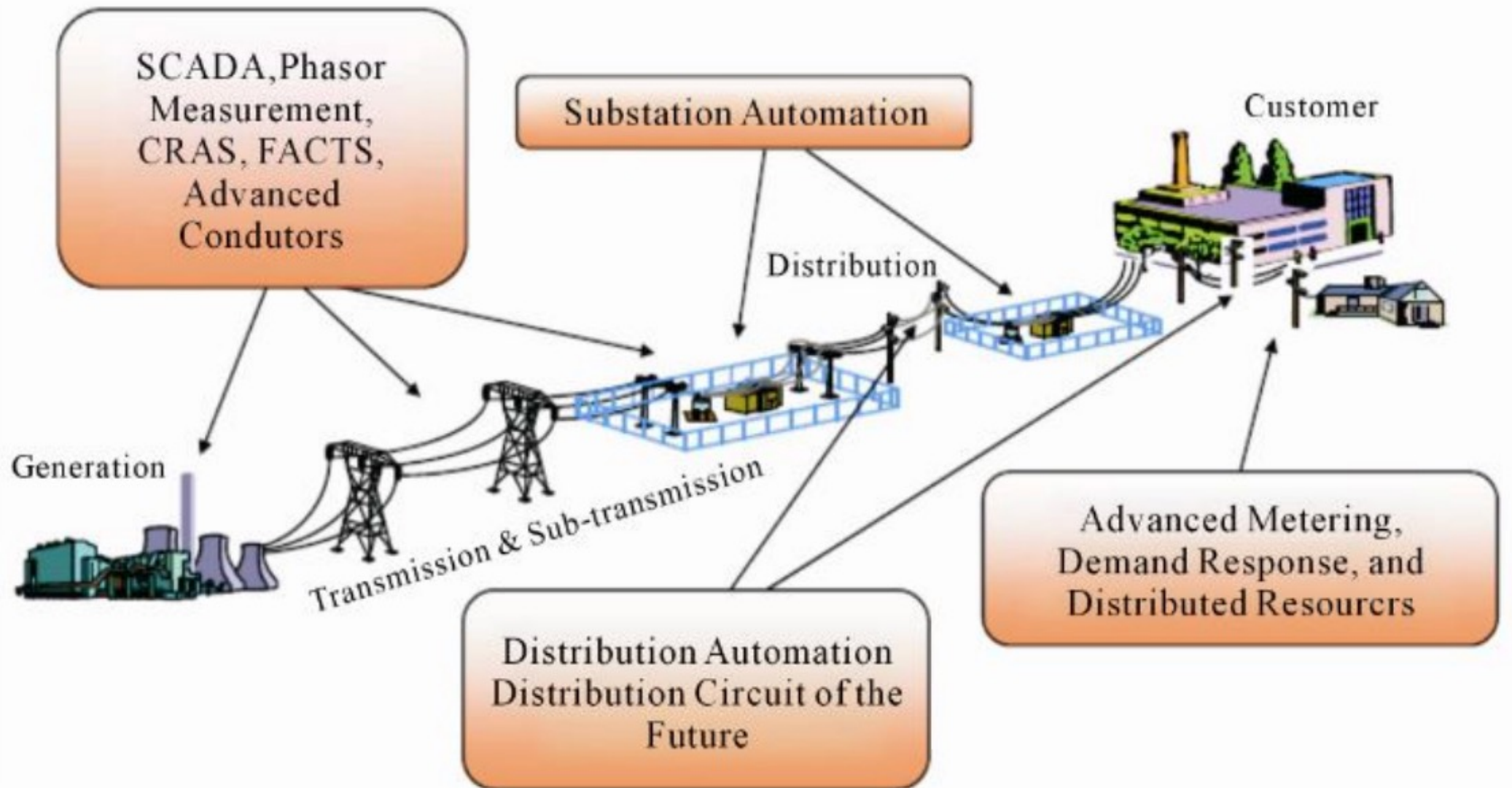


Digital Transformation for Smart Net-Zero Cities

(Technology, People, Data, and Process)



Elements of a Smart Grid



Source: Biswas, Parag, Abdur Rashid, Abdullah Al Masum, MD Abdullah Al Nasim, ASM Anas Ferdous, Kishor Datta Gupta, and Angona Biswas.

"An extensive and methodical review of smart grids for sustainable energy management-addressing challenges with ai, renewable energy integration and leading-edge technologies." IEEE Access (2025).

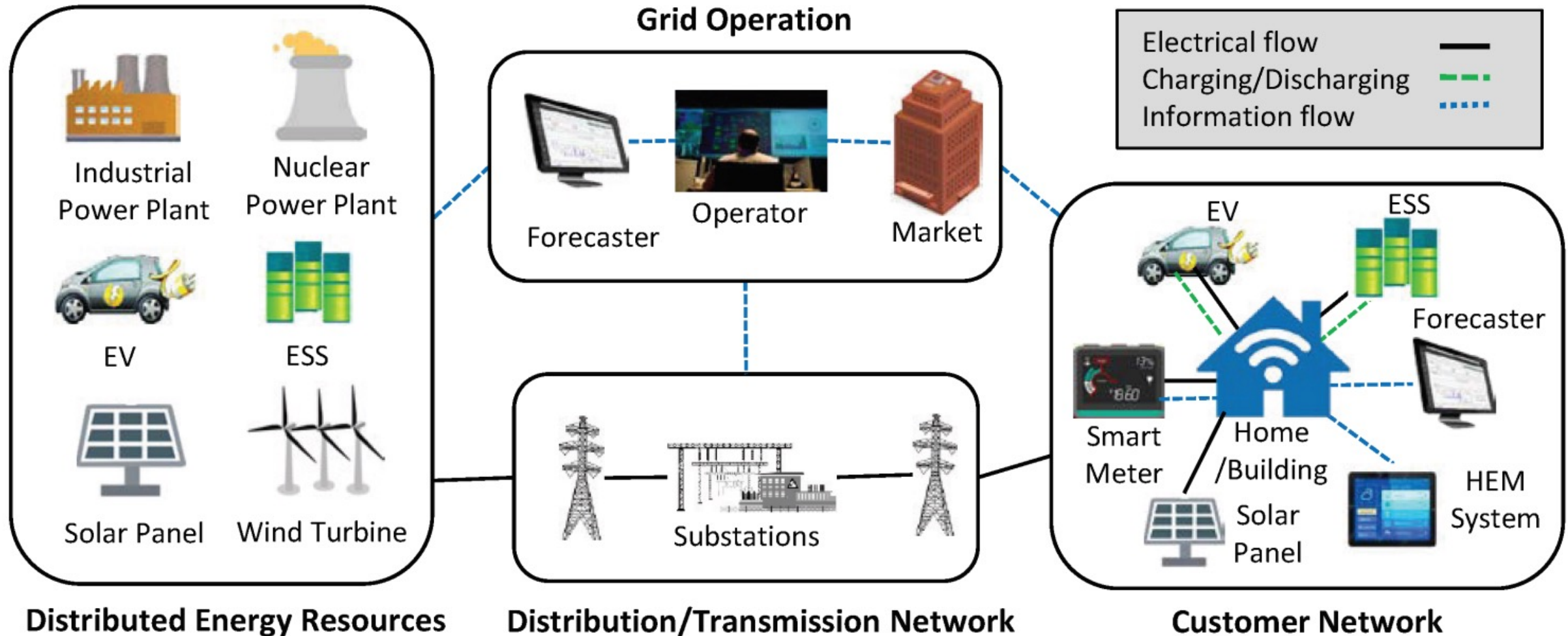
AI in Decentralized Intelligent Power Grids

Components

Distributed Generation

Distribution and Management

Smart Consumption



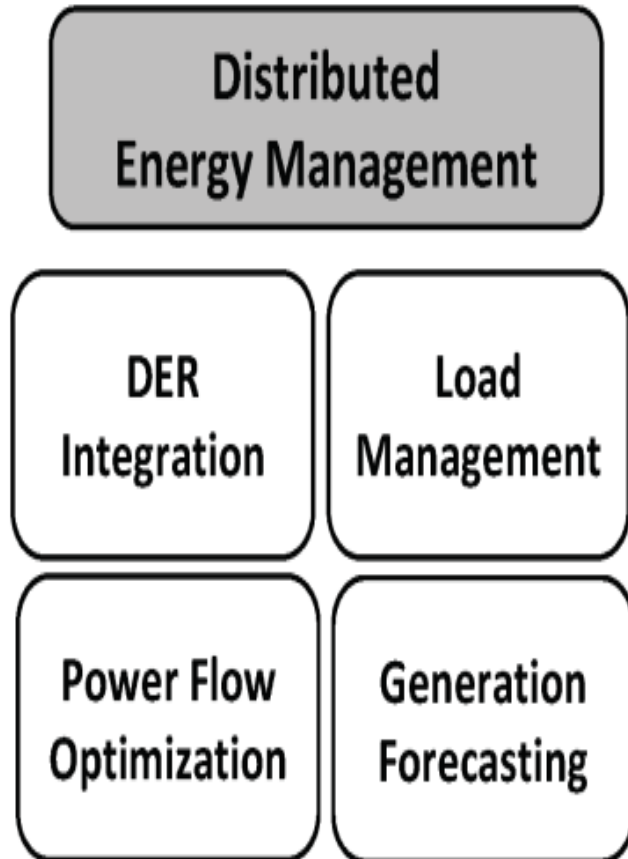
Source: Biswas, Parag, Abdur Rashid, Abdullah Al Masum, MD Abdullah Al Nasim, ASM Anas Ferdous, Kishor Datta Gupta, and Angona Biswas.

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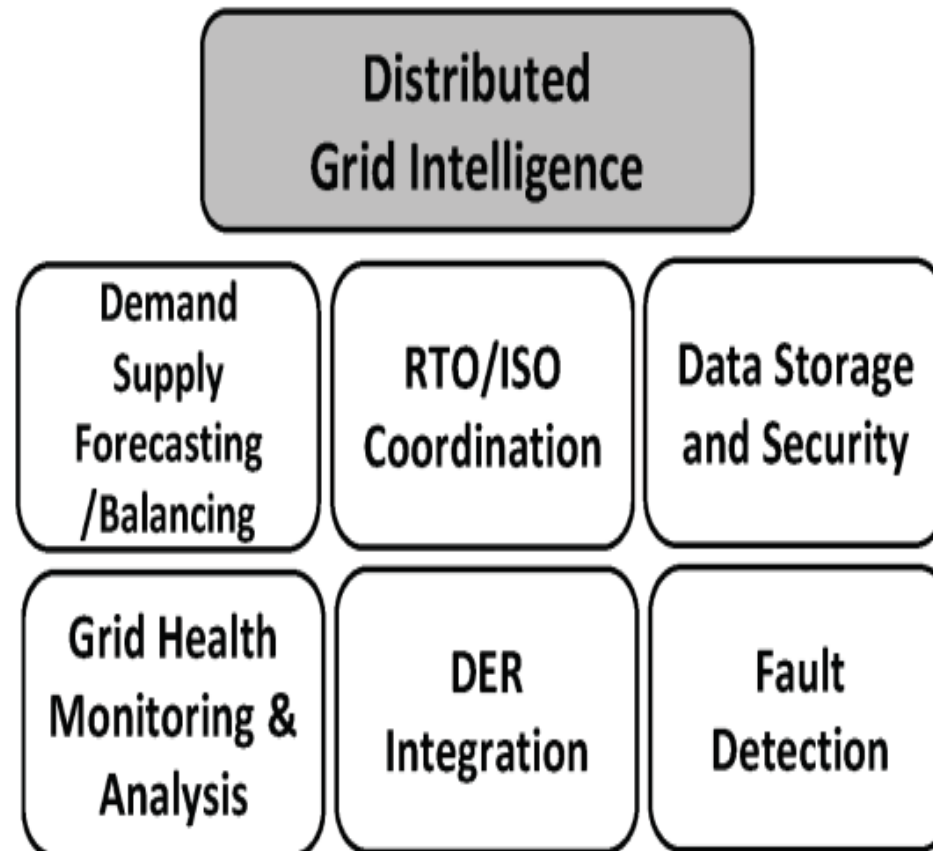
AI in Decentralized Intelligent Power Grids

Applications

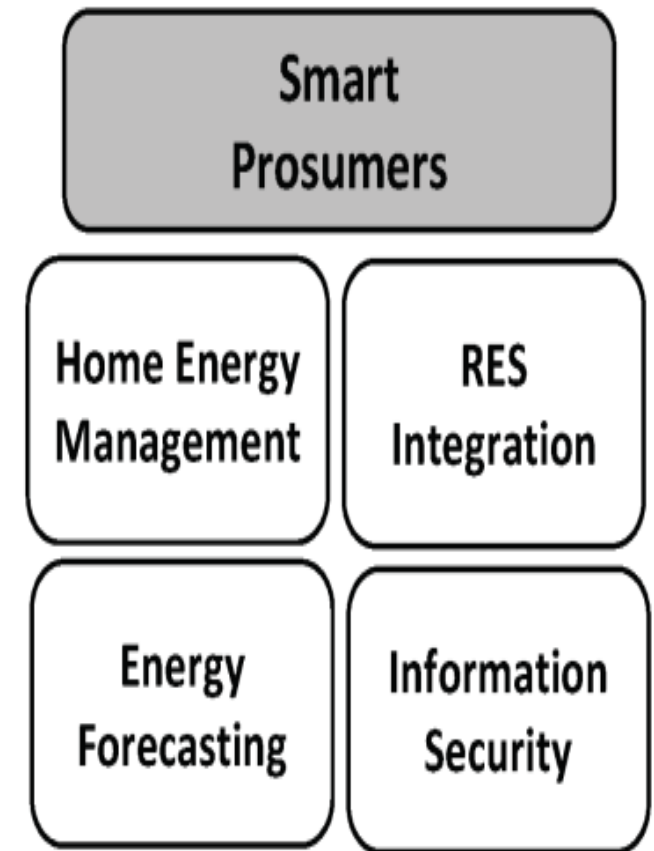
Distributed Generation



Distribution and Management



Smart Consumption



AI in Decentralized Intelligent Power Grids

AI Technology

Distributed Generation

- Multi-agent system-based microgrid operation strategy for DR
- Distributed grid intelligence using FREEDM system to manage the DERs
- ANN for optimizing distributed grid operation
- Consensus-based distributed intelligence for optimizing SG control
- Optimization of distributed generation operation using GA

Distribution and Management

- ANN for forecasting local energy demand
- Central Information Model (CIM) for implementing VPP communication and control architecture in SCADA
- Deep Learning (Support Vector Regression (SVR), Recurrent Neural Network (RNN)) for electricity price forecasting
- Markov Decision Process and RL based smart energy community management
- Meta-heuristic algorithm for regulating voltage profile
- ANN for detecting energy fraud
- Multi-service energy storage for providing shared ownership of ESS between local network operator and customers

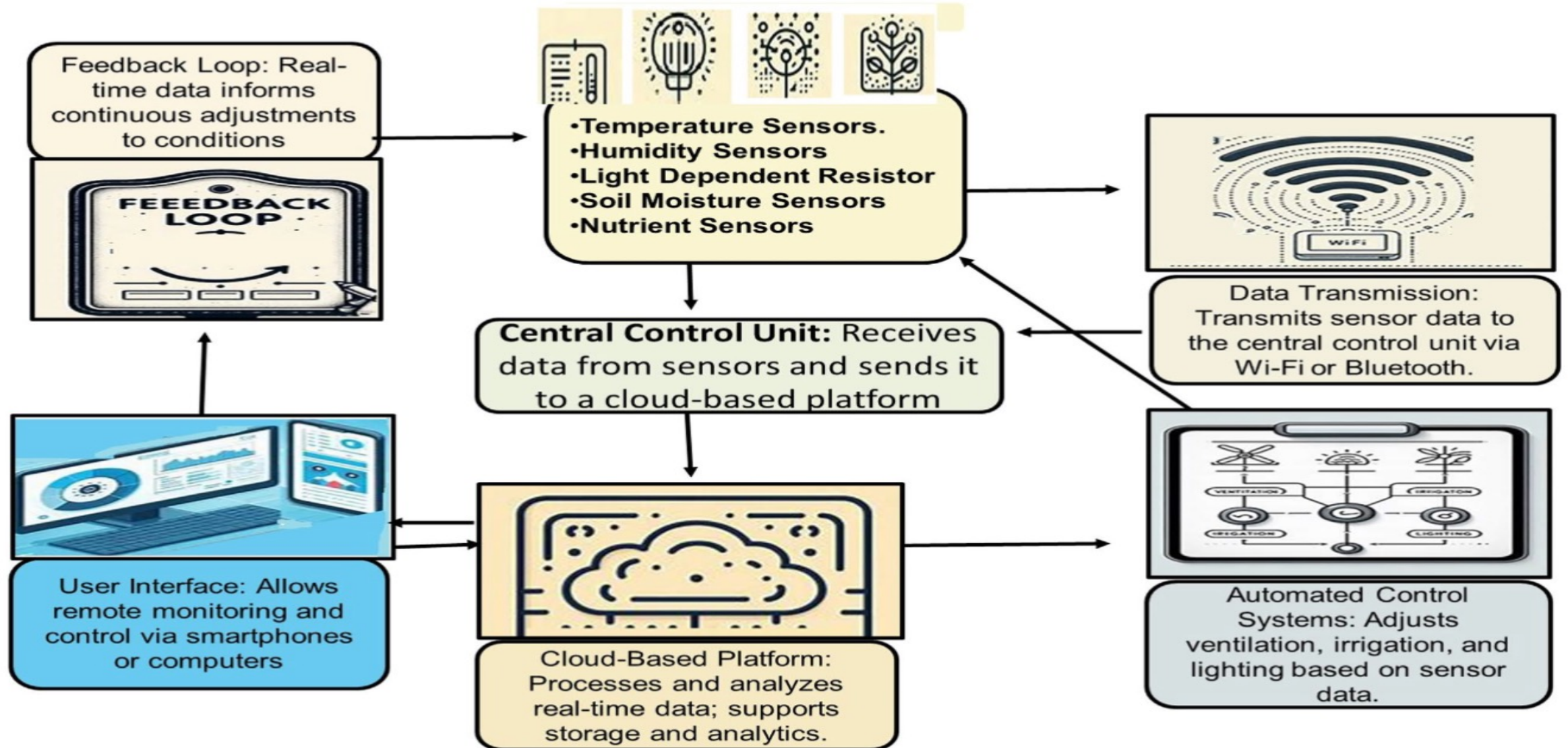
Smart Consumption

- ANN for DSM for smart consumers
- ANN for forecasting day-ahead load profile
- Machine Learning (support vector machine, ANN) for predicting electricity price
- Deep learning (Conditional Restricted Boltzmann Machine (CRBM)) for forecasting building energy consumption
- ANN and dynamic differential evolution for demand side management
- ANN and RL for demand response of HEM

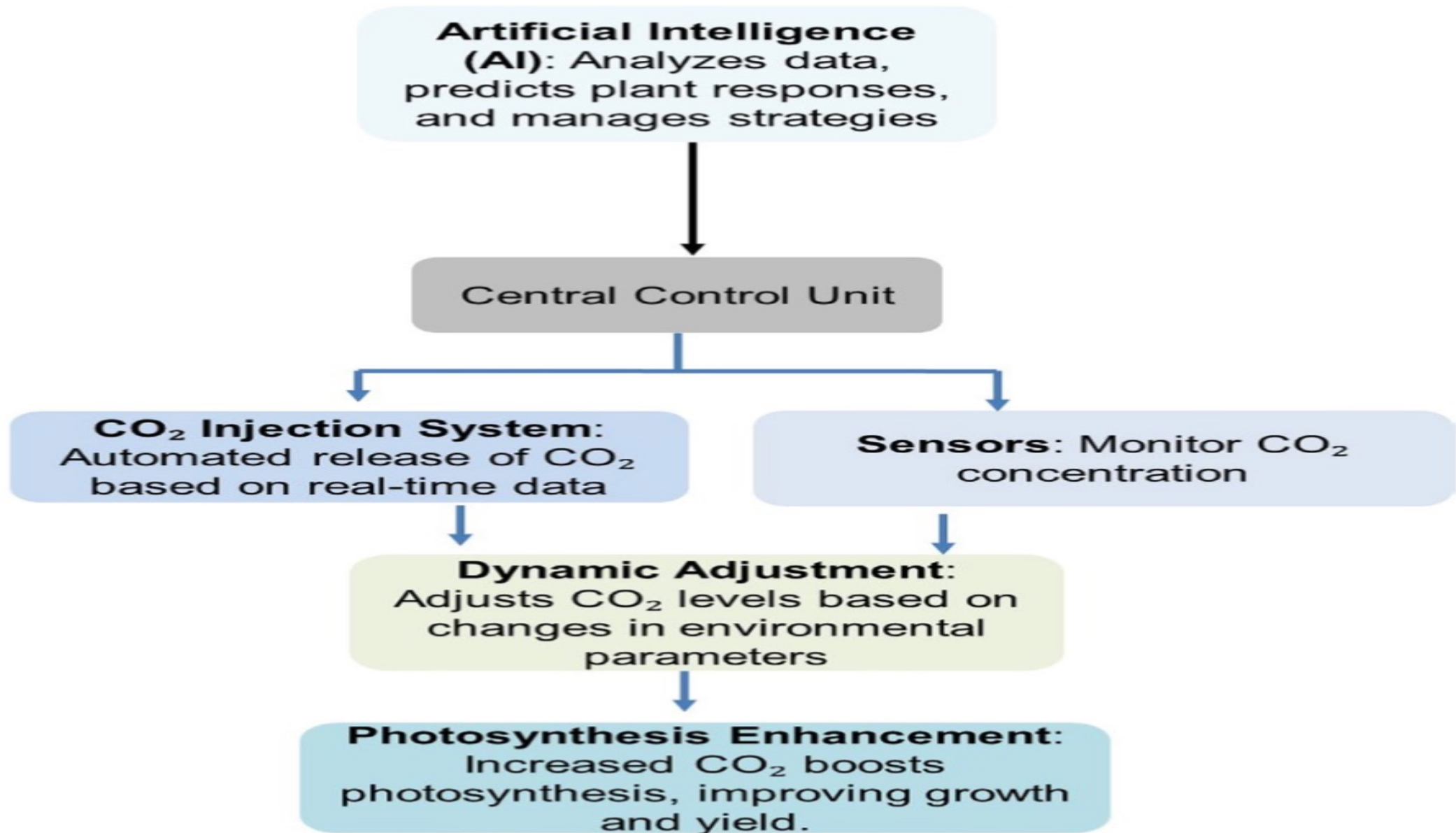
AI Technology Applications in Sustainability

1. 永續AI導入介紹 (Introduction to Sustainable AI)
2. AI在智慧能源管理的應用
(AI in Smart Energy Management)
3. AI在氣候變遷與環境監測的應用
(AI in Climate Change and Environmental Monitoring)
4. AI在循環經濟的應用案例
(AI in the Circular Economy)
5. AI永續技術專案小組討論與應用構想設計
(Sustainable AI Project Team Discussion and Application Design)
6. 綜合討論 (Open Discussion)

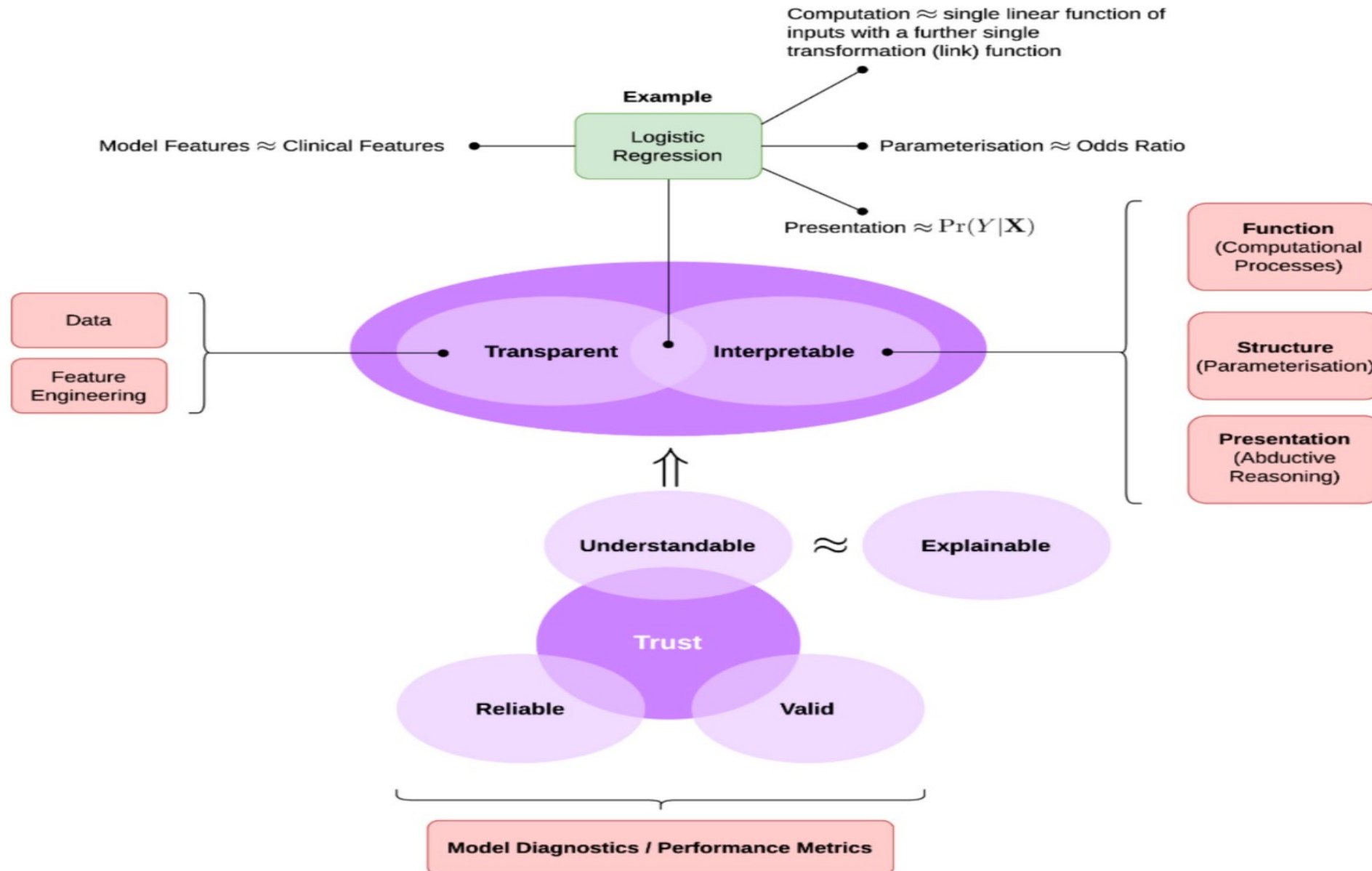
Integrated Real-time Data Monitoring and Control System for a Smart Greenhouse Environment



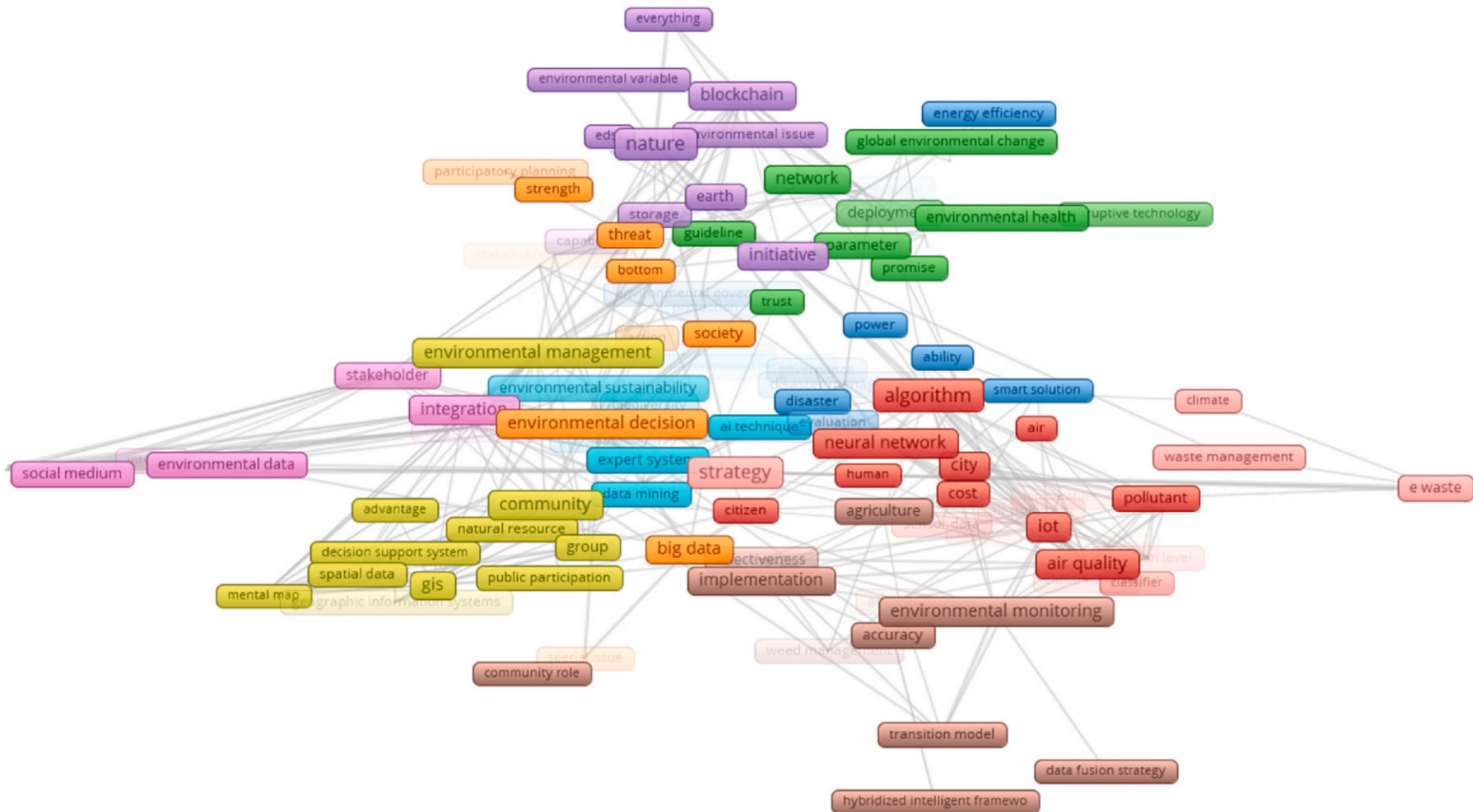
AI Environmental Control System with CO₂ Enrichment



AI in Climate Change Predictive Modeling



AI in Environmental Management



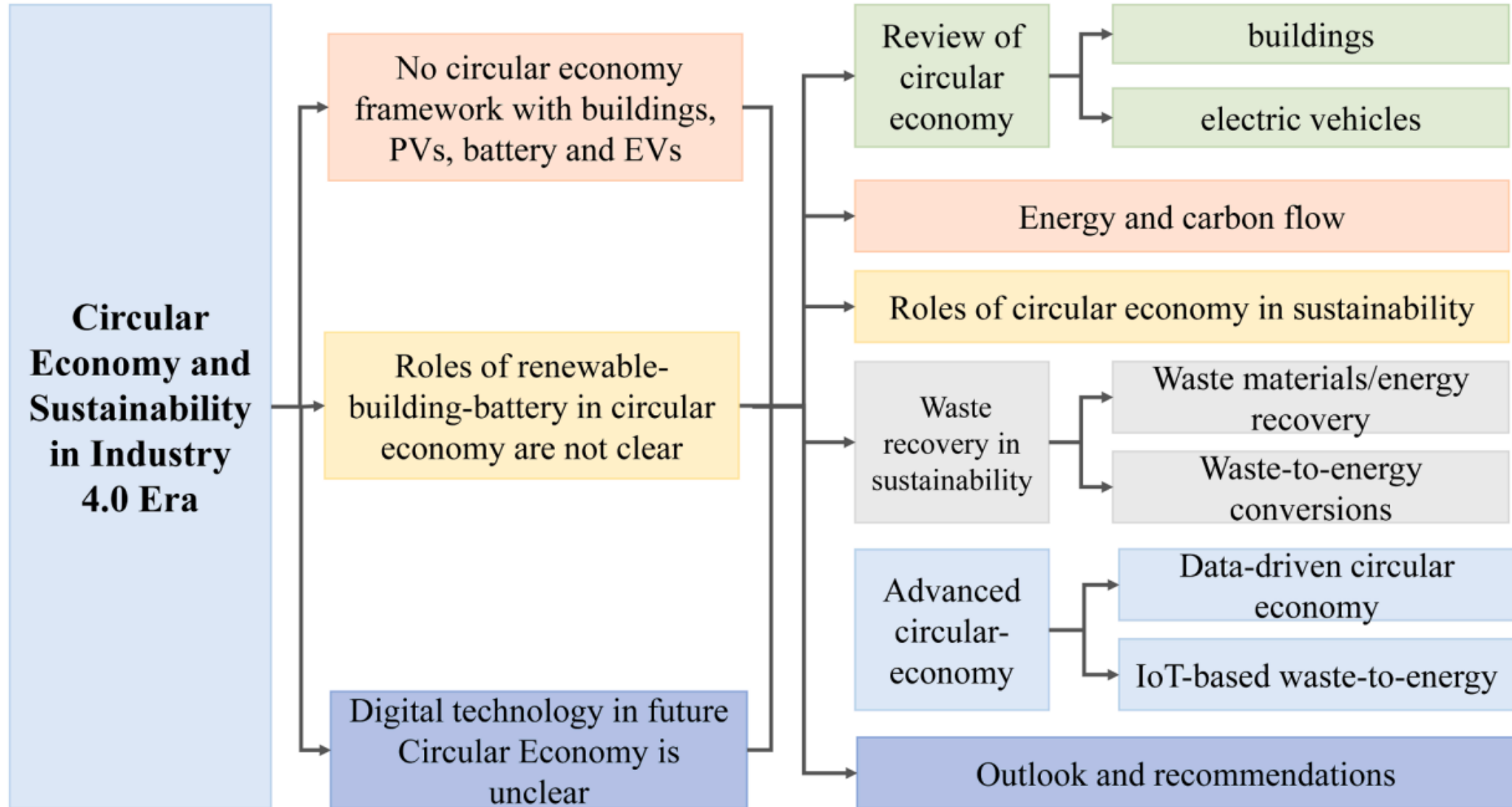
AI Agents in Environmental Sciences



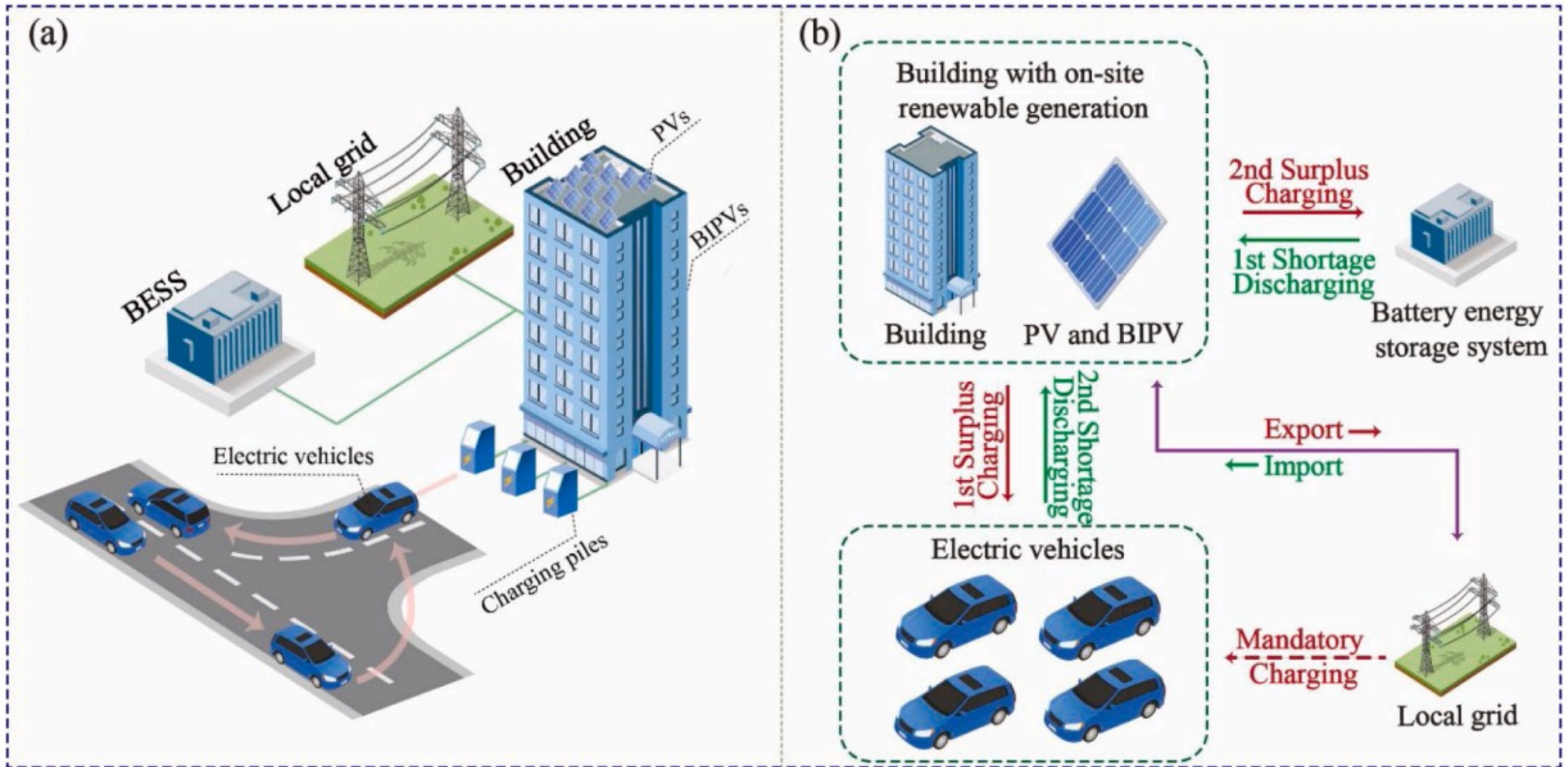
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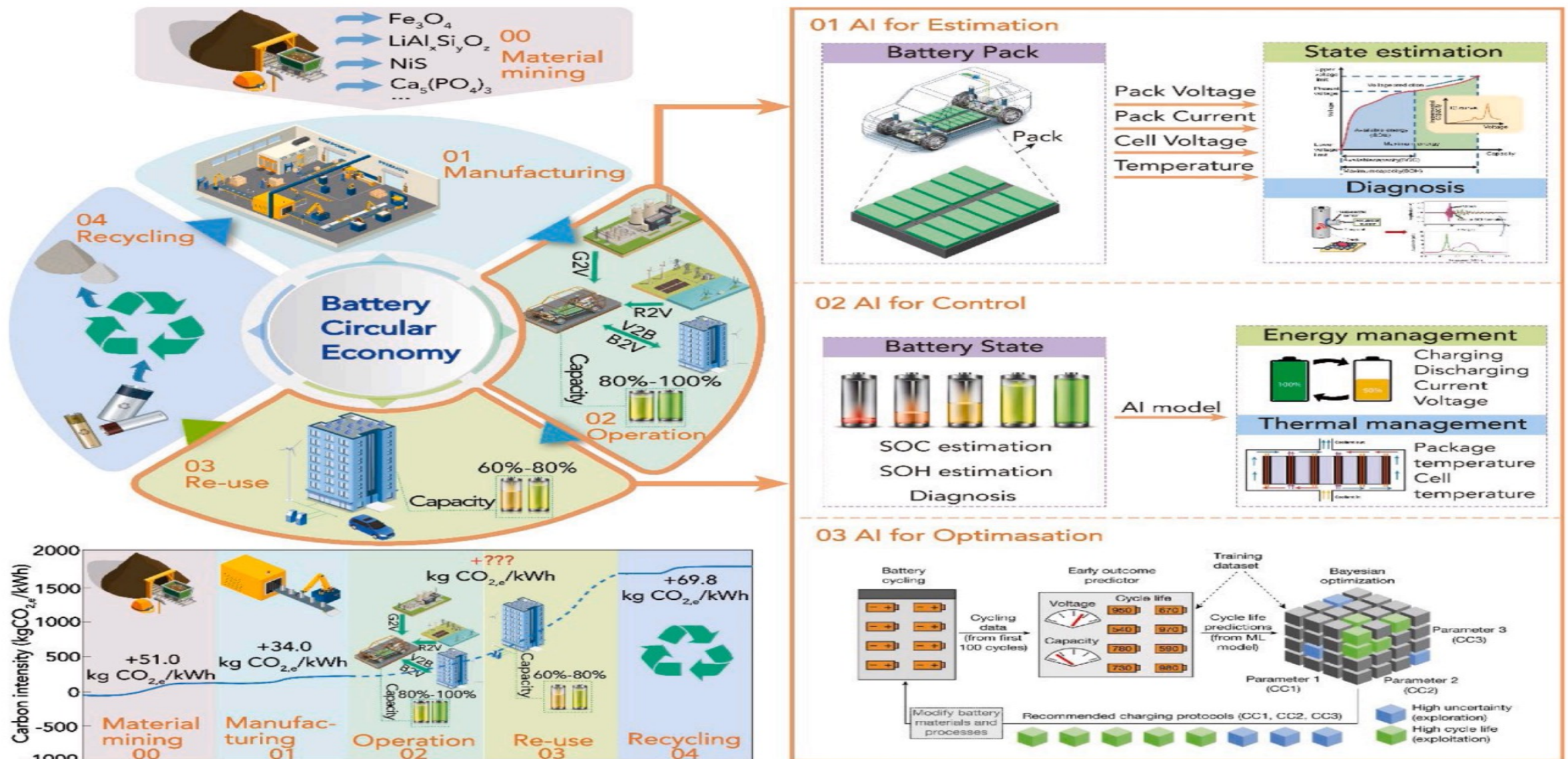
AI-driven digital circular economy with material and energy sustainability for industry 4.0



AI for Circular Economy



AI and Data-driven Battery Circular Economy



AI Technology Applications in Sustainability

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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

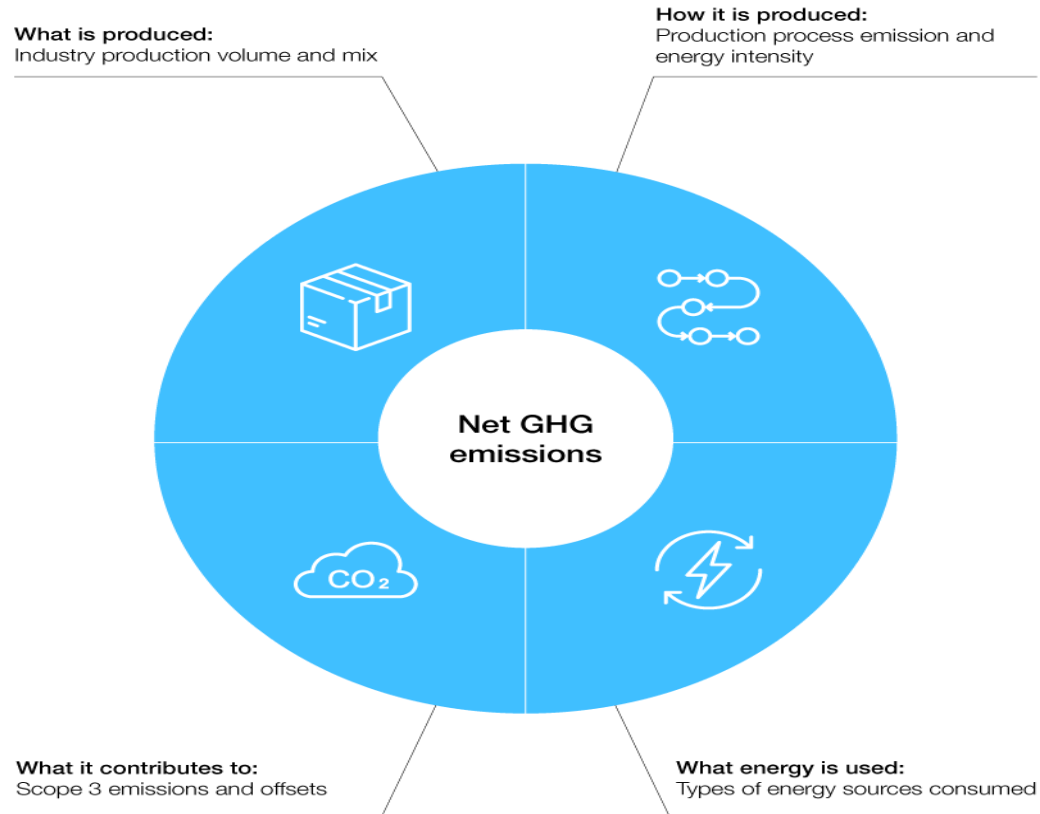
ESG and Net-Zero: The Essentials

- **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 Enablers

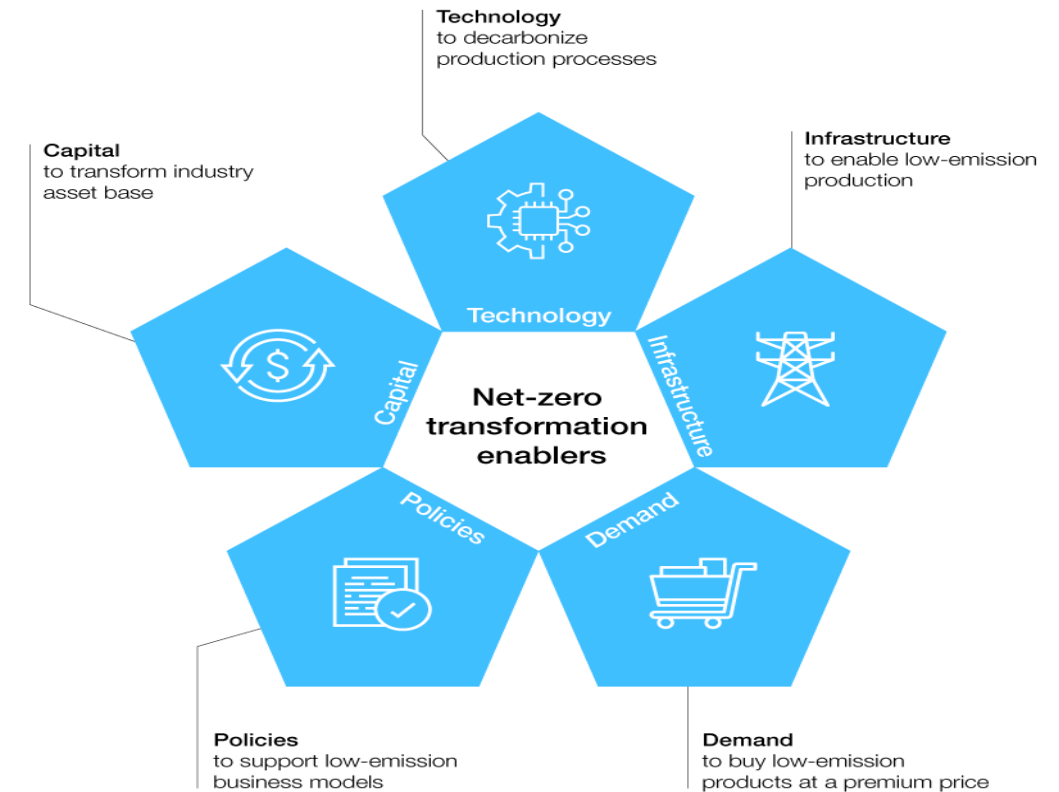
Net-zero industry **performance**

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

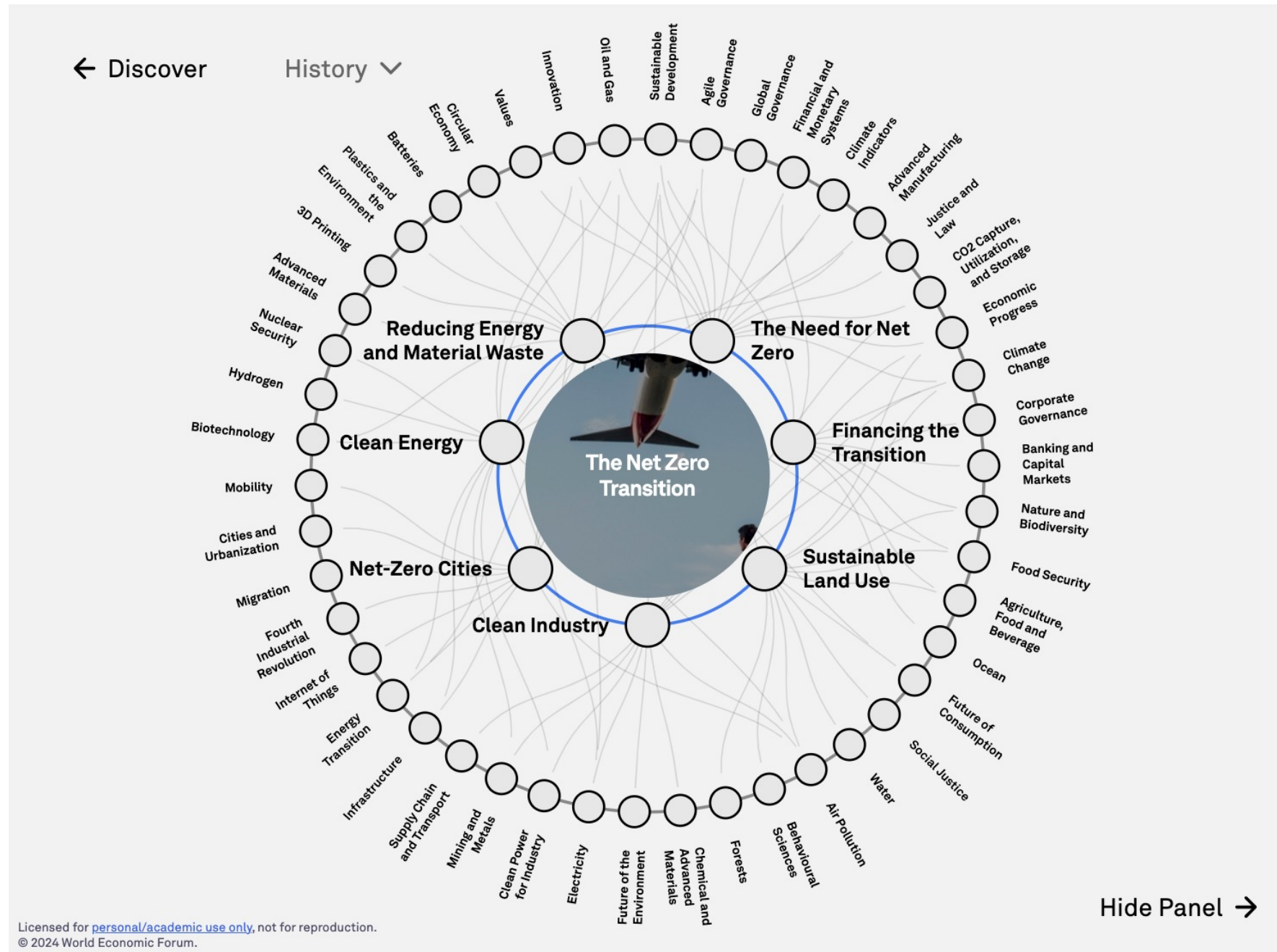


Net-zero industry **readiness**

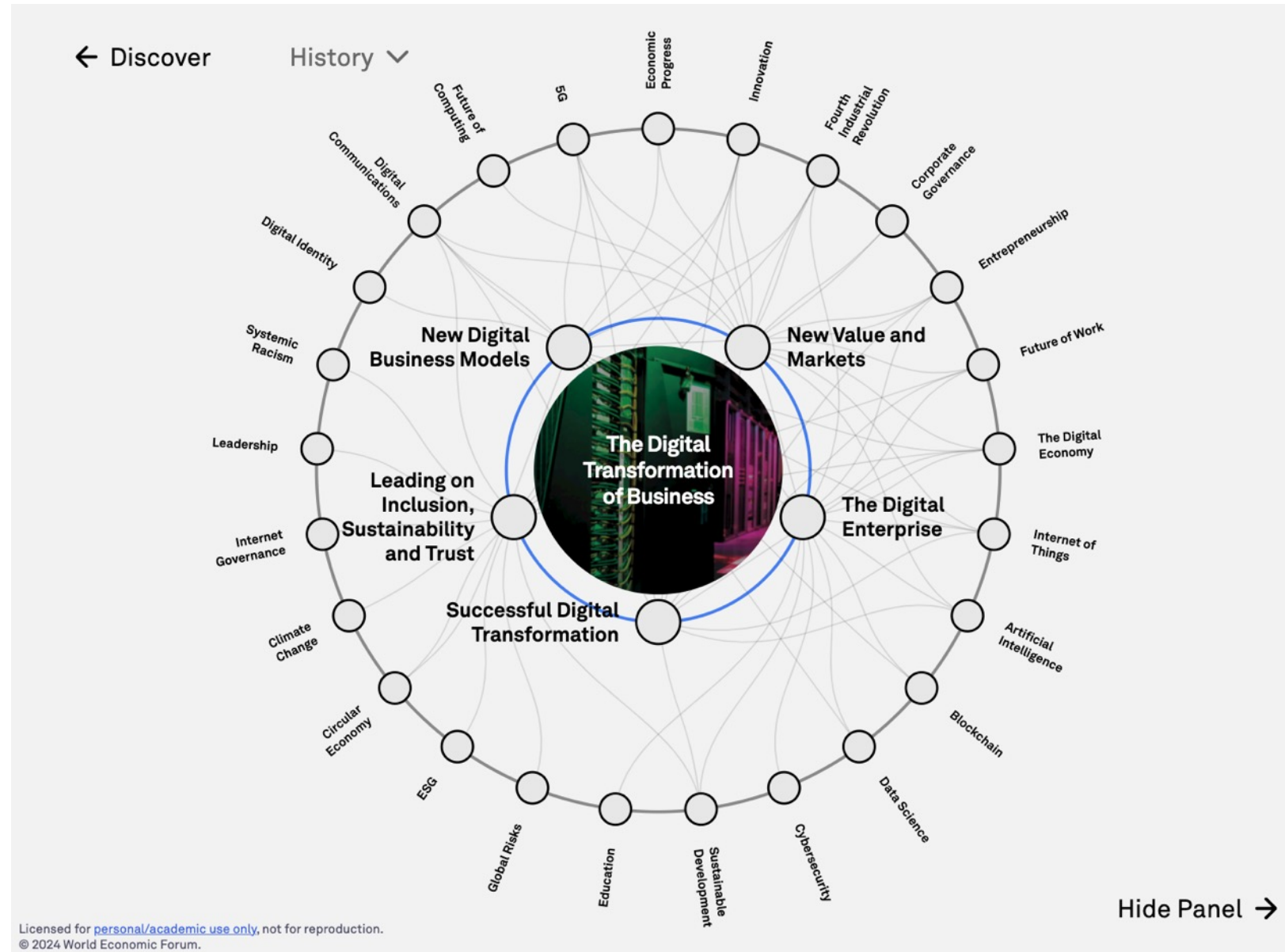
The five enabling dimensions of industry net-zero transformation:



The Net Zero Transition



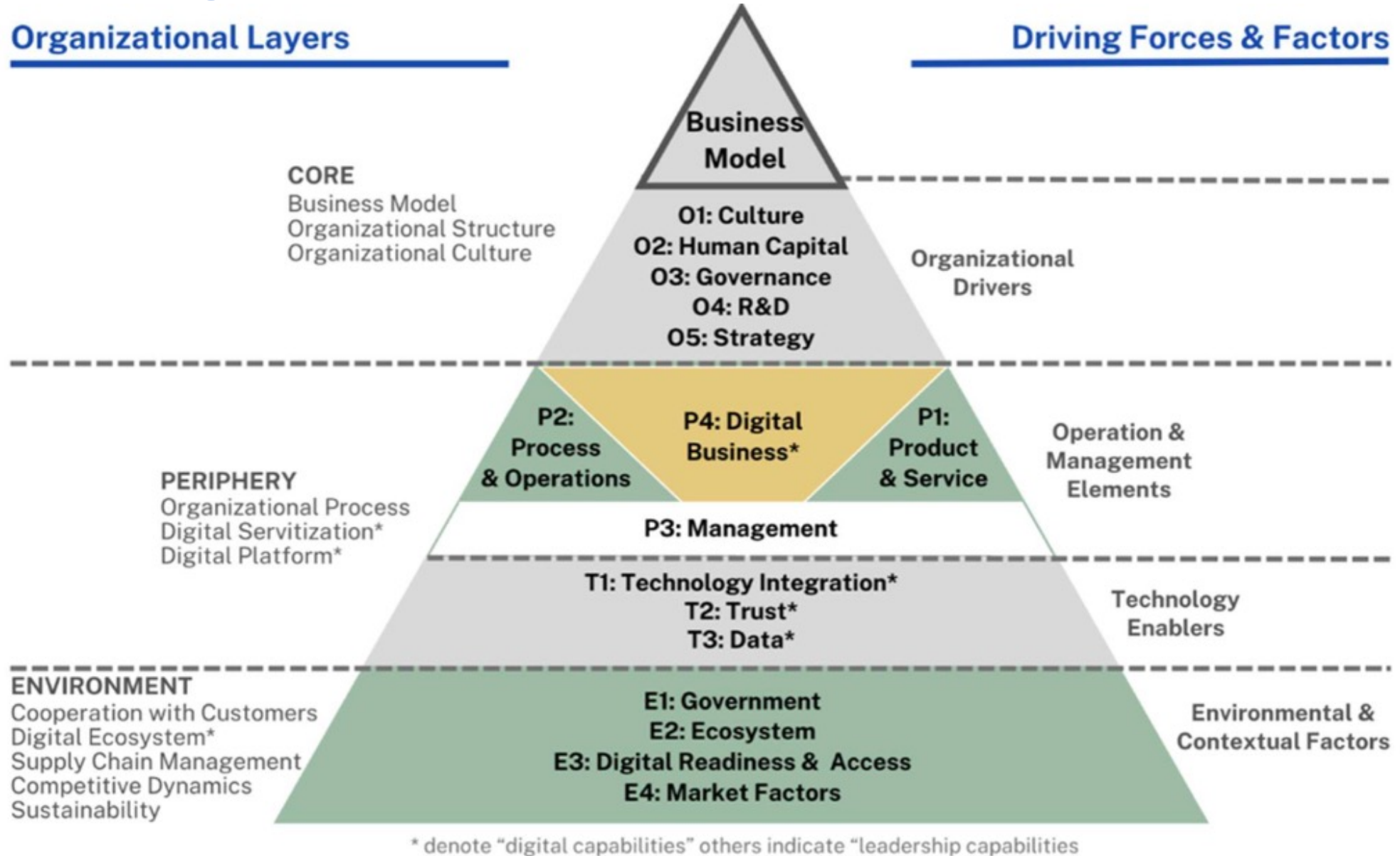
The Digital Transformation of Business



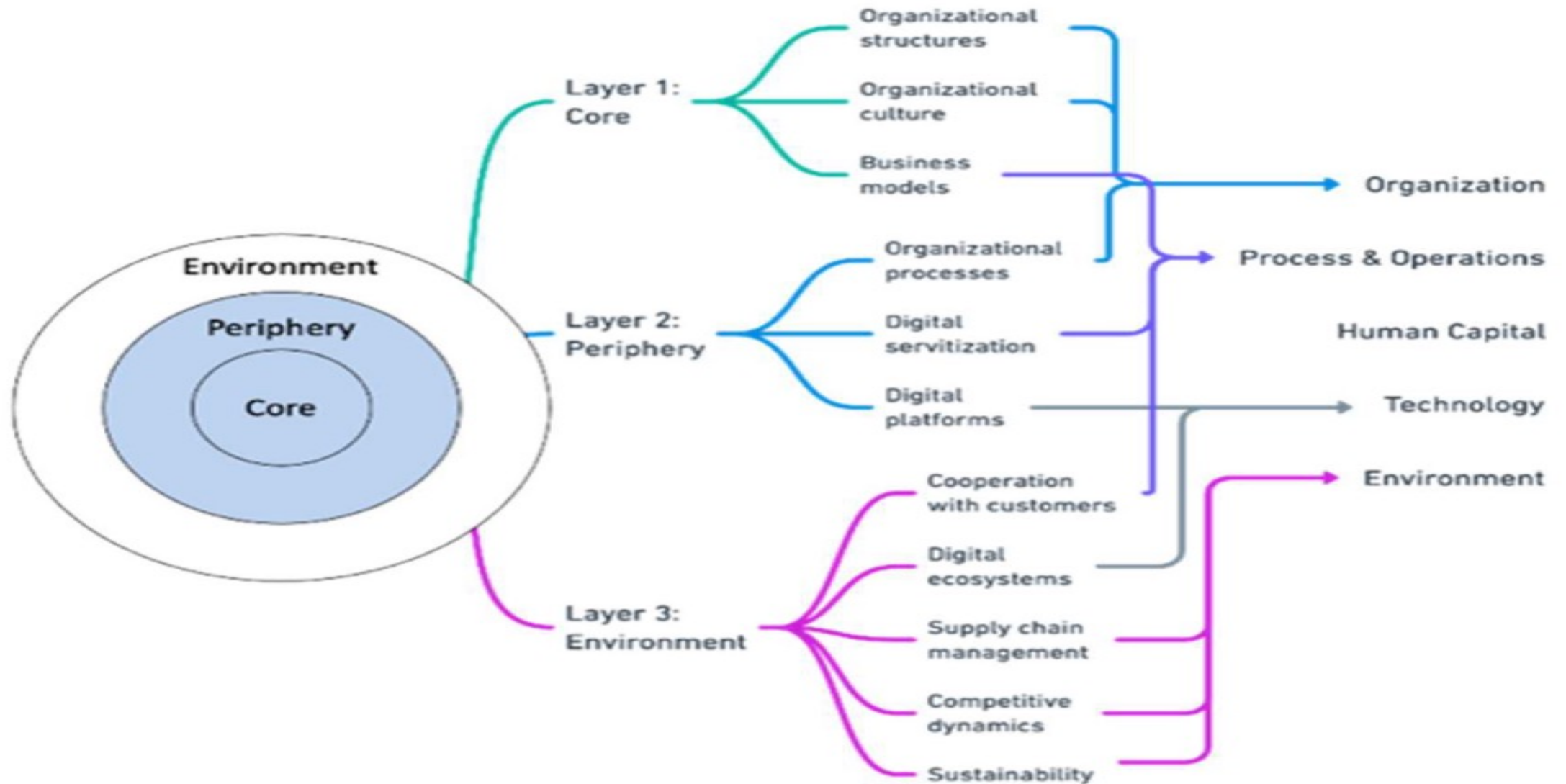
Digital Transformation

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

Digital Transformation Framework



Digital Transformation: Theoretical and practical dimensions



Made with Whimsical

Sustainable Development Goals (SDGs)



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

Evolution of Sustainable Finance Research

SDGs:

Sustainable Development Goals

SDGs

Innovative Financial Instrument

Impact Investing

ESG: Environmental, Social, and Governance

CSR: Corporate Social Responsibility

Conscious Capitalism

Climate Financing

Carbon Financing

Green Financing

Ethical Investing

Socially Responsible Investing

Topic

1986

1995

2005

2015

2020

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

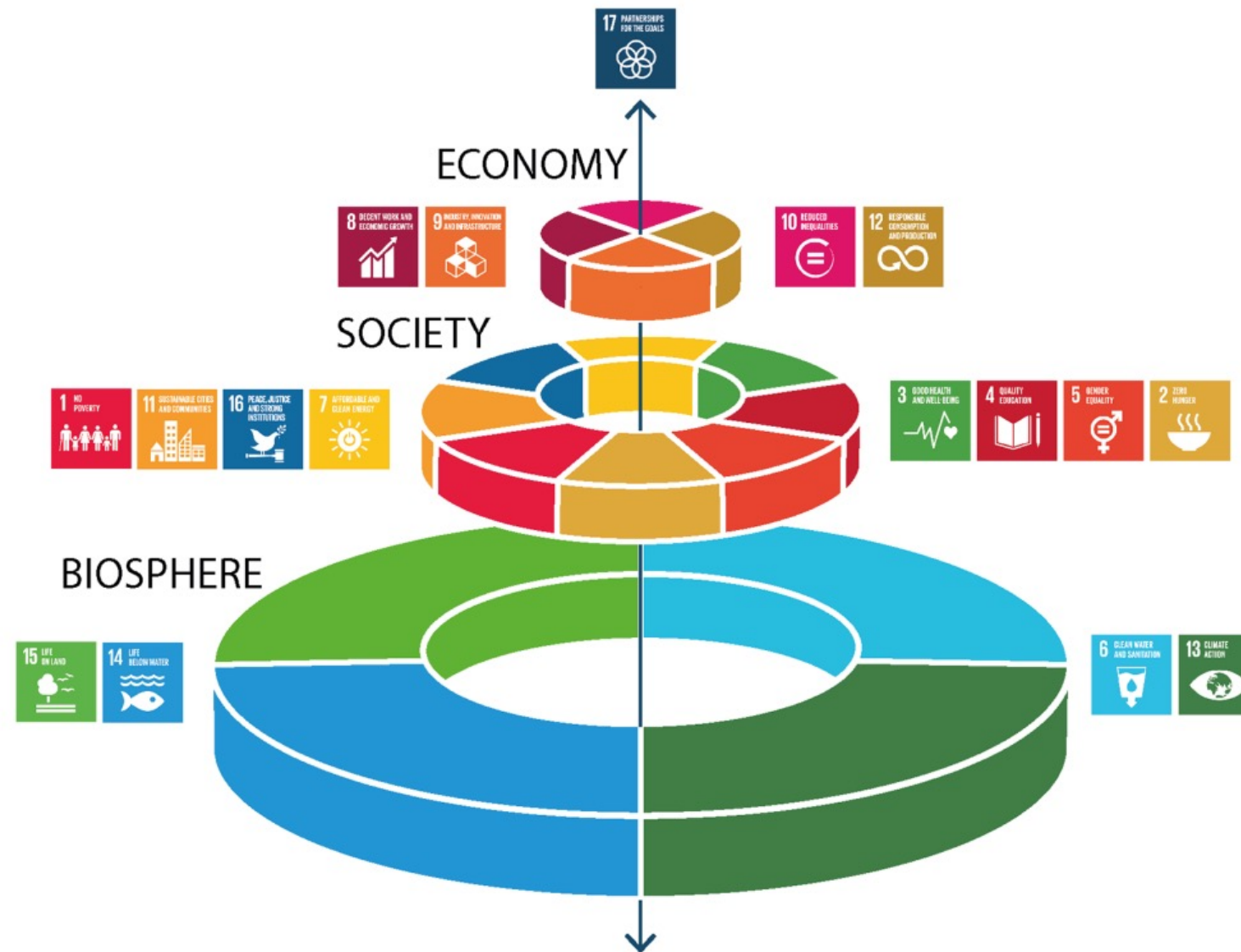
Partnership

Peace

Prosperity

People

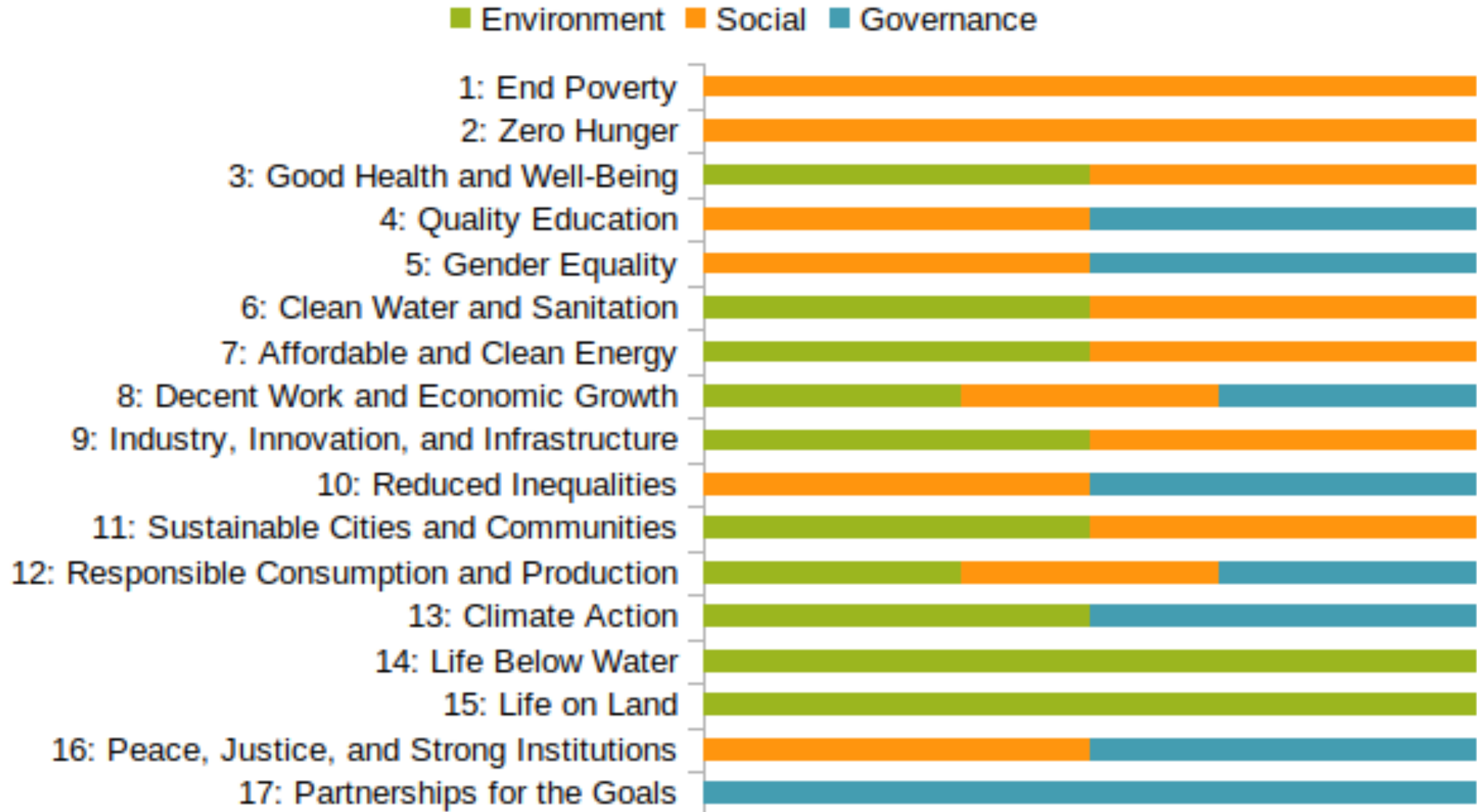
Planet



ESG to 17 SDGs



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**

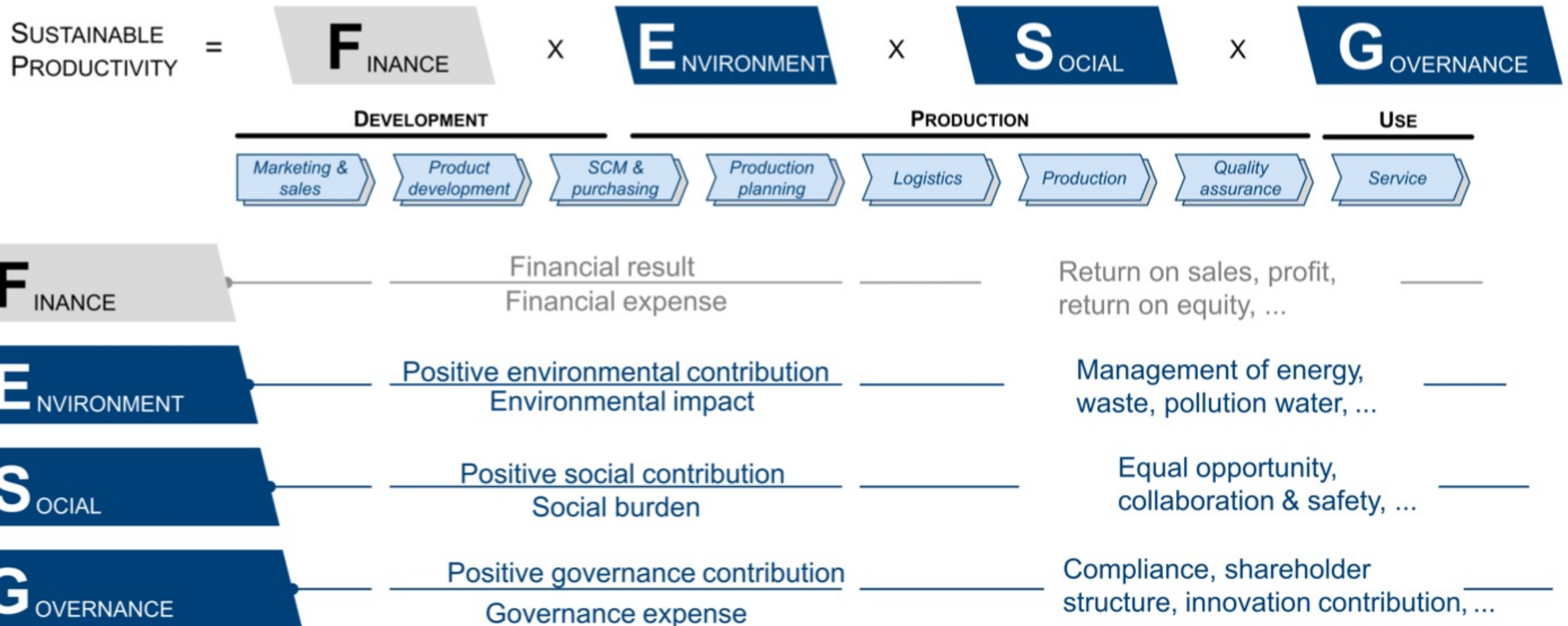
- **Data-driven decision-making, efficiency gains, new business models, collaboration**
- **AI optimizing renewable energy**

- **Challenge**

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

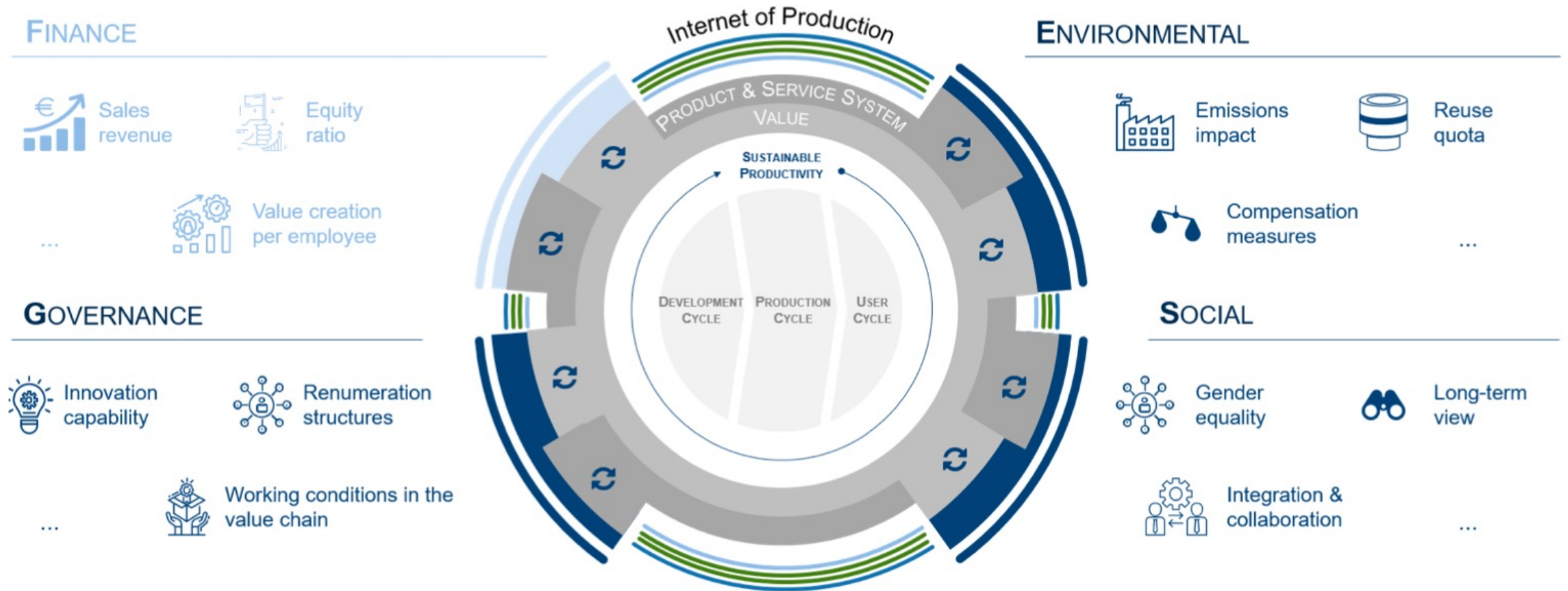
Sustainable Productivity:

Finance ESG



Sustainable Resilient Manufacturing

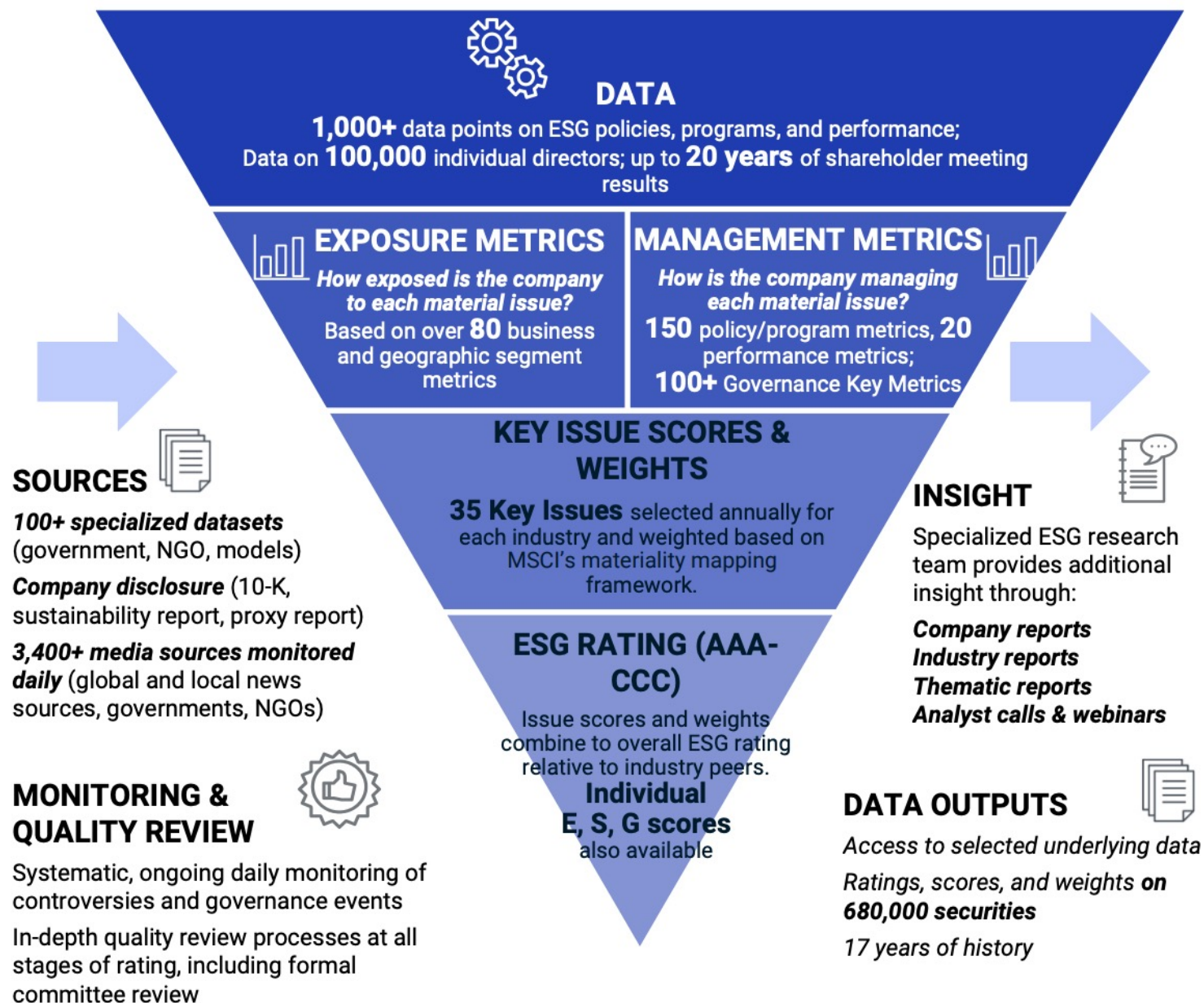
ESG



ESG Indexes

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

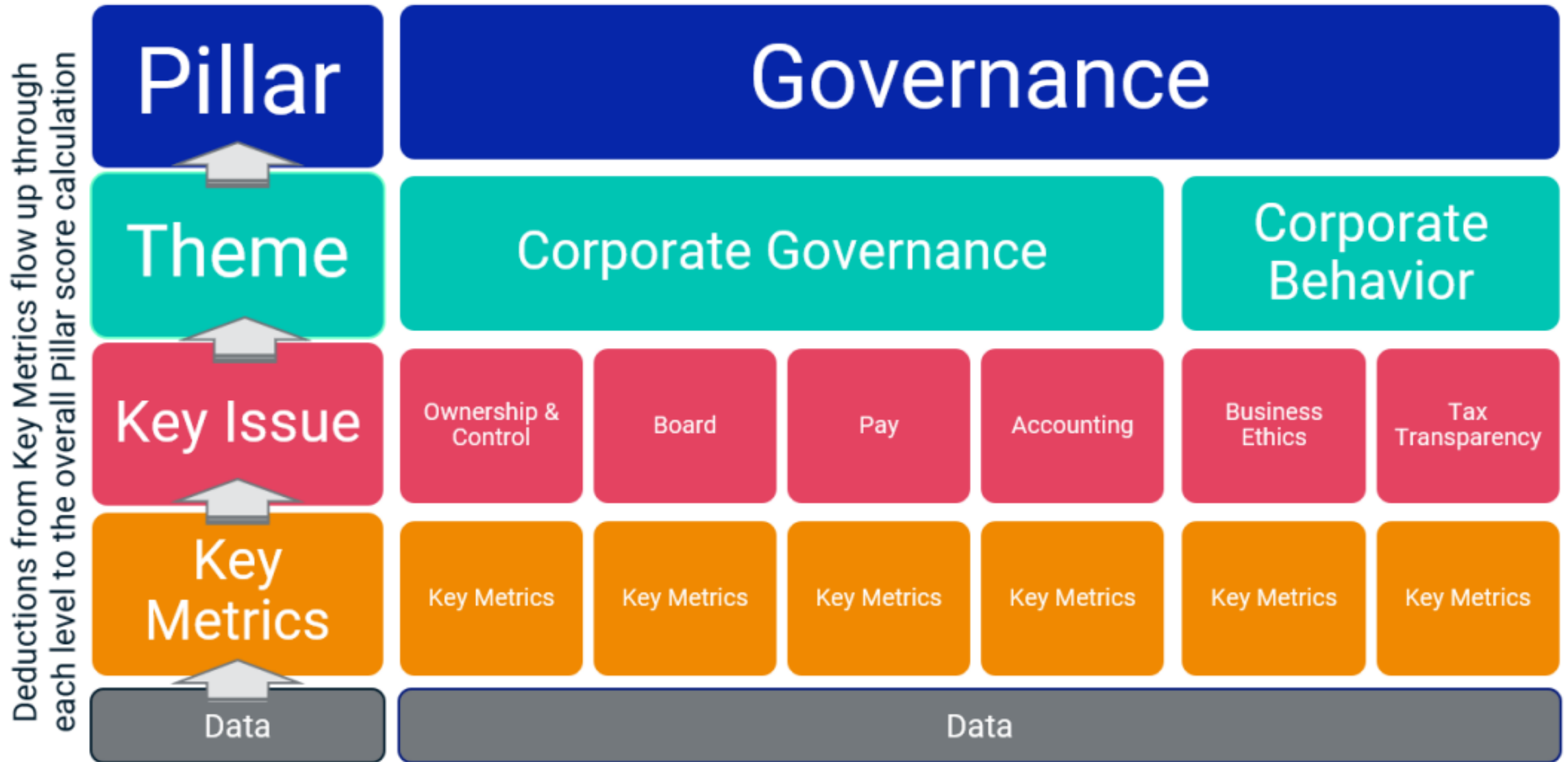
MSCI ESG Rating Framework



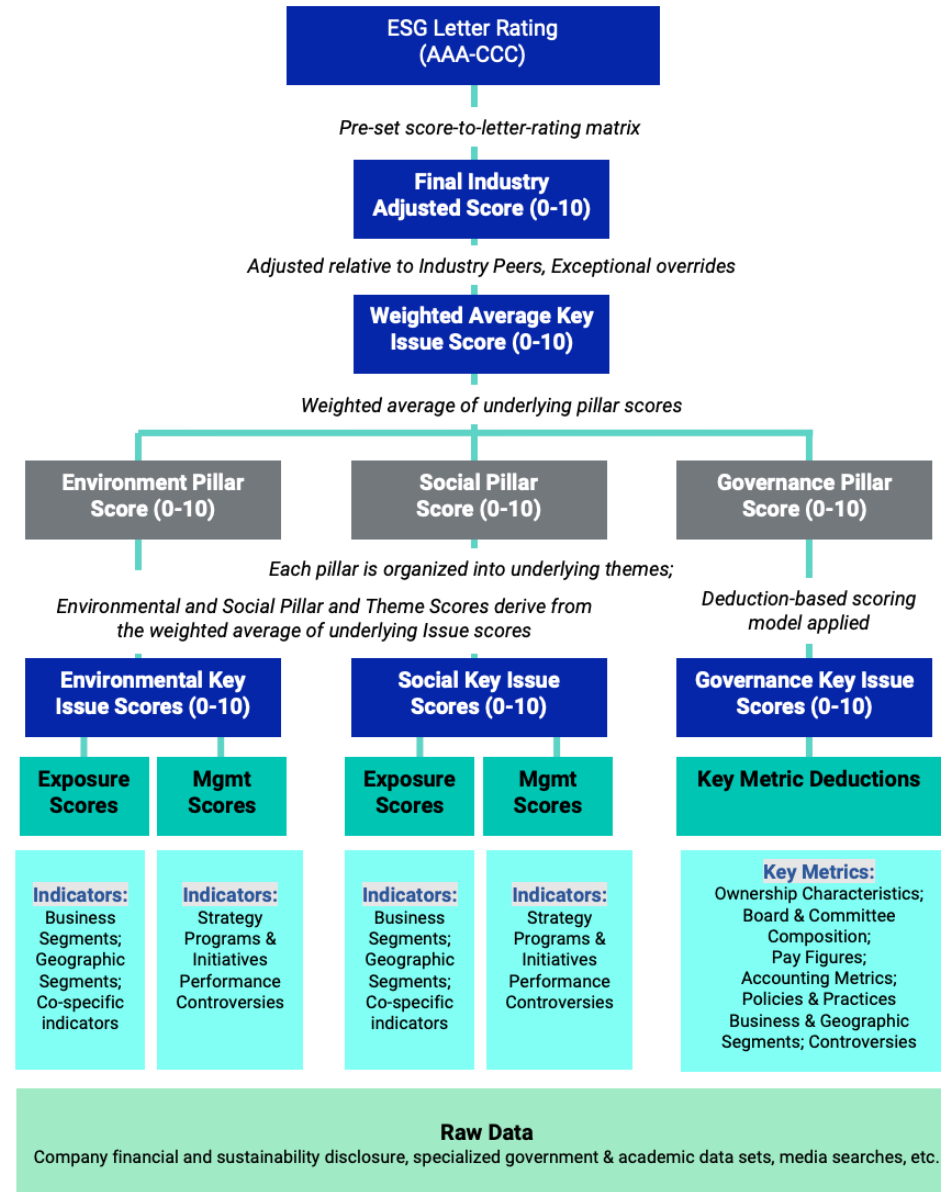
MSCI ESG Key Issue Hierarchy

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

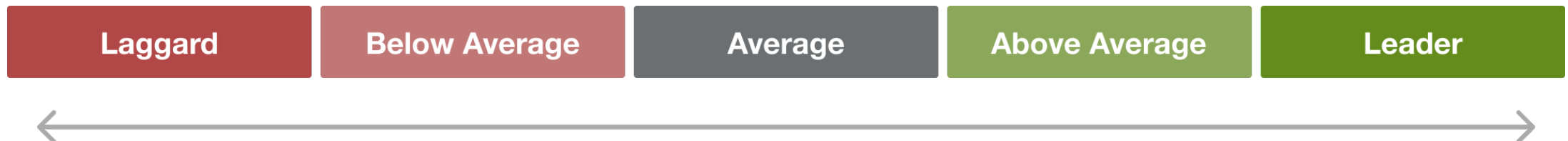
Sustainalytics' ESG Risk Ratings measure a company's exposure to industry-specific material ESG risks and how well a company is managing those risks.

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

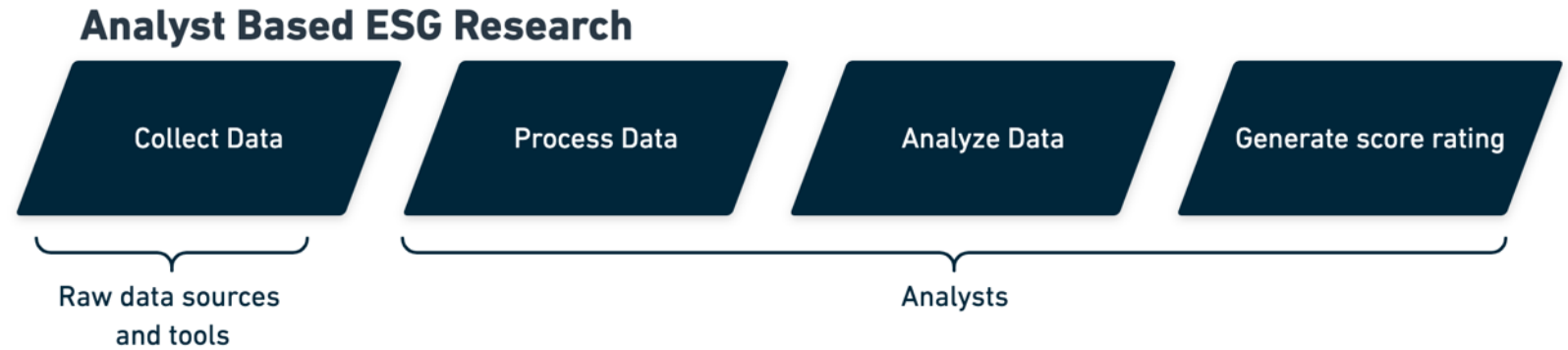
Derives signals from unstructured data



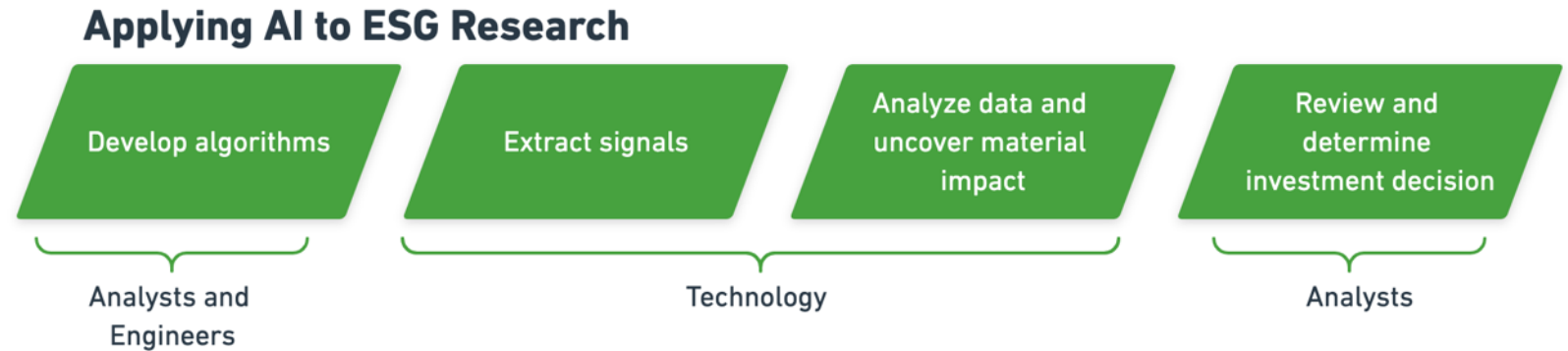
Truvalue Labs

Analyst expertise at the beginning of the process produces consistent results

Analyst based ESG Research

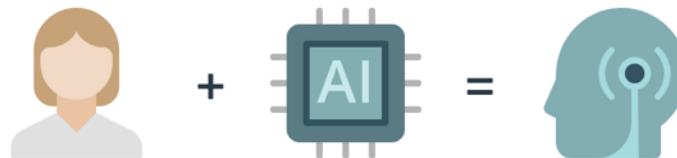


AI based ESG Research



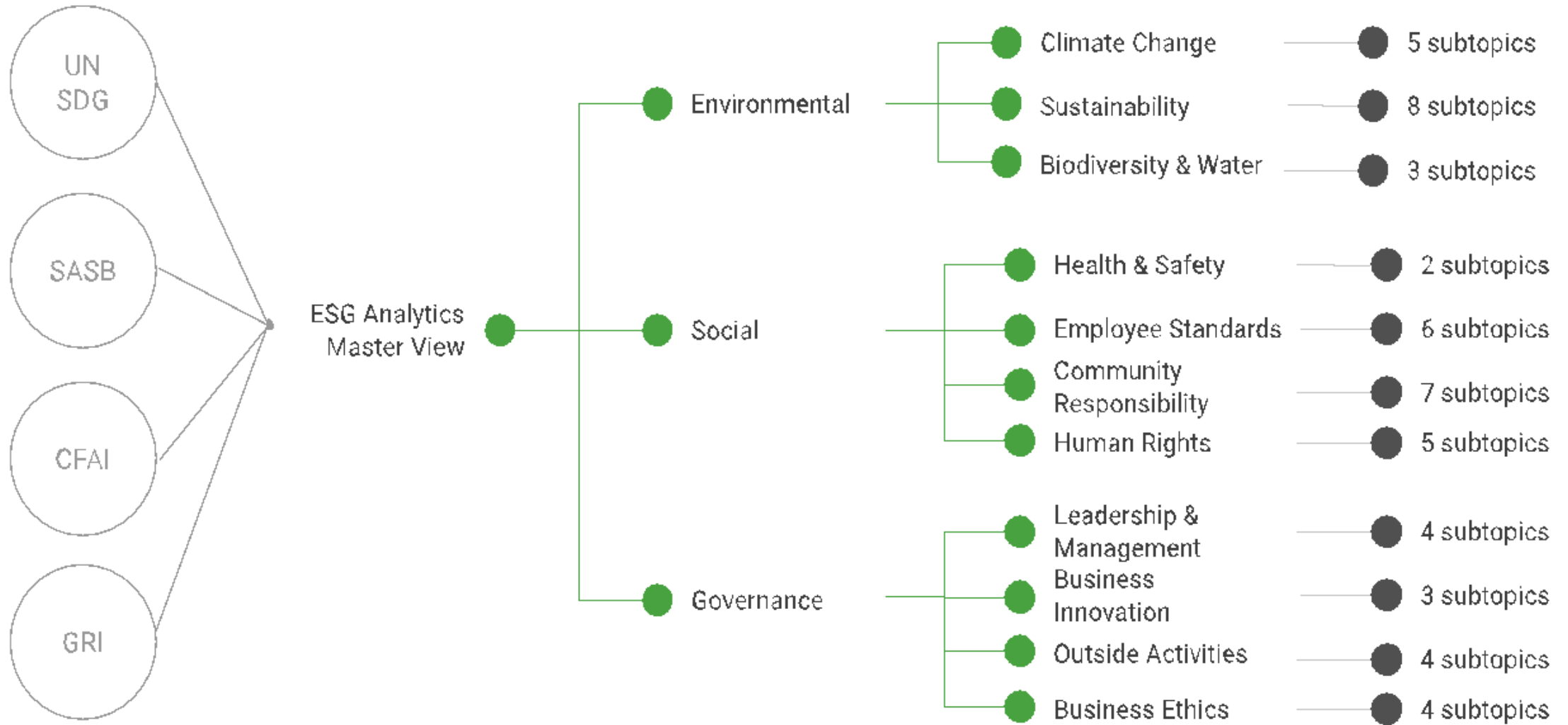
It would take an analyst over 5 years to do what our AI can in 1 week

Combining analysts with AI creates gives you the full picture



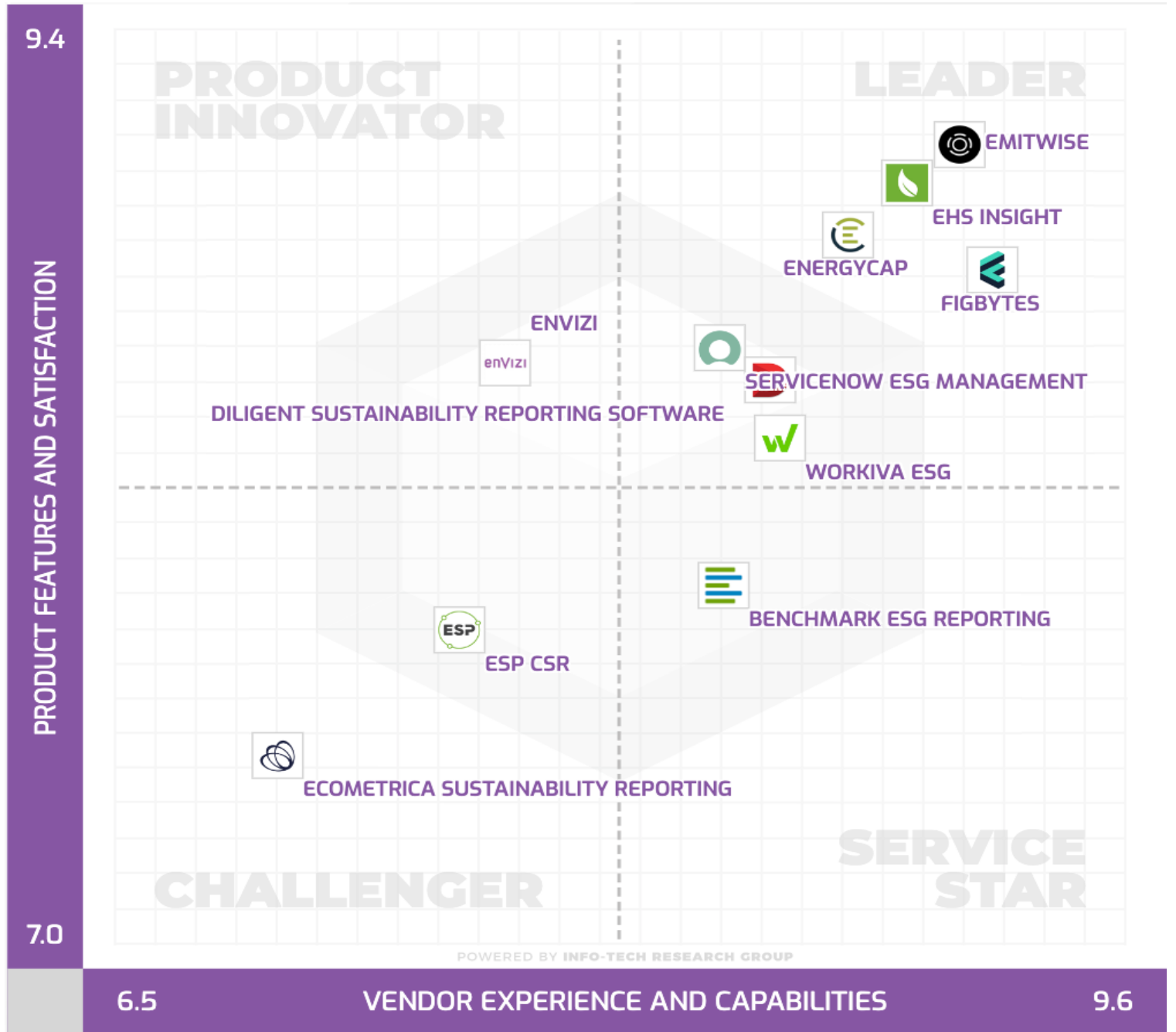
ESG ANALYTICS
Invest where it matters.

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.



Grok 3 Deep Search





Generative AI

 **Completed**
49s · 71 Sources

 Thinking

 **Exploring user intent**

 Researching recent developments

 Investigating healthcare applications

Exploring user intent

- The request is "Generative AI," which feels a bit unclear. It could be asking for a definition, recent updates, or use cases.

 Searching for **"definition of generative AI"**

 10 results found

 **Generative artificial intelligence - Wikipedia** en.wikipedia.org

 **Generative AI – What is it and How Does it Work? | NVIDIA** nvidia.com

 **What is generative AI? - IBM Research** research.ibm.com

 **What is Generative AI? - Gen AI Explained - AWS** aws.amazon.com

 **Explained: Generative AI | MIT News | Massachusetts I...** news.mit.edu

See more (5)

 Browsing results

- Currently looking for a definition from the search results, including sources like Wikipedia and IBM. Generative AI creates

How can Grok help?

  DeepSearch  Think

Grok 3  

Perplexity.ai Deep Research

 perplexity

New Thread

Home

Discover

Spaces

Library

Generative AI

Deep Research

Images

Sources 39

54 steps

linkedin

The Future of Generative AI: Key Trends and Opportunities in...

ciklum

Top 10 GenAI Trends to Watch in Technology 2025 and Beyond

research.aimultiple

Top 100+ Generative AI Applications with Real-Life...

+36 sources

Generative AI: Current State, Applications, and Future Trends in 2025

Generative AI has rapidly evolved into a transformative technology, revolutionizing content creation, business operations, and digital interactions across industries. As of early 2025, this technology has moved beyond experimental phases into mainstream adoption, with McKinsey reporting that 65% of organizations now regularly use generative AI, demonstrating its growing significance in the business landscape 4 .

Understanding Generative AI

Generative AI refers to a sophisticated branch of artificial intelligence that employs machine

Ask follow-up

Deep Research

Networks), which have enabled increasingly sophisticated applications 1 .

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ESG Challenges and Opportunities

- **Challenges**

- Fragmented and unstructured ESG data.
- Lack of standardization and transparency.
- Timeliness of data availability.

- **Opportunities**

- Rising demand for actionable ESG insights.
- Innovation in sustainable solutions and policies.
- Generative AI as a tool for transformation.

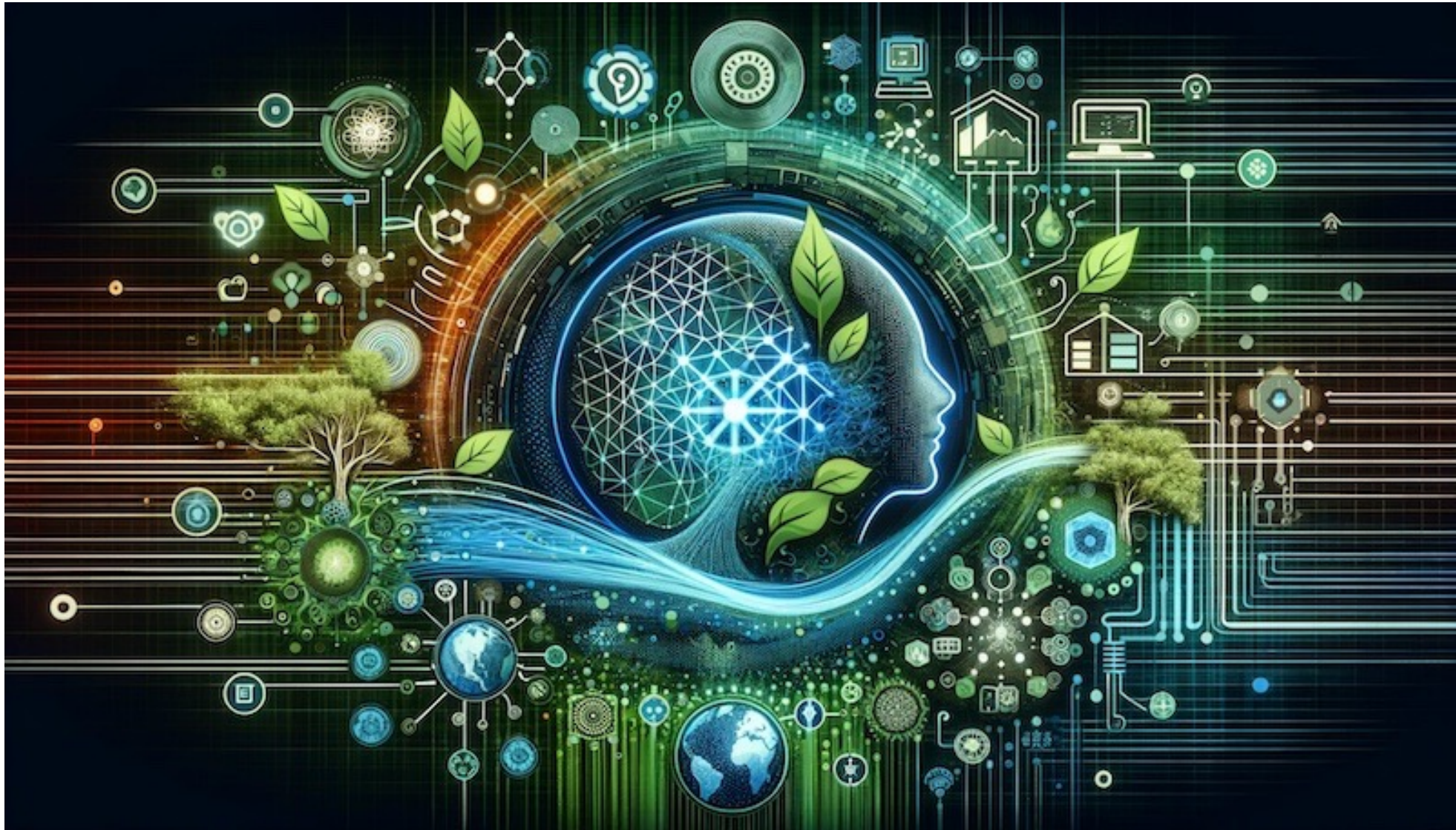
Sustainability and ESG Data Analytics



Generative AI for ESG Data Analytics

- **Data Integration and Enrichment:**
 - Synthesizing structured and unstructured ESG data.
- **Automated Reporting and Insight Generation:**
 - Tailored ESG reports and insights for stakeholders.
- **Scenario Modeling and Forecasting:**
 - Simulating potential risks and opportunities.
- **Addressing Bias and Ensuring Accountability:**
 - Transparent, fair, and ethical AI deployment.

Generative AI and LLMs for Sustainability and ESG Data Analytics



Sustainability Innovation with Generative AI

- **Sustainable Product Design:**
 - Eco-friendly designs minimizing waste and energy.
- **Policy Formulation and Implementation:**
 - AI-driven simulations for effective policies.
- **Stakeholder Engagement and Awareness:**
 - Communicating ESG strategies with compelling AI-driven visuals.

NTPU
國立臺北大學
National Taipei University



Future Directions

- Integrating blockchain, IoT, and digital twins.
- Democratizing AI tools for all stakeholders.
- Promoting collaboration among experts and communities.

Conclusion

- **Generative AI is transforming ESG analytics and sustainability innovation.**
- **Collaboration among researchers, policymakers, and innovators is key.**
- **Generative AI to build a sustainable future.**

Summary

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Acknowledgments: Research Projects

- 1. Generative AI Multi-Agent Systems with LLM-Based RAG for ESG Reporting Automation**
 - NSTC (E4104), NSTC 114-2221-E-305-002-, 2025/08/01~2026/07/31
- 2. Innovative Agentic AI Technology for Autonomous ESG Report Generation**
 - Industrial Technology Research Institute (ITRI), Fintech and Green Finance Center (FGFC, NTPU), NTPU-114A513E01, 2025/03/01~2025/12/31
- 3. Digital Support, Unimpeded Communication: The Development, Support and Promotion of AI-assisted Communication Assistive Devices for Speech Impairment(3/3), Sub-project 3: Multimodal Cross-lingual Task-Oriented Dialogue System for Inclusive Communication Support,**
 - NSTC (HZZ22), NSTC 114-2425-H-305-003-, 3 Years (2023/05/01-2026/04/30) Year 3: 2025/05/01~2026/04/30
- 4. Research on speech processing, synthesis, recognition, and sentence construction of people with language disabilities, Sub-project 3: Multimodal Cross-lingual Task-Oriented Dialogue System**
 - NTPU, 114-NTPU_ORDA-F-004, 3 Years (2023/01/01-2025/12/31) Year 3: 2025/01/01~2025/12/31
- 5. Development of a Deep Learning for Dental Implant Detection in Panoramic Radiographs,**
 - University System of Taipei Joint Research Program (NTPU, TMU), USTP-NTPU-TMU-114-02, 2025/01/01~2025/12/31

Acknowledgments: IFIT Lab Members



Intelligent Financial Innovation Technology, IFIT Lab, IM, NTPU

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- Qinglin Yang, Yetong Zhao, Huawei Huang, Zehui Xiong, Jiawen Kang, and Zibin Zheng (2022). "Fusing blockchain and AI with metaverse: A survey." IEEE Open Journal of the Computer Society 3 : 122-136.
- Ouyang, L., Wu, J., Jiang, X., Almeida, D., Wainwright, C. L., Mishkin, P., ... & Lowe, R. (2022). Training language models to follow instructions with human feedback. arXiv preprint arXiv:2203.02155.

Q & A

AI技術在永續議題下的應用 (AI Technology Applications in Sustainability)

Time: 2025/9/22 (一) 13:30-16:30

Place: 21館200-2, 新竹縣竹東鎮中興路4段195號21館

Host: 薛雅寧, 工業技術研究院 產業學院 策略及跨域訓練部

戴敏育 教授 (Prof. Min-Yuh Day)

國立臺北大學 資訊管理研究所 所長

金融科技暨綠色金融研究中心 主任



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

