CEF

MONTHLY RESEARCH DIGEST

An Executive Briefing on New & Notable Sustainability Research

In This Issue – **April 2026**

Editors: Alissa Stevens, Senior Editor, and Mike Rama, Deputy Director

Please direct comments and questions to Mike Rama, mike@corporateecoforum.com.

CLEAN TECHNOLOGIES

Energy Technology Perspectives 2026

By International Energy Agency

View the full report here

Notable Highlights

- The combined **global market value for clean energy technologies has grown by an average of 20% per year over the past decade, reaching nearly $1.2 trillion in 2025.** By 2035, the **market could reach around $2 trillion** (under current government policies) or nearly $3 trillion (under stated government policies). **Electric vehicles account for about 75%** of the total market value in both scenarios.
- **The market for low-emissions fuels** grew by an average of 7% annually over the past decade, **reaching around $215 billion in 2025.** It accounts for less than 10% of the market for oil-based transport fuels in 2025.
- **80% of global solar PV and wind generation now has lower levelized costs** than coal or gas. **Battery component prices have decreased by 75%** since 2015.
- **China controls 60-85% of production capacity** for solar PV, wind turbines, batteries, heat pumps, and electrolyzers. While other countries could theoretically meet most of their own demand, **every supply chain has at least one critical bottleneck, limiting geographical diversification.**
- The Report Findings include **"dashboards" for 18 technologies across sectors** (including deployment trends, cost competitiveness, and enabling factors) and **strategic considerations to strengthen supply chains**.

Objective

- To examine the state of global clean energy technologies and related materials, including deployment and manufacturing, supply chain vulnerabilities, and industrial competitiveness.

Background

- The quantitative analysis for this IEA flagship report draws on the IEA's Global and Energy Climate model and Manufacturing and Trade model. Input and feedback were provided by dozens of companies, government agencies, multilateral bodies, industry associations, universities, think tanks, and standards/certification bodies (methodology on pg. 8-11, 23-25).

- The scope for deployment spans a range of technologies and materials, with some in early development (e.g., CCUS, SAF). The scope for manufacturing is limited to mass-manufactured tech/components with complex supply chains (e.g., batteries, solar PV).
- Projections are based on three IEA scenarios (2024 baselines):
    - Net Zero Emissions by 2050 Scenario (NZE).
    - Current Policies Scenario (CPS): no change in current energy-related policies.
    - Stated Policies Scenario (STEPS): current energy-related policies that have been adopted, announced, or are in the advanced planning stages.

Report Findings

Clean energy technology deployment (pg. 85-119):

▷ **Subchapters:** market trends (pg. 86), near-zero-emission materials (90), low-emission fuels market (94), global outlook (95), market opportunities (100), investment needs (107), drivers of deployment (109)

- The **combined global market value for clean energy technologies** has grown by an average of 20% per year over the past decade, reaching nearly $1.2 trillion in 2025.
    - **By 2035, the market could reach around $2 trillion** (under current government policies) or nearly $3 trillion (under stated government policies).
    - **EVs account for about 75%** of the total market value in both scenarios.
- **China is the largest clean energy technology market** (accounting for nearly 45% of the global market in 2025), followed by Europe (with average annual growth of 20%+ since 2015) and the U.S. (accounting for less than 15% of the global market).
- **The market for near-zero-emission materials is uncertain due to persistently high production costs and low consumer willingness to absorb them.** The market value of near-zero-emission steel, cement, aluminum, and ammonia is projected to reach $5 billion by 2035 under the Current Policies scenario and $20 billion under Stated Policies.
- **The market value of low-emissions fuels** is projected to reach $390 billion by 2035 under Current and Stated Policies, with around **60% of the growth driven by biofuels expansion**. Stronger policy support is needed to overcome cost premiums.
- **Tech deployment is contingent on manufacturing and enabling infrastructure.**
    - Global investment in production assets for clean energy technologies, near-zero-emission materials, and low-emission fuels was around $245 billion in 2025—

triple that of 2020. Investment in fuel facilities alone is estimated to be equal to investment in oil refineries ($30 billion).

- Investment in enabling infrastructure, primarily electricity grids, was around $430 billion, about 40% higher than in 2020.
- Average annual **investment in production assets is projected to decrease by 60%** from 2031 to 2035 under Stated Policies, while **average annual grid investment is projected to increase by 60%** (details on pg. 108).

Tech deployment dashboards (pg. 123-157):

The report chapter includes detailed dashboards for 18 technologies, breaking down deployment trends, cost competitiveness, and enabling factors.

▷ **Dashboards:** electric vehicles (pg. 124), zero-emission trucks (126), ammonia and methanol propulsion ships (128), building heat pumps (130), air conditioning (132), zero-carbon-ready buildings (134), industrial heat pumps (136), near-zero-emission steel (138), near-zero cement (140), recycling (142), solar PV and wind (144), nuclear (146), geothermal (148), stationary energy storage (150), low-emissions hydrogen, ammonia, and methanol (152), sustainable aviation fuels (154), carbon dioxide removal (156)

- Some **80% of global solar PV and wind generation now has lower levelized costs** than coal or gas. The future pace of deployment hinges on policy support to foster markets and overcome infrastructure bottlenecks.
- Average annual **investment in CCUS grew more than 15-fold** from 2020 to 2025, to over $5 billion. 90% of announced projects have not reached final investment decisions.
- **105 Mt of near-zero-emission steel production capacity** has been announced since 2020—around 5% of global production today and roughly double the conventional capacity added. Only 5% has reached a final investment decision (FID).
- Global **investment in low-emission hydrogen production grew 80%** year-on-year to nearly $8 billion in 2025.
- Global sustainable aviation fuel **(SAF) output is projected to grow tenfold by 2035** (under current policies), reaching 4% of projected jet fuel demand.
- Several technical records for **nuclear fusion** were broken in 2025, and venture capital has flowed into the sector; however, the **timeline for commercialization is uncertain**.
- **Early-stage technologies** (e.g., iron ore electrolysis and solid-state cooling) are attracting increased investment but facing substantial technical and cost barriers. They are **unlikely to reach significant market shares** within a decade.

Clean energy tech manufacturing and trade trends (pg. 177-208):

▷ **Subchapters:** global investment and trade (pg. 178), policy landscape (185), manufacturing project pipelines (194), prices and profitability (200)

- In the **U.S., tariffs and duties contributed to increased domestic production of solar PV modules (over 40%) and battery cells (over 25%)** from 2023 to 2025. Production tax credits still in place in 2025, as well as shifting trade patterns, are offsetting around half of the estimated increase in average costs for imports and domestic production.
- **Industry profit margins have tightened across the board.** Solar PV manufacturers have seen margins collapse under intense price competition, notably in China, where the top 10 firms posted $4.5 billion in losses in 2024.

Clean energy tech manufacturing and trade outlook (pg. 217-262):

▷ **Subchapters:** global trends (pg. 218), solar PV outlook (226), wind outlook (235), EV and battery outlook (244), electrolyzer outlook (256), heat pump outlook (259)

- **The trajectory of clean tech manufacturing investment will be shaped by efforts to diversify supply chains.**
- China remains the largest producer of solar PV modules. **Stronger policies could bring the U.S. close to self-sufficiency for solar PV** module production by 2030.
- The US project pipeline for battery cell manufacturing is sufficient to meet US demand for electric vehicles through to 2030.

Supply chain risks (pg. 269-292):

- **Subchapters:** supply chain security (pg. 270), supply concentration (271), implications for security and resilience (274), technology-specific security considerations (283), maritime chokepoints (286)

- **The economic impact of supply chain disruptions varies across technologies.**
  - **A month-long disruption** to battery exports from the largest supplier is estimated to cause **$17 billion in output losses at EV plants** elsewhere.
  - A month of disruption to Chinese exports of solar components would cause solar PV module production plants outside China to lose around $1 billion in output.
- Increased digitalization exposes energy technologies' control systems and distribution grids to new, evolving **cybersecurity risks**.

Industrial competitiveness (pg. 297-346):

▷ **Subchapters:** drivers of competitiveness (pg. 298); regional manufacturing trends (304); the competitiveness of energy-intensive industries (312); the competitiveness of solar PV (331), wind turbines (335), batteries (338), heat pumps (342), electrolyzers (344)

- **Production costs are the most significant factor** in shaping the competitive advantage of clean energy technologies.
- **Energy costs can account for over two-thirds of production costs in upstream industries,** making them critical to the competitiveness of producing near-zero-emissions materials. In the U.S. and China, **low-cost renewables could make hydrogen-based steelmaking cost-competitive** with conventional technologies.
- **China retains a significant production cost advantage** over advanced economies. However, there are **opportunities across all supply chains to bridge the gap.**
  - In Europe, increasing battery manufacturing efficiency can make up over 40% of the cost difference with China.
  - Closing the gap in energy and labor costs alone could eliminate 65% of China's cost advantage in upstream solar PV manufacturing and 75% of its advantage in wind blade production.
- **Companies must strike a balance between domestic production and imports** of technologies and materials, depending on the industry's strategic importance. For example, producing solar PV modules made in the EU with imported wafers from Africa could cost 20% less than a fully EU-made module.

Strategic considerations for strengthening clean energy technology supply chains (pg. 353-370):

▷ **Subchapters:** intertwined nature of competitiveness and security (pg. 354), supply chain mapping (358), key security and supply considerations (359), prioritizing actions to improve competitiveness (364)

- **Supply chain security and industrial competitiveness go hand in hand:**
  - Diversification improves supply chain security, and it can be further strengthened by increasing domestic manufacturing capacity across countries.
  - However, **if a company optimizes purely for cost**, always buying components from wherever they are cheapest, **it risks leaving the industry more vulnerable** to upstream supply disruptions.

- Efforts to enhance supply security and manufacturing competitiveness must be coordinated to maximize impact. Pages 356-358 include **questions for assessing the progress** of coordinated efforts.
- Pages 364-366 include a **framework for quantifying the benefits** of competitiveness measures and assessing the likelihood of success.

- **Strategic considerations for strengthening clean energy tech supply chains**:
  - **Close the domestic manufacturing cost-competitiveness gap:** Focus on areas where efficiency gains, economies of scale, and innovation can make a significant difference, rather than only addressing structural disadvantages stemming from cheap energy and labor.
  - **Cultivate strategic international partnerships to maximize regions' strengths:** Partner with established equipment makers to increase quality faster, enable transfer of know-how, and strengthen local supply chains. High-yield factories (i.e., with less waste and fewer defects) can help lower costs.
  - **Implement policy measures** that lower energy prices and foster innovation and economies of scale.

Clean Investment Monitor: Tracking Global Clean Technology Investment

By Rhodium Group, MIT Center for Energy and Environmental Policy Research

View the full report here

Notable Highlights

- **Global clean tech investment reached a record $1.96 trillion in 2025,** triple the amount from 2018 ($627 billion).
- However, **investment growth has slowed, increasing by just 7%** in 2025 after a 28% increase in 2023.
- **Investment in electric power deployment** increased from around $443 billion in 2018 to a **record $948 billion in 2025, led by solar,** which grew by 153% to $458 billion. Wind investment grew by 91% to $250 billion, stationary battery storage investment grew by 2,100% to $66 billion, and conventional nuclear investment grew by 100% to $74 billion.
- **Clean tech manufacturing investment declined by 40%** from peak 2023 levels to $155 billion.
- Global **manufacturing capacity** for solar, wind, batteries, and EVs **exceeded global demand** in 2025 ("overcapacity"). If all manufacturing investments announced to date proceed, **overcapacity is projected to intensify by 2030.**

Objective

- To track global investment in the manufacture and deployment of clean energy and decarbonization technologies in the power, transport, manufacturing, and industry sectors (solar, wind, EVs, batteries, cement, clean iron and steel, and SAF).

Background

- The first two annual editions of the Clean Investment Monitor (CIM) tracked clean tech investment in the United States. This edition tracks investment worldwide.
- The report assesses quarterly manufacturing and industry investment in clean energy technologies in China, Europe, the U.S., India, and the "Rest of the World" from 2018 to 2025 (methodology on pg. 4, 9, 25).
    - Investment and capacity data were captured from the CIM database for over 6,340 projects across over 2,440 manufacturing and industrial facilities.

  - Demand projections for were developed using Rhodium's Global Energy Model and National Energy Modeling System.
  - Global and country-level data are available on the ClimateDeck platform.
- "Overcapacity" refers to technology supply exceeding demand.

Report Findings

2025 global clean tech investment (pg. 2-6):

- **Global clean tech investment in the U.S. and Europe increased** from $255 billion in 2024 to $406 billion in 2025.
- **Investment in China declined by 3%** from 2024 to 2025, to $849 billion. It has accounted for 40-50% of total clean tech investment every year since 2018.
- The **most rapid growth in 2025 occurred in India** (a 46% increase to $101 billion) and the Rest of the World (a 12% increase to $352 billion).

Global investment in clean power and transport technologies (pg. 6-8):

- **Wind energy technology deployment has been uneven** due to permitting constraints, supply chain pressures, and policy uncertainty.
- Investment in **EV purchases grew sixfold** from 2018 to roughly $860 billion. Over 90% was concentrated in light-duty vehicles, though investment in medium- and heavy-duty vehicles is beginning to scale.

Clean tech manufacturing and industry investment (pg. 9-14, 21-23):

- **Global clean tech manufacturing investment declined by 40% from peak 2023 levels to $155 billion in 2025.**
  - Annual investment in solar manufacturing fell by 69% to $31 billion in 2025.
  - EV and battery manufacturing investment declined by 18% and 43% from their 2021 and 2023 peaks, respectively. This was driven primarily by investment saturation in China and the reversal of IRA-led investment in the U.S.
  - Investment in sustainable aviation fuel and clean iron and steel peaked in 2024 at $6 billion and $11 billion, respectively, before declining in 2025.
  - Low-carbon cement investment increased to nearly $1 billion in 2025.
- **Manufacturing investment declined in the U.S., China, and Europe**.

- **US investment in clean tech manufacturing and industry fell by 17%** to $41 billion in 2025. A record $8 billion in projects was canceled due to policy rollbacks, and EV manufacturing projects representing $22 billion in planned investment were canceled due to changes in federal EV standards.
- **China's** battery manufacturing capacity was double domestic demand in 2024. This **led to a 70% reduction** in new manufacturing investments from peak 2023 levels.
- **European** manufacturing and industrial investment increased by 50% in 2023 and 2024, then **decreased by an estimated 20%** in 2025 to $19 billion.

- While announced battery cell manufacturing investments declined slightly, **investment in battery energy storage systems** (used to balance intermittent renewable sources on the grid) (BESS) **reached a record of over $15 billion.**
  - 97% of all new announced US battery manufacturing investments in 2025 were geared toward BESS applications.
  - Several US companies announced plans to shift some battery production from EVs to BESS due to rising data center and renewable integration needs.
- In India, annual manufacturing investment increased by 17% to $11.4 billion. If announced projects are completed, **India will have the largest manufacturing capacity** for batteries, solar, and wind outside China and the U.S. by 2030.
- **Investment diversification is increasing**, with Turkey, South Korea, and other countries forming a **network of regional nodes** across the battery, EV, solar, and critical minerals value chains (details on pg. 13).

Technology manufacturing overcapacity (pg. 15-23):

- Global manufacturing capacity for solar, wind, batteries, and EVs exceeded global demand in 2025 ("overcapacity"). If all manufacturing investments announced to date proceed, overcapacity is projected to intensify by 2030.
  - Solar manufacturing capacity is projected to reach 5-8x domestic demand in China and 2x demand in the U.S. by 2030.
  - 2030 **battery manufacturing capacity is expected to be nearly 3x** the current operational cell capacity and to far exceed projected demand.
  - **The U.S. has the biggest discrepancy with wind manufacturing capacity**, at 4x projected 2030 demand.
  - US electric vehicle manufacturing capacity is projected to be 1-3x demand.

NATURE

50 Investible Opportunities for a New Nature Economy

By World Economic Forum (WEF), in collaboration with Oliver Wyman

View the full report here

Notable Highlights

- The report identifies **51 investible opportunities** for water, circularity, bioeconomy, technology, regeneration, and process/product redesign **that can generate commercial value while supporting nature-positive outcomes.**
- **Most of the 51 investible opportunities could collectively generate $10.1 trillion in global annual business savings or revenue** across sectors by 2030.
- The **Supplementary Appendix** provides a **detailed analysis of all opportunities**, including business cases, financing and de-risking instruments, and nature impacts.
- The Report Findings include **priority actions for financial institutions** to drive nature-positive economic growth.

Objective

- To highlight 51 investible opportunities across 13 sectors that can generate commercial value while supporting nature-positive outcomes.

Background

- The report builds on WEF's Nature Positive Transitions series.
- A shortlist of 51 nature-positive opportunities across 13 sectors was selected from around 250 opportunities (methodology on pg. 2, 10-12, 15-16).
    - Opportunities were assessed for a positive impact on business financials and on five nature-impact drivers aligned with the TNFD (land-use change, ocean-use change, freshwater use, resource use, and pollution).
    - They are categorized into four archetypes (defined in the Report Findings below) based on their tech maturity and capital intensity (pg. 15).
- The analysis focuses on five financing mechanisms: bonds, loans, equity, de-risking, and Other (e.g., ESG funds).
- "Nature-positive" refers to the global halt and reversal of nature loss by 2030.

Report Findings

51 investible nature-positive opportunities (pg. 9-14):

Opportunities are categorized into four archetypes below based on their tech maturity and capital intensity. The Supplementary Appendix includes a detailed analysis of each opportunity.

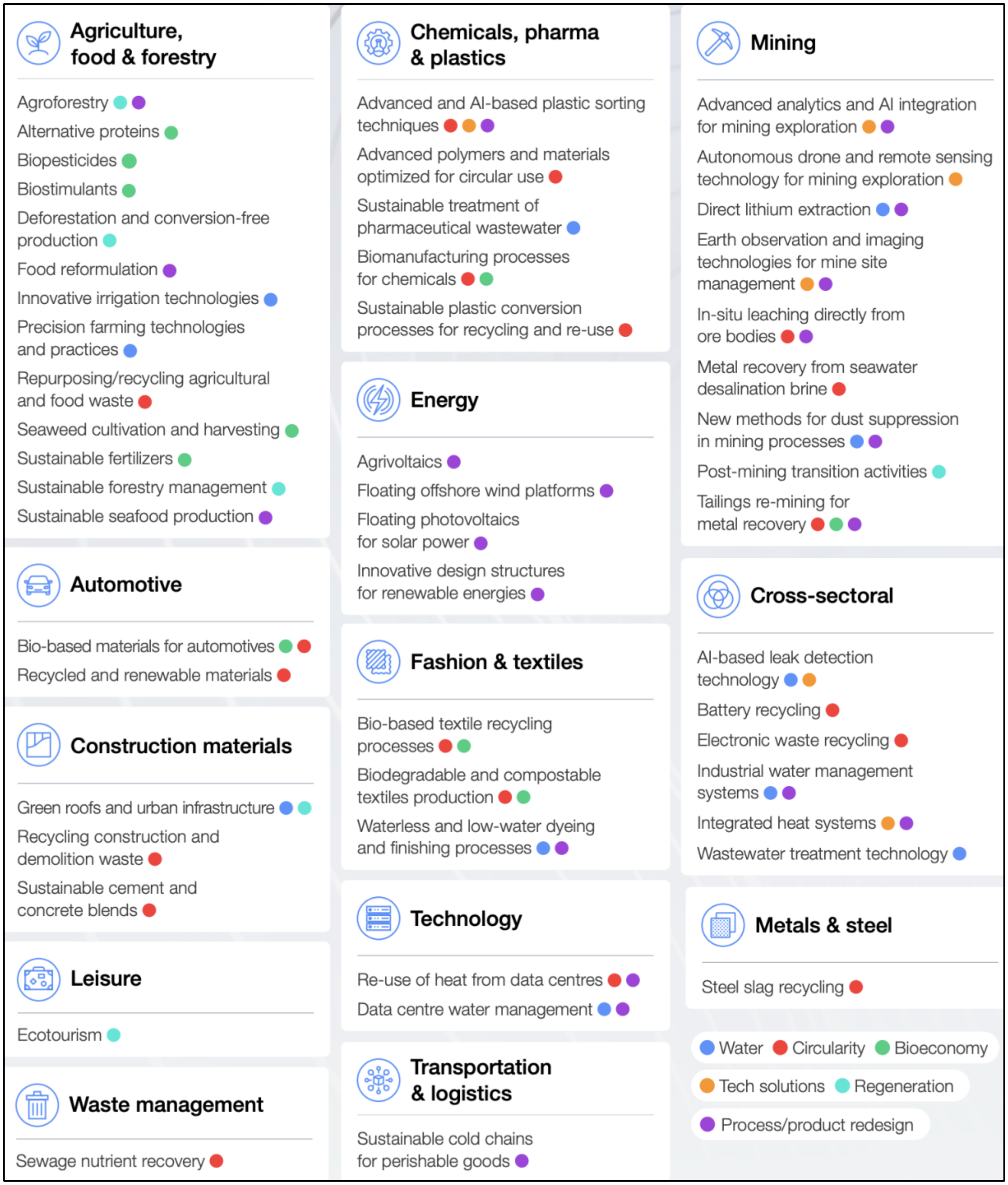

Image taken from pg. 10

NOTE: Each report section includes a chart of the investible nature-positive opportunities, including their primary nature and financial impacts, co-benefits, tech maturity, capital intensity, and scalability.

Archetype #1: Operational Uplift opportunities (pg. 17-20):

Operational Uplifts are proven to deliver efficiency gains and risk reductions and often include lower capital needs and shorter payback periods.

▷ **Pages 17-19 break down Operational Uplifts across sectors** (e.g., deforestation- and conversion-free production, industrial water management) **and include case studies.**

- Operational Uplifts are **quick wins that companies can accomplish within limited sustainability budgets.**
- However, these opportunities **can be difficult to finance** because individual projects are typically small, fragmented, and lack a clear asset base to secure loans.
- **Banks can overcome this by** pooling similar small loans and standardizing their terms, or by financing through general-purpose loans tied to KPIs. Once aggregated, these loans can be repackaged into larger instruments that attract a broader set of investors.

Archetype #2: Scalable Opportunities (pg. 20-23):

Scalable Opportunities have demonstrated viability through pilots or at the local level and require demand certainty and/or a defined risk allocation to scale up.

▷ **Pages 21-23 break down Scalable Opportunities across sectors** (e.g., AI-based plastic sorting, sustainable cement and concrete) **and include a case study.**

- **Companies can seize a first-mover advantage** by pioneering new products and business models, **and help scale opportunities** by sharing case studies and best practices, and collaborating on the underlying market infrastructure.
- **Key barriers to scaling up** these opportunities include **higher production costs**, a lack of **supporting infrastructure**, **green premiums** for sustainable products, and skepticism about consumers' willingness or ability to pay such premiums.
- Business leaders are also having **optimistic experiences with green premiums**, finding that they reflect added value beyond sustainability benefits, aren't necessary, or don't need to be the only solution to higher production costs (examples on pg. 20).
- Given that these opportunities typically require demand certainty, a track record of performance, and insurance for residual risks, **suitable financing structures embed de-risking features** within mechanisms such as blended financing.

Archetype #3: Emerging Innovation opportunities (pg. 24-28):

Emerging Innovations are early-stage ventures with significant upside potential that require staged investment to increase technological and commercial maturity.

▷ **Pages 24-27 break down Emerging Innovations across sectors** (e.g., floating offshore wind, irrigation techniques) **and include two case studies.**

- **Emerging Innovations span a range of sectors and applications**, including bio-economy innovations (e.g., bio-based materials), the deployment of technologies in new ways (e.g., floating photovoltaics), and novel technologies that improve efficiency and reduce resource loss (e.g., AI-based leak detection).
- **New structures often must be created to help Emerging Innovations reach commercialization,** including:
  - Market-ready contracts with potential buyers to support due diligence and underwriting (e.g., standardized purchase agreements)
  - Common measurement, reporting, and verification (MRV) protocols and data tools to make performance verifiable and comparable
  - Clear pathways for new solutions to plug into existing business processes and infrastructure and be operationalized consistently
  - Availability and performance guarantees (e.g., to cover losses due to technology underperformance)
- **To increase the technological maturity** of Emerging Innovations, companies can **increase R&D budgets in high-potential areas** and invest in innovative start-ups and business lines.

Archetype #4: Ecosystem Opportunities (pg. 29-33):

Ecosystem Opportunities require coordinated action across value chains to aggregate supply, demand, data, and infrastructure for scale-up.

▷ **Pages 30-31 break down Ecosystem Opportunities across sectors** (e.g., e-waste recycling, the reuse of heat from data centers) **and include a case study.**

- Successful collaborations often combine the strengths of large established players with the innovative agility of start-ups.
- **Key barriers** include the complexity of coordinating multiple stakeholders with differing objectives and priorities, as well as the **need for shared infrastructure and data platforms.**
- **Financial institutions can enable the scale-up** of Ecosystem Opportunities by **using a range of financing instruments** tailored to different actors (see examples on page 32).

- **Financial and policy support should be designed to enable collaboration, risk-sharing, and coordination** across the ecosystem (e.g., logistics infrastructure to ensure consistent feedstock flows, shared infrastructure to build common assets).

Priority actions for financial institutions to drive nature-positive economic growth (pg. 34-36):

- **Build institutional "nature fluency" to mainstream nature-positive investments and finance.**
  - Use existing net-zero climate strategy and governance as an entry point to expand climate risk assessments, transition plans, and sustainable finance frameworks to cover nature-related risks and opportunities.
  - Enhance practical capabilities across the front office, risk, and product teams to build awareness and support client discussions.
  - Update risk appetites, credit and investment policies, eligibility criteria, procurement standards, and product governance and sustainable finance policies to embed nature-positive priorities into day-to-day operations.
- **Use conversations about nature-positive transition plans and strategies as a reference point to identify nature-positive investible opportunities across operations and supply chains.**
  - Make nature transition planning a standard entry point for client dialogue.
  - Assess everyday capital expenditure to identify projects that contribute to nature-positive goals.
  - WEF released guidance for assessing the credibility of corporate nature transition plans.
- **Integrate existing nature-related data within company operations, supply chains, and public sources into risk, underwriting, and portfolio tools.**
  - Early evidence of nature impacts may be directional or incomplete.
  - Signal priority data needs (e.g., asset locations, nature-related impacts and dependencies).
  - Support pilots that improve data quality over time.
- **Foster innovation in financial products and delivery models.**
  - Most nature-positive opportunities can be financed today through standard instruments, such as corporate loans, project finance, and sustainability-linked products, rather than bespoke structures.

- For more complex opportunities, layer in innovative approaches (e.g., blended capital) and de-risking mechanisms (e.g., guarantees or insurance).

- **Build multi-stakeholder coalitions to scale nature-positive opportunities with distinct risk-return profiles and high capital needs,** especially Ecosystem Opportunities and Emerging Innovations.
  - Build the coalition based on the opportunity's risk-return profile to support entire value chains rather than isolated transactions.
  - Collaborate on joint platforms, risk-sharing mechanisms, and real-world pilots backed by procurement and offtake commitments to transition successful solutions into investible mainstream markets.

Societal Benefits of Large-Scale River and Wetland Restoration

By World Wildlife Fund (WWF)

View the full report here

Notable Highlights

- **Water delivers an estimated $58 trillion in economic use value (measurable financial benefit)**, and freshwater ecosystems deliver an estimated $36.4 trillion in annual ecosystem service value (the economic value of nature's benefits to people and industries).
- **Large-scale freshwater restoration can help sequester carbon**, **reduce flood-related risks** and pollution, **increase water supply**, enhance biodiversity and supporting ecosystem services, and improve food security—provided that the measures are appropriate to the given problem and the local context.
- **Proven, measurable examples** of economic, environmental, and social benefits of large-scale freshwater restoration **are provided in the report.**
- **The economic benefits aren't without trade-offs** (e.g., adverse effects on agricultural land, increased methane emissions). **Businesses must navigate competing benefits** (e.g., water supply vs. biodiversity), **evaluate short-term losses** against long-term gains, and mitigate negative socioeconomic impacts.
- The Report Findings include **recommendations for managing trade-offs.**

Objective

- To provide global evidence that investment in large-scale river and wetland restoration delivers measurable economic, environmental, and social benefits.

Background

- The report is based on a technical paper prepared by Badu Advisory Pty and Fluvial Systems for WWF-UK.
- It focuses on large-scale interventions for inland freshwater ecosystems or those connected to river systems: reconnecting rivers to floodplains, rewetting peatlands (restoring water levels), reforesting riparian areas (land alongside freshwater bodies), removing barriers, reducing pollution, and establishing natural water flow patterns.

- The report data is based on a review of studies across all global regions published between 2005 and 2025, as well as literature from NGOs and international bodies like the World Bank and the United Nations (methodology on pg. 22, 78-80).

Report Findings

The business and societal benefits of freshwater ecosystem restoration (pg. 25-43):

NOTE: The following report pages include detailed insights, evidence, and case studies.

Carbon storage and greenhouse gas fluxes (pg. 33-35):

- **Restoration turns degraded wetlands into durable carbon sinks.** While restoration can initially increase methane emissions, the increases are temporary and are outweighed by avoided emissions.
- Rewetting peatlands is a favored wetland restoration measure because they have a high natural carbon storage capacity, and the process is straightforward.
- Restoration across 355-484 million hectares of wetlands **could sequester 3-9% of current global carbon emissions.**
- Field studies in the U.S. and Canada demonstrate that raising water tables in peatlands and floodplains cut CO2 losses by up to 90%.

Water supply (pg. 25-26):

- Freshwater restoration can **improve water yields**, river flows, and infiltration into soils and aquifers, thereby increasing soil moisture and **enhancing baseflows** (which sustain water flows during dry periods).
- In the US Upper Midwest, grassland and wetland restoration **increased baseflows by 40%.**
- In South Africa, removing invasive riparian vegetation **increased annual water yield by 9.1 billion gallons** (about 42% of the output of a new dam) for about 20% lower cost.
- A global review of 61 projects using nature-based recharge (to replenish groundwater) found 50 reported significant increases in groundwater levels.

Biodiversity and supporting ecosystem services (pg. 41-43):

- Biodiversity and ecosystem services are co-produced by the same ecological processes; **the functions that support species also underpin regulating services**, such as flood attenuation and water purification.
- Large-scale river and floodplain reconnection delivers **ecosystem-wide benefits**, including healthier floodplain wetlands and forests and larger fish and bird populations.
- In the U.S., basin-scale dam removal on the Elwha River reopened historical habitats, with eight of nine migratory salmonid species upstream returning within five years.

Pollution reduction (pg. 27-29):

- Healthy freshwater ecosystems maintain water quality through natural processes of filtration, sediment trapping, nutrient cycling, and contaminant breakdown. Freshwater restoration can **improve water quality, resulting in significant reductions in water treatment costs** and improved public health outcomes.
- Wetlands can remove up to 90% of nitrates from agricultural runoff.
- **$1 invested in floodplain restoration today can avoid $5 in future flood losses.**
- Conservation of rivers and their catchments helped New York City **avoid constructing an $8-10 billion filtration plant** and $365 million in annual treatment costs.
- Fencing streams to exclude cattle and revegetating riparian corridors can reduce microbial contamination, improving drinking water and public health.

Flood risk reduction (pg. 30-32):

- Restoring floodplains and wetlands can reduce flood peaks and surges, **significantly reducing flood damage,** often more cost-effectively than hard infrastructure.
- Restoring lost floodplains in the Upper Mississippi Basin could store around 13 trillion gallons of floodwater and avoid an estimated $16 billion in flood damage.

Food security (pg. 36-38):

- Freshwater restoration **supports food security by increasing food production and generating income.**
- Reconnecting rivers can restore migratory fish runs that underpin fisheries: On Maine's Penobscot River, dam removals and fish-passage upgrades enabled annual returns of over 5 million river herring, revitalizing river-dependent fisheries.

- Community co-management and protected breeding areas **can enable predictable harvests:** On the Brazilian Amazonian floodplains of the Juruá and Purus systems, protected lakes harbor substantially larger arapaima (fish) populations than open-access waters, and co-managed lakes yield higher catches.

Culture and well-being (pg. 39-40):

- Freshwater restoration can increase outdoor recreation and tourism, strengthen cultural and spiritual connections, and improve the aesthetic qualities of freshwater systems, **enhancing well-being and supporting local economies**.
- A $10 million investment to restore Muskegon Lake in Michigan generated $60 million in local economic benefits, including higher property values and increased tourism.

Trade-offs of freshwater restoration (pg. 44-46):

- Restoration projects **often involve upfront investment and temporary disruptions.**
- Restoring natural floodplains or reconnecting rivers with wetlands can enhance carbon sequestration and biodiversity but often requires converting farmland.
- Restoring natural river flows can help improve ecosystem health and secure downstream urban water supplies, but it **reduces the water available for agriculture.**
- Projects can impose **uneven costs on communities and sectors**. A barrier to peatland rewetting is the economic impact on farmers who rely on drained peatlands for income.
- Some ecosystem **conditions worsen briefly before improving.**

Recommendations for managing trade-offs (pg. 44-46):

- **Engage stakeholders in restoration planning early:** Assess who gains and loses from actions, and incorporate measures like retraining or revenue-sharing to offset negative impacts. This **can improve the long-term viability of projects** by securing local buy-in.
- **Understand the timing of project costs and benefits** to make informed decisions.
- **Balance the long-term vision with short-term support:** Couple initiatives with assistance, education, and incentives to compensate those affected in the short term.
- **Recognize that different time horizons matter to different stakeholders.** For example, local communities may prioritize short-term livelihoods, while businesses may focus on ensuring resilience and sustainability.
- Single-focus restorations (e.g., designed to maximize one species or service) often inadvertently harm others. **Adopt a multi-benefit approach** to reduce these risks.

RESPONSIBLE AI

Responsible AI in Practice: 2025 Global Insights from the AI Company Data Initiative

By Thomson Reuters Foundation, UNESCO

View the full report here

Notable Highlights

- **44% of companies report having an AI strategy;** however, **87% have not publicly committed to adhering to a formal AI governance framework.**
- 40% reporting having board or committee-level AI oversight, **31% have a dedicated AI governance team or resource, 12% have a policy to ensure human oversight** of AI systems, and nearly 4% report having an AI ethics committee.
- **31% provide evidence of training or reskilling programs** to help employees adapt to an AI-integrated workplace, though only 12% offer structured, comprehensive training across the organization.
- **72% do not report conducting AI-related impact assessments.**
- Of the 44% of companies that report having an AI strategy, **76% show no evidence of having policies to evaluate the quality of data used to train AI systems**. This heightens the risk of embedded bias, the perpetuation of inequities and discrimination, privacy leaks, and the propagation of non-compliant data.
- Pages 70-80 include **case studies on companies' responsible AI practices.**
- The Report Findings include **responsible AI guidance for investors**.

Objective

- To analyze corporate AI adoption and the mechanisms businesses have in place to manage AI risks, and provide responsible AI guidance for investors.

Background

- The report data is based on findings from the AI Company Data Initiative (AICDI) pilot year, including a study of 2,972 companies across 11 sectors and engagement with 14 companies (methodology on pg. 6, 17, 23-27, 70).

- The analysis identified patterns across regions and sectors rather than evaluating individual companies.
- The AICDI framework is grounded in UNESCO's Recommendation on the Ethics of Artificial Intelligence (pg. 17).

Report Findings

Company commitments to AI governance frameworks (pg. 29-33):

- **Of the 13% of companies with a public commitment to adhere to a formal AI governance framework, 53% cite using the EU AI Act**, half of which operate outside the EU. Companies in EU-linked supply chains often meet requirements from the outset, allowing them to avoid costly changes later and maintain smooth access to the EU market.
- **24% adhering to a framework cite adhering to two or more.** This may strengthen governance by widening risk coverage. However, integrating frameworks within a single internal governance system enables companies to combine compliance baselines with human rights and environmental considerations.

Evidence of the implementation of AI strategies is limited (pg. 34-41):

- There is far **less evidence of AI strategy implementation** than of strategic commitments, suggesting that many organizations are building AI governance infrastructure atop established cybersecurity and data protection roles.
- Only **15% of companies say they can trace ethical impacts of their AI systems** to a responsible person or organization at the relevant stages of the AI system lifecycle.
- 97% of companies provide no evidence of a formal AI model registry in public disclosures.

Corporate protection for workers amid AI reshaping jobs (pg. 42-51):

- **Only 14% of companies were found to have policies to mitigate the negative impacts of AI on workers.**
- **Companies should set specific, measurable, and enforceable AI safeguards.** Best practice includes actively engaging workers in developing these safeguards and/or in discussions of potential AI-related issues to understand their concerns.

- 98% of companies did not publish evidence on whether they have an AI-related complaint mechanism.
- **15% report using AI-powered Human Resource tools.** 7% say they consult Diversity & Inclusion staff or processes for AI-related projects, possibly reflecting limited internal capacity or a lack of cross-functional coordination.

Ethical issues related to AI governance and risk management (pg. 52-55):

- **72% do not report that they conduct AI-related impact assessments.** Of the 28% that do, 18% conduct Data Protection Impact Assessments, 11% conduct Environmental Impact Assessments, and 7% conduct Human Rights Impact Assessments.
- Companies largely frame AI governance around data security, privacy, and compliance risks, rather than ethical priorities.
- Only **9% of companies report having bias-mitigation controls**, with 2% obtaining third-party assurance.

Corporate oversight of data underpinning AI systems (pg. 56-62):

- Of the 44% of companies that report having an AI strategy, only 20% report having policies for data sharing with third-party AI solution providers. **Lifecycle accountability is needed for third-party software/data.**

Responsible AI guidance for investors (pg. 81-90):

- **The lack of corporate AI governance and disclosures exposes investor portfolios to** operational disruptions (e.g., due to a lack of workforce protection), legal risk (e.g., algorithmic errors triggering fines), higher regulatory compliance costs, disparities in risk premiums across sectors, and environmental blind spots that create regulatory or reputational backlash.
- Pages 83-85 include an **engagement checklist** to help **understand companies' responsible AI approaches.**
- Pages 86-88 include **responsible AI principles** for evaluating AI-related proxy proposals.
- Pages 89-90 include an investor case study on responsible AI and portfolio engagement.

CHEMICALS

PFAS: From non-stick to stuck in court

By *Planet Tracker*

View the full report here

Notable Highlights

- The report is accompanied by a **PFAS Litigation Risk Dashboard** **companies can use to estimate relative facility-level exposure associated with PFAS**.
- **PFAS litigation is already generating multi-billion-dollar liabilities for companies**, with over 15,000 active US federal lawsuits filed as of January 2026.
- **55% of companies have high PFAS litigation risk** (relative PFAS-related exposure and hotspots), 32% have medium risk, and 13% have low risk.
- If current levels of PFAS pollution in Europe continue, **cumulative societal costs are estimated to reach at least $511 billion by 2050**, leading to stricter corporate regulations, greater litigation risk, and increased compliance and remediation costs.
- **Tackling PFAS releases at the source by 2040 would avoid about $116 billion** of these costs, whereas relying mainly on **end-of-pipe treatment** of polluted water **would push remediation spending to over $1.2 trillion** by 2040.
- The Report Findings include Actions **for companies and investors to phase out PFAS.**

Objective

- To help companies estimate their facility-level exposure associated with PFAS, reduce PFAS-related risk, and shift away from PFAS-dependent business models.

Background

- The analysis focuses on major PFAS-using and -emitting industries in the U.S. and Europe: chemical manufacturing, firefighting foams, textiles, food packaging, cosmetics, waste management, and water utilities.

- The report data is based on Planet Tracker's PFAS Litigation Risk Dashboard, which scores 1,079 public companies and 5,248 associated facilities on their litigation risk (relative PFAS-related exposure and hotspots) (methodology here and on pg. 6, 38-42).
  - Each company receives a composite PFAS Litigation Risk Score (from 1-5), calculated as a weighted average of five component scores (company activity, country regulation, sector profile, area pollution, and population concentration). Higher scores indicate higher litigation risk.
  - 53% of facilities have data coverage for two or fewer of the five components.
  - Scores are based on regulatory and permitting data, external PFAS emission and exposure datasets, corporate disclosures, and public legal case information.

Report Findings

Corporate PFAS litigation risk (pg. 6-8):

- **Roughly one-third of all high-risk facilities are within 20 parent companies.** Page 8 ranks **the top 10** (by facility count) by PFAS litigation risk.
- **Global asset managers have hundreds of billions of dollars in combined equity exposure.** Page 25 ranks **the top 10** asset managers by exposure to high-risk PFAS companies.
- **Company disclosures on potential PFAS liabilities** often meet only minimum regulatory requirements and **lack the granularity investors need** to measure exposures on a comparable basis. This, along with increasing PFAS-related litigation and enforcement, makes it **more difficult for investors to accurately value companies with PFAS exposure.**
- Pages 32-37 include a **breakdown of major PFAS-related lawsuits and legal precedents** in the U.S. and Europe.

Drivers of PFAS litigation risk (pg. 9-12):

- PFAS litigation risk is concentrated where emissions, uses, and waste intersect with densely populated areas and vulnerable water sources.
- **PFAS regulations are tightening in the U.S., the European Union, the U.K., and China.** Page 10 includes a summary of key PFAS regulatory regimes.
- Upstream producers, including companies whose business models rely on PFAS, face the greatest legal and remediation risks.
- **Downstream companies can still face reputational damage and lawsuits** if their products lead to PFAS contamination, even if they don't manufacture PFAS themselves.

- **Insurers** are increasingly examining PFAS exposure and **may limit or exclude coverage**, forcing companies to absorb the financial consequences of PFAS liability.
- **Low-income, minority, and Indigenous communities often carry a disproportionate share of the burden**, as hazardous facilities and legacy pollution tend to be concentrated in less wealthy areas.
- Page 11 includes examples of **PFAS hotspots in Europe**.
- Pages 13-22 include two **case studies of US companies in high-intensity PFAS sectors** with well-documented litigation histories.

Actions for companies and investors to phase out PFAS (pg. 23-26):

- **Actions for companies to phase out PFAS:**
    - **Redesign products or processes** so PFAS are no longer needed.
    - Shift toward **service-based business models** and greater repair and reuse to lower overall chemical throughput and reduce PFAS dependence.
    - **Replace PFAS with safer chemistries** that provide comparable water, oil, or grease resistance across at least part of your product ranges, such as fluorine-free alternatives.
        - Switching to fluorine-free replacements often involves higher upfront costs. However, these should be weighed against potential PFAS-related settlements, remediation costs, and legal fees.
        - ChemSec's **PFAS Guide** can help companies evaluate safer alternatives.
- **Investors should engage companies to adopt credible strategies for eliminating their PFAS exposure, including:**
    - Comprehensive mapping of PFAS use, facilities, and contaminated sites.
    - Public, facility-level disclosure of PFAS risks and remediation progress.
    - Clear, time-bound PFAS phaseout commitments, including interim targets and capex commitments.
    - Alignment of executive incentives and capital allocation with PFAS risk reduction.
    - Robust scenario analysis for PFAS liabilities that reflects regulation trends.
    - Proactive engagement with regulators, communities, and workers.
- **Investors can use the PFAS Litigation Risk Dashboard for pre-investment screening, portfolio monitoring, and reporting:** Map company scores directly onto portfolios to identify which holdings fall into the highest PFAS risk bands and the size of that exposure relative to total assets under management (details on pg. 26).

ENVIRONMENTAL & SOCIAL RISK

Breaking Down Silos: Navigating the Intersection of Environmental and Social Risks for Investors

By University of Cambridge Institute for Sustainability Leadership (CISL)

View the full report here

Notable Highlights

- ♦ **The intersection of environmental and social risks is financially material to corporate resilience:** Where social vulnerability is high, climate shocks are more likely to disrupt labor availability and productivity, trigger supply chain breakdowns, and require fiscal intervention.
- ♦ **Integrated environmental/social risk assessments enable more effective risk management by strengthening capital allocation** (by identifying where resilience investments reduce downside risk), **engagement strategies** (by clarifying when corporate action alone is insufficient), **risk pricing** (by improving long-term risk assessment), and the ability to identify where a single investment or intervention can generate **compound benefits.**
- ♦ The report includes a **conceptual framework to help companies assess intersecting environmental and social risks across three dimensions:** geographic scale, value chain complexities, sociodemographic vulnerabilities.
- ♦ The Report Findings include a **case study applying the framework to agrifood systems** (where climate exposures, social inequalities, and value chain dependencies converge most visibly) and **priority levers to mobilize private capital for climate resilience and social equity.**

Objective

- To introduce a conceptual framework to help companies assess compounding environmental and social risks and identify opportunities to drive resilience.

Background

- The framework draws inspiration from different sources, including the TISFD Conceptual Foundations.

- An ILG Social Steering Group and an Expert Advisory Group of executives from financial bodies, research institutions, and multilateral organizations provided additional insights (methodology on pg. 2, 4).

Report Findings

The intersection of environmental and social risks is financially material to corporate resilience (pg. 6-10):

- **Climate shocks erode assets and human and natural capital**, deepening poverty and social exclusion. In turn, **inequality constrains access** to finance, technology, and institutional support, heightening vulnerability to future climate-related shocks.
- Climate events increasingly lead to second- and third-order impacts with direct financial implications, such as food price inflation, credit downgrades, and insurance losses.
- **These intersections create compounding impacts** that can determine whether environmental and/or social shocks remain localized or escalate into systemic disruptions; how quickly losses cascade across value chains and geographies; the scale, duration, and volatility of financial impacts; and whether capital deployed for resilience generates stable long-term returns or becomes stranded.
- Pages 8-10 break down **examples of the material financial impacts** of environmental and social interlinkages across four sectors.

The financial implications of fragmented risk assessments (pg. 11-12):

- **Most risk assessment frameworks remain fragmented,** treating environmental and social factors in silos and capturing only immediate economic losses. This limits the capacity to understand how intersecting risks manifest in the real economy.
    - **Underestimated downside risks can lead to capital misallocation:** Social vulnerabilities are often treated as out of scope, resulting in capital being allocated to fragile assets that appear resilient on paper.
    - **Feedback loops are often overlooked in traditional scenario models:** For example, a climate shock can reduce employment, which in turn weakens demand and constrains private investment in the recovery.
    - Climate-social interlinkages **operate across time horizons**, reducing long-term investment returns.

Framework to assess intersecting environmental & social risks (pg. 13):

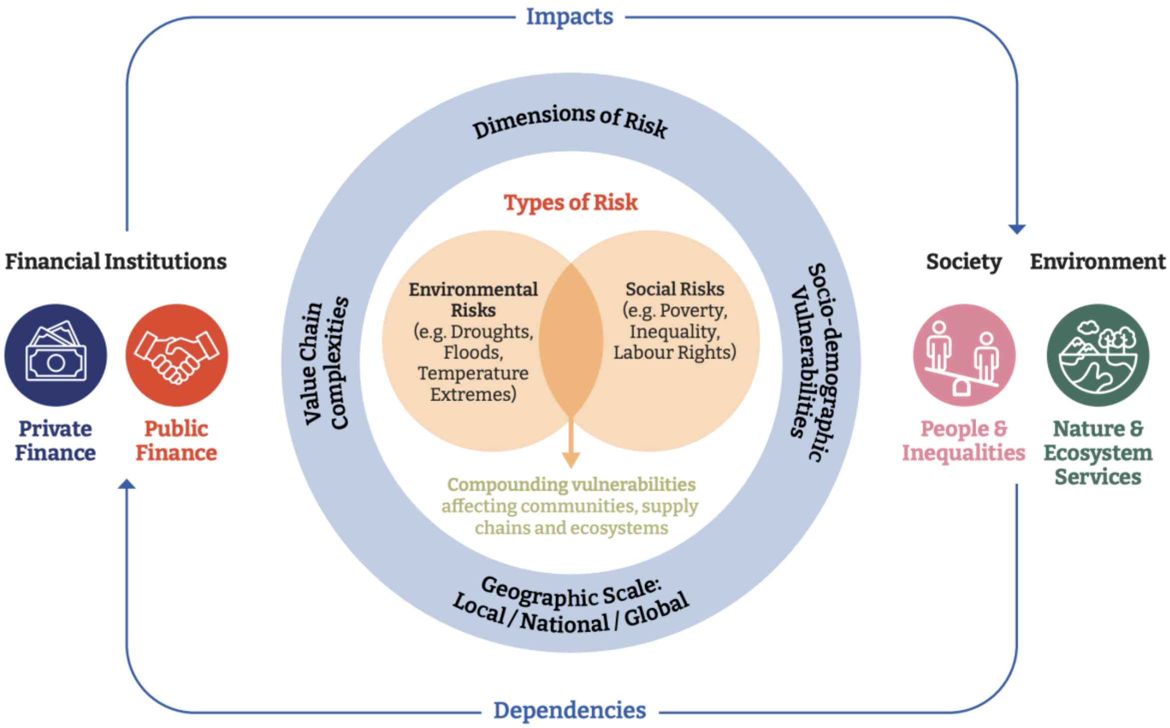

Image taken from pg. 13

- **The framework covers environmental risks, social risks** (related to how companies interact with employees, customers, and stakeholders)**, compounding risks** (coinciding social, economic, and environmental risks), **and compounding vulnerabilities** (cumulative loss of resilience and/or the ability to adapt and respond to shocks).
- **The framework assesses risk across three dimensions:**
    - **Geographic scale:** While certain shocks emerge at the local level, their consequences can scale across markets. Assessing risk across geographies is critical to understanding correlation and exposure to macro-financial instability.
    - **Value chain complexities:** Disruptions linked to physical hazards, labor constraints, infrastructure failures, or policy intervention cascade through supply chains, affecting revenues, costs, and performance.
    - **Socio-demographic vulnerabilities:** Inequalities in income, labor conditions, access to finance, and social protection influence whether climate-related shocks lead to temporary disruption or persistent economic damage.
- Pages 16-23 present a **case study that applies the framework to agrifood systems.**

Three priority levers to mobilize private capital for climate resilience and social equity (pg. 22-24):

- **Value chain finance:** In many sectors, the actors most exposed to environmental and social shocks are often the least able to access finance. Extend targeted financing across the vulnerable parts of the value chain to build resilience without concentrating risk on those least equipped to bear it.
- **Stewardship and active engagement:** These are essential tools for addressing compounding risks that cannot be mitigated through capital allocation alone. Use company influence to shift norms and shape public policy, incentives, and governance structures in ways that reduce long-term systemic risk.
- **Blended finance and catalytic capital:** Combine private, public, and philanthropic capital to identify opportunities for compounding impact, de-risk investments in emerging markets, and finance early-stage, high-impact practices.