The Unavoidable Opportunity:

Investing in the Growing Market for Climate Resilience Solutions

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I. Executive Summary

Climate resilience and adaptation is an attractive growth investment theme that is investible today, including through publicly listed companies.

The growing urgency of climate change has generated two related investment opportunities: the need to reduce the causes of climate change through investments in decarbonization and the need to manage mounting physical effects through investments in climate resilience. Technologies and solutions that can reduce the risks and impacts of climate change are growing in demand, generating related and attractive growth opportunities for investors. Governments are planning flood defenses, companies are hardening their physical infrastructure and supply chains, and households are protecting themselves against extreme heat.

Climate resilience investments are fundamentally attractive for several reasons. There is now greater certainty around the near-term trajectory of climate change and the demand drivers for climate resilience, which are uncorrelated and independent from other market forces. Climate resilience measures can support investible opportunities that leverage the power of nature-based solutions and enhance biodiversity. Because physical climate impacts will disproportionately affect the poorest and most vulnerable populations and nations, climate resilience solutions can also advance equity and environmental justice considerations. Yet climate resilience is substantially underinvested and, we believe, not priced into markets, leaving open greater opportunity for investors.

Climate resilience investments are not well understood by investors, and therefore practical frameworks are needed to inform investment decisions. Few companies today self-identify as "climate resilience" or "adaptation" companies.* However, established, market-driven approaches can be used to identify companies that provide climate resilience and adaptation solutions. Many taxonomies exist to identify climate resilience companies, yet these models may be limited to specific regions, focus only on emerging technologies, or tend towards needs assessments rather than solutions. In order to provide a comprehensive approach, considering all regions and companies, a new model has been developed and peer-reviewed for identifying climate resilience and adaptation companies, and is introduced in this paper as the "CRISP Framework."

Publicly traded companies offer an opportunity to invest at scale in climate resilience and adaptation. A new market analysis that applies the climate resilience framework to publicly accessible data has identified a

** Adaptation and resilience are two related parts of a continuum of strategies to address the effects of climate change: Adaptation refers to systemic adjustments to climate change, while climate resilience refers to the ability to recover from risks and impacts of climate change. These terms will be considered together in this paper.*

universe of over 800 public companies that offer climate resilience and adaptation solutions. This universe of solutions offers broad access to the adaptation investment growth theme for additional capital to support a variety of public markets investment approaches. Investors in private companies have already demonstrated opportunities for investments in climate resilience and adaptation solutions, and the market is ready to move beyond private equity to larger, more substantial investments in publicly traded companies.

This paper presents an initial toolkit for investors considering climate resilience as a thematic area, particularly in public markets. It describes:

- Why climate resilience solutions offer a compelling investment thesis from a returns perspective
- What is meant by climate resilience solutions: the products, technologies, and services that are in growing demand as households, companies, and governments seek to protect the economy and communities from escalating physical climate risk
- A proposed framework to define which companies are "in the business of resilience"
- Methods to locate these companies within the investable universe of publicly listed companies
- How investors can design investment products to provide their clients with exposure to the theme

Spotlight on Emerging Markets – Executive Summary

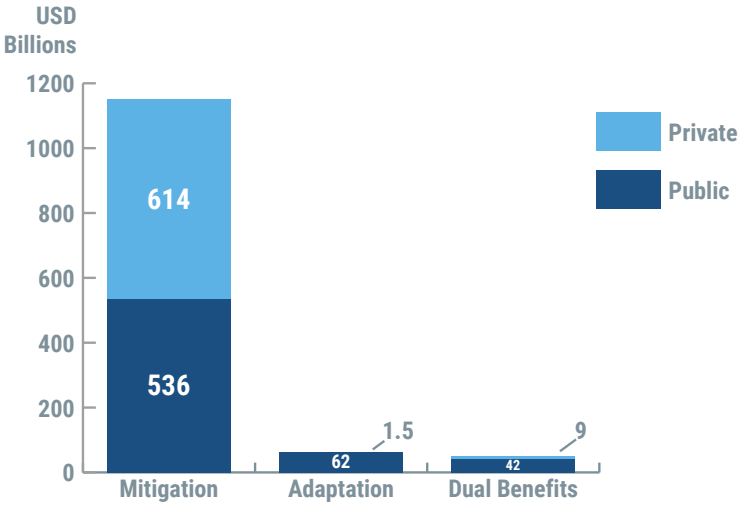
Emerging markets across the globe represent $6.5 trillion[1] in total market capitalization and are expected to outpace the growth of developed markets by 2030.[2] Climate change, however, is one of the top risks to these economic projections.[3] As a result, demand for adaptation solutions in emerging markets is ripe for growth to address climate hazards on the horizon and already occurring at record pace. This paper includes a new analysis mapping companies that provide adaptation solutions listed in 47 markets worldwide, including 24 emerging markets (see Section IV). Of the 827 companies identified globally, 231 were listed in emerging and developing countries, demonstrating that a sizeable share of the potential investment opportunity for climate resilience solutions is based in the Global South.

II. Adaptation Investment Thesis – Scope of Opportunity

Climate change is creating a compelling investment opportunity in the category of climate resilience.

Climate change is a humanitarian tragedy and planetwide emergency with devastating impacts and human costs. The direct and ensuing effects of climate change are bearing down on all geographies, all segments of society and all economies. Last year, the World Meteorological Organization (WMO) reported that almost 12,000 extreme weather, climate, and water-related events over the past 50 years have caused over $4.3 trillion in losses.[4] In 2022, natural disasters caused global economic losses of $313 billion, of which less than half was insured.[5] In the U.S. alone, climate and weather disasters have caused roughly $120 billion in damages per year since 2017.[6] The urgency for action has accelerated with United Nations Intergovernmental Panel on Climate Change (IPCC) warning in 2023 is that the world is "risking severe damages, costs, and upheaval."[7] Solutions to climate change are essential.

Figure 1: Uses of Climate Finance 2021/2022



Source: Climate Policy Initiative, Global Landscape of Climate Finance 2023, p21

By now investors are familiar with decarbonization as a growth investment thesis. Billions of dollars of capital have shifted into renewable energy, electric vehicles, energy storage, and low carbon solutions for everything from agriculture to infrastructure as investors have recognized the opportunity for returns created by the growing urgency to address the causes of climate change.

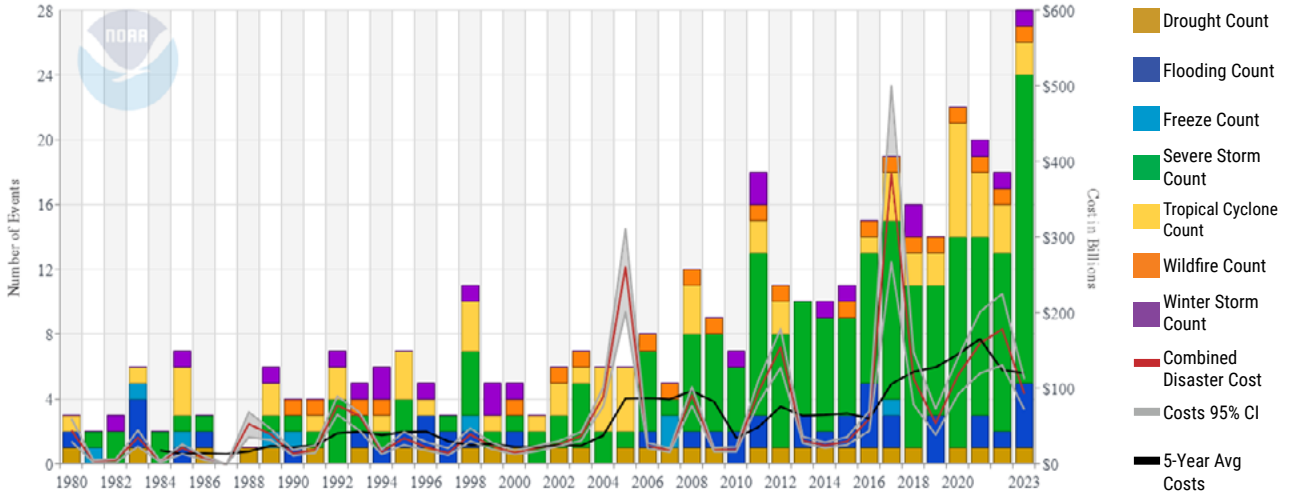
Resilience to the effects of climate change has similar drivers, arguably even more fundamental and more certain ones. The need to climate-proof economies and societies will grow inexorably in the coming decade regardless of the pace of decarbonization. Yet to date, financing for adaptation has been framed around the cost, primarily to governments, of hardening economies and communities to physical climate risk. Because they are viewed only as costs, investments in adaptation have been miniscule compared to those in decarbonization.

Climate Policy Initiative (CPI) estimated $1.3 trillion annual average investments into climate-related equities, bonds, projects, and assets in 2021/2022, almost double the previous period.[8] Although less than 5% of this flow - $63 billion - was for adaptation, investment

grew 29% from $49 billion in the prior period. That said, nearly all adaptation was funded by public actors (98%) according to CPI,[9] which leaves just $1.3 billion in identified and tracked private sector investment in adaptation 2021/2022 across the globe. The private sector drives almost half of financing for renewable energy, but has not yet systematically focused on the escalating demand for adaptation[10] as shown in Figure 1 above.

Figure 2: Billion Dollar Disasters

United States Billion-Dollar Disaster Events 1980-2023 (CPI-Adjusted)



Citation: NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2023). https://www.ncei.noaa.gov/access/billions/, DOI: 10.25921/stkw-7w73

In our view, the climate resilience growth investment opportunity is based on three overarching drivers:



1 Climate change is generating increasing and more certain risks and impacts.

There is greater certainty around the near-term trajectory of climate change and the demand drivers for climate resilience. Even with solid progress on decarbonization, the scientific community's latest IPCC v.6 report projects 1.5C degrees of warming in almost all scenarios within the next 10 years, which will highly likely increase impacts on society and the global economy. Demonstrating just how evident these impacts already are, the U.S. suffered **billion-dollar climate catastrophes 28 times** in 2023, the highest number of disasters ever in a calendar year, as shown in Figure 2 below.[11] The need for adaptation finance in developing countries is even more cogent; requirements are 10 to 18 times as large as international public finance flows.[12]

Table 1: Illustrative List of Current Climate Hazards, Risks and Impacts

Key Climate Hazards[13]	Risks[14]	Impacts[15]
Extreme Temperatures	Heat stress, cold waves, wild-fires, reduced arable land	Crop loss, asthma, spread of pests, vector-borne disease
Drought		
Extreme Storms	Inland and coastal flooding, power outages, saline intru-sion	Property loss, business loss and interruption, infra-structure damage, crop and marine life loss, disease
Sea Level Rise	Flooding, saline intrusion, coastal erosion	Infrastructure loss, property loss

Climate hazards will increase risks and impacts across the economy, as indicated in Table 1. Expected climate risks and impacts are well-documented by the IPCC and other global climate organizations. Many of these impacts are already evident, with future damages likely to be enormous given the lock-in of greenhouse gas emissions over previous decades. As a result, the costs of climate adaptation will grow only more expensive with the passage of time. Climate change may represent more certainty of risk and impact over the next ten years than potential economic effects of interest rates, inflation, artificial intelligence, consumer preferences, or other factors that can affect investment performance.

2 Climate risks and impacts are generating increasing demand for technologies and solutions that build resilience and adaptation.

As climate risks and impacts increase, demand for new technologies and adaptations solutions is accelerating. Financial regulators and central banks have pointed to the physical impacts of climate change as a material and potentially systemic risk for financial markets. In the insurance sector, climate change is now the top risk - higher than cybersecurity - according to the 12th Annual Survey of Emerging Risks.[16] Institutional investors, insurance companies, pension funds and other asset managers are keen to understand these climate risks as well as the opportunities to improve investment performance.

Companies understand that climate risk matters and are actively considering it in their strategies. A group of over 200 of the world's largest corporations reported $1 trillion in estimated financial risk from climate change.[17] Accordingly, companies in most sectors, including 69% of biotech, healthcare, and pharma companies, 83% of retailers, and 88% of financial services firms, are actively integrating climate change impacts into their respective business strategies.[18]

Efforts to deepen understanding of potential risks are supported by emerging climate data and analytics companies, artificial intelligence and many other tools such as earth observation, remote sensing, and satellites. Increasingly robust data gives companies the tools to translate these risks into opportunity costs to help justify investments in adaptive technologies.

All sectors from agriculture, water, transportation, energy, financial services, and healthcare must adapt to new climate conditions while decarbonizing in tandem. Agricultural analytics, water efficiency solutions, supply chain analytics, grid reliability, advanced insurance, and

agile healthcare diagnostics all will be increasingly needed as a result of rapidly changing environmental conditions. Representative solutions to climate impacts are shown in Figure 3 as illustrative examples.

Recognition and experience of climate risks and impacts is already leading to **increased spending** to address specific climate hazards in the private sector. For example, Pacific Gas and Electric (PG&E), the 10th largest utility in the United States, increased its wildfire mitigation plan over $1 billion from the actual cost in 2021 to $5.96 billion planned for the year 2022.[19] Recent regulatory actions in the U.S., such as the Inflation Reduction Act, are further **incentivizing investors** to allocate capital toward solutions that combat climate-related risks.

Figure 3: Examples of Adaptation Solutions by Sectors and Hazards

(Illustrative, not exhaustive list)



Sector	Examples of Adaptation Solutions	
	Climate Adaptation Intelligence	Climate Adaptation Products & Services
Agriculture	• Climate monitoring and forecasting • Temperature regulation technologies for livestock • Remote sensing-based drought monitoring tool • Crop data and analytics platform with mapping interface	• Drought tolerant crops • Cold chain storage • Irrigation technologies using high-efficiency systems
Real Estate	• Satellite imagery for monitoring and impact assess-ment • Sea-level processing software	• Flood mitigation technologies • Efficient cooling technologies • Green roofs
Water Supply & Management	• Water monitoring and modelling (e.g. water resource mapping) • Hydrological forecasting system	• Water storage technologies • Water preservation technologies; e.g., smart water meters • Irrigation technologies
Information Technology	• Climate risk analytics • Geospatial solutions	• Early warning systems for extreme events • Early response systems
Infrastructure & Transportation	• Intelligent transportation systems to monitor road conditions, address hazards in real time, moving traffic away from areas experiencing a natural disaster, point first responders to identify priority intervention areas	• Stormwater management - drainage and conveyance • Extreme heat/cold resistant paving material • Wetlands restoration
Energy	• Artificial intelligence for grid management • Artificial intelligence for outage management • Community-level communication systems	• Grid hardening technologies • Weatherization of renewable assets • Distributed energy systems/community grids
Health	• Disease surveillance systems for outbreak detection • Remote diagnostics • Rapid diagnostic tests	• Vaccines for new diseases • Drug treatments for new diseases • Air purification systems
Financial Services	• Data analytics to better assess borrower repayment risk • Biometrics	• Climate parametric insurance • Digital payment systems • Blockchain

3 Mounting demand for climate resilience technologies and solutions creates a growth investment opportunity in existing and new companies that produce those products and services.

Companies offering solutions for climate resilience will benefit from increasing demand to address the growing risks and impacts from climate change, with BlackRock already reporting initial indicators of increasing demand for such products.[20] Given this growing demand, the market may be under-valuing companies that meet the need for climate solutions, a factor that BlackRock considers a driver of investment opportunity.[21] Many of the technologies and solutions required to address climate impacts already exist, as shown in Figure 3, and may be available in the market today, although

not always identified as "adaptation solutions."

In addition to market opportunity, climate resilience investments can **enhance the returns of decarbonization investments**. For example, hydropower generation will need to incorporate new data and analytics about increasing drought conditions occurring as a result of climate change. Failure to incorporate projected drought has already threatened renewable hydropower generation in California.[22] Smart grid upgrades to support intermittent renewable energy will also have to address new spikes in demand created by climate-enhanced heat waves.[23] Climate modelling to simulate increased wildfire risk due to hotter, drier conditions will be critical to reducing the risk of wildfires caused by transmission and distribution powerlines.[24] Supply chains will have to both reduce their carbon intensity and address potential disruptions caused by more frequent and severe hurricanes, storms, and wildfires.

As investors scale capital into decarbonization, investing in climate resilience technologies and solutions can safeguard and support the success of those investments. Incorporating climate change assumptions around changes in wind patterns, cloud cover, and water levels into renewable energy projects can future-proof them against increasing impacts of climate change. Including sea level rise and flooding analyses into the design of energy efficient buildings can make them better low carbon investments. Developing climate smart agriculture that is both less carbon intensive and more resilient to drought and extreme weather can generate both greater food security and better long term investment performance.

Climate resilience investments can also help **enable further investments in biodiversity and nature-based solutions**. For example, investments in climate risk data and analytics can inform the design projects that support biodiversity, agriculture and human health. Geospatial data and imagery can help to monitor and implement nature-based solutions. Accurate forecasts of climate-enhanced flooding, for example, can help design flood defenses like mangroves and wetlands to supplement seawalls and levees. Natural climate solutions can effectively and efficiently achieve adaptation goals as well as support mitigation, biodiversity, and more equitable community development. Nature protection and restoration, by far the largest forms of carbon sequestration, must be resilient to wildfires, droughts, heatwaves, and longer-term warming to preserve their mitigation benefits.

Finally, climate resilience solutions can **address the most impacted and vulnerable populations** and help address equity, justice, and gender considerations. Disadvantaged populations in both developed and developing countries have historically faced higher vulnerability and suffered the greatest impact from environmental hazards, and increasingly from the physical risks and impacts of climate change. Women and girls are particularly vulnerable to water scarcity, agricultural stress, and natural disasters, all of which are increasing due to climate change.[25] Even if these populations do not have the resources to be direct buyers of these solutions, they can benefit from distribution and use in their regions. Intelligence technologies such as satellite imagery, digital mapping, catastrophe risk modeling and weather analytics can provide critical information as systemic solutions to safeguard and protect disadvantaged populations in all areas of the world, e.g. adaptation solutions

that support water access and food security in the face of increasing drought and food production stress will also be important to supporting the most vulnerable across the world.

Some pioneering investors have already seen these growth opportunities and put adaptation at the heart of their investment strategies. The first dedicated adaptation and climate resilience private investment fund, Lightsmith Climate Resilience Partners (also known as CRAFT, the Climate Resilience and Adaptation Finance and Technology-transfer facility), reached first close in 2019, and has been actively making growth equity investments in private companies that support climate resilience. Large financial institutions have identified adaptation strategies within their dedicated Climate or Impact funds, which together exceed a billion dollars.[26] However, at present few easily investable public market products exist by which investors can gain targeted and systematic exposure to companies that produce solutions for adaptation and climate resilience.

Spotlight on Emerging Markets – Scope of Opportunity

While no standard definition of emerging markets exists, leading institutional investors using the MSCI Emerging Markets Index as a benchmark can measure market exposures for 24 countries in this universe including China, India, and Brazil with as many as 3,400 issuers in the investment opportunity set.[27] In aggregate, emerging markets represent 46% of the world's purchasing power and 34% of global nominal GDP.[28] Relative to other developing countries,[29] these markets have more mature capital markets along with supportive government and regulatory structures.

The investment risks pertaining to emerging markets are generally elevated, however, and not confined to adaptation and resilience companies. Emerging markets underperformed developed markets in the decade between 2011 and 2023, largely due to lower corporate earnings growth.[30] Both liquidity and access to capital are lower for emerging markets compared to developed markets.[31] Overall, assets in emerging markets are perceived as riskier than their counterparts in developed markets, as quantified in the volatility of returns when comparing the two.[32]

Climate change may pose an even greater risk to emerging markets, which tend to be in the path of climate destruction with lower budgets for safeguards against these risks. In fact, climate hazards are already affecting these regions - **driving demand for solutions**. Investors can lean into this demand, as well as the rising incomes and economic growth in these regions, while also seeking investments with decarbonization co-benefits. Investors and local communities alike can benefit by driving local resilience, creating markets to sell into, and integrating investments with decarbonization investments such as distributed energy.

III. Identifying Adaptation Solutions Companies

Climate resilience investments can be identified by investors.

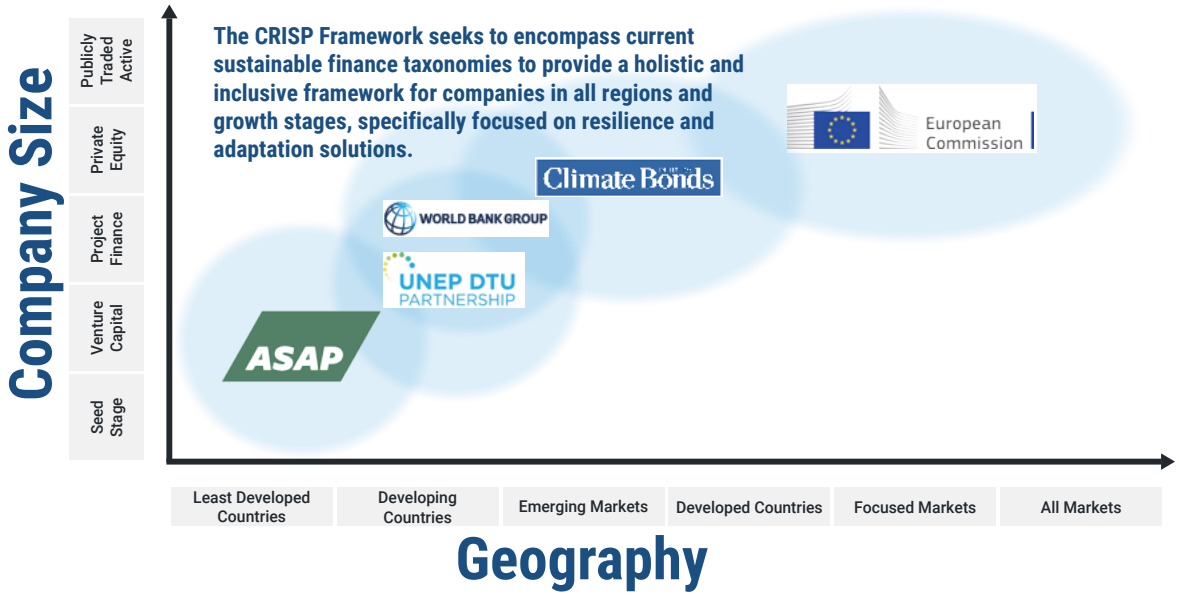
Since not all companies self-identify their products and services as "climate resilience" or "adaptation" technologies and solutions, there is need for greater clarity as to the investible universe for investors to uncover these growth opportunities. In order to support investors in identifying adaptation solutions companies, GARI has developed a framework that incorporates existing methodologies and aligns with ongoing developments to identify adaptation opportunities with a range of investment strategies, including application to listed equities.

Goals of the Framework for Identification

GARI's 2024 *Climate Resilience Investments in Solutions Principles* **(CRISP)** framework is intended to offer a structured approach for transparently determining whether a company has growth potential as an "adaptation play" based on the technologies, products and services offered across all asset classes, sectors, and geographies.

The CRISP framework builds on existing definitions and approaches to identifying adaptation companies, with consistency and alignment with the EU Sustainable Finance Taxonomy, Climate Bonds Taxonomy, and the 2020 ASAP Adaptation Solutions Taxonomy. However, existing taxonomies such as these, and those proposed by UN Environment Programme Technology Needs Assessment (TNA),[33] World Bank Group,[34] and many others[35] may be regionally targeted, focused on

Figure 4: Taxonomies for Resilience Investment



needs assessment versus solutions, or limited to identifying emerging technologies (see Figure 4). The CRISP framework is proposed as a comprehensive approach to address the current gaps and limitations.

The goal of the framework is to consistently guide investments into adaptation and resilience at various stages and to facilitate the identification, evaluation, investment, reporting, and engagement with companies. Adaptation companies are part of large and emerging theme, a hallmark of growth investing. Facilitating adaptation and resilience as a growth theme for equity investments is a key desired outcome of the identification framework.

Scope of the Framework

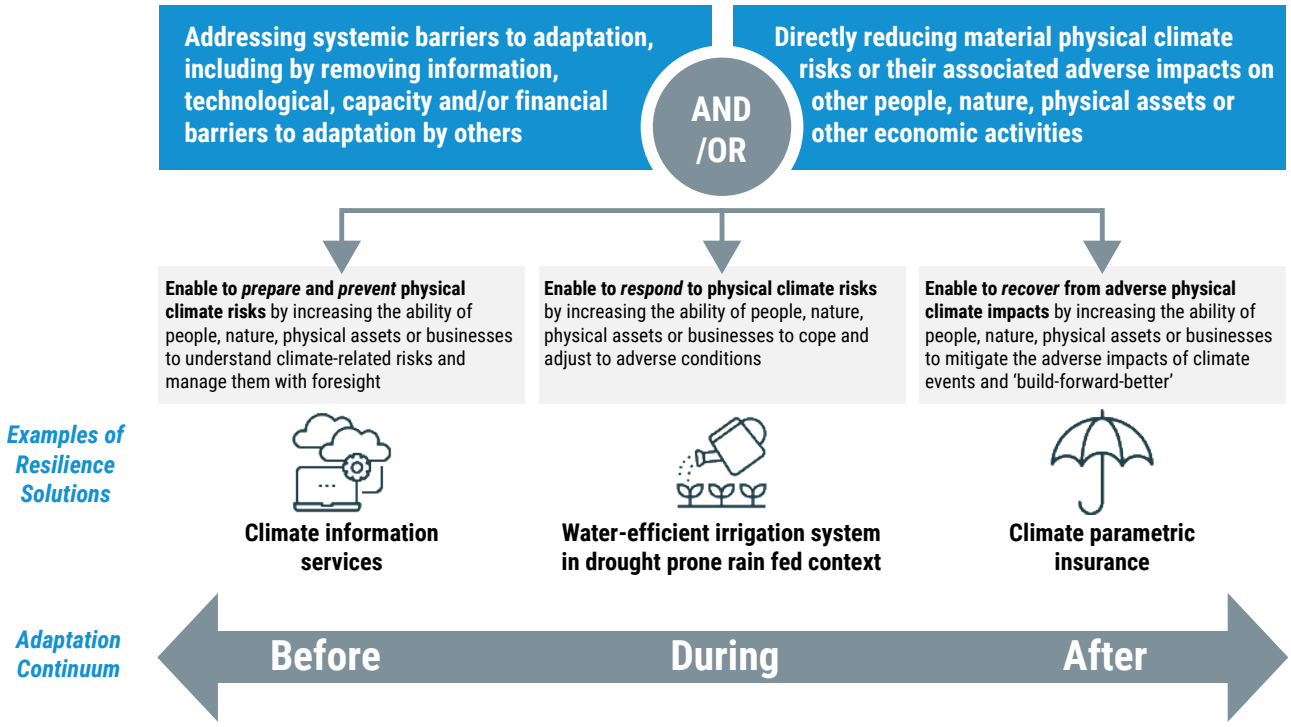
The scope of this framework is limited to companies **that provide adaptation and resilience products and services to third parties** rather than businesses that are taking measures to make their operations more internally resilient, which has become a mainstream element of risk management.

Principles of the 2024 CRISP Framework

The 2024 CRISP framework aims to create an inclusive, flexible approach to identifying potential climate resilience companies that recognizes both the development of adaptation and climate resilience as an emerging investment theme, and that climate change risk and impacts will continue to evolve over time. It is intended to be applied broadly and does not prescribe a list of companies, sectors, requirements nor categorically exclude types of companies, but

Figure 5: Description of an Adaptation Solution Company

A Resilience Solutions Company is a company that has a significant business offering of a technology, product, service and/or practice that enables others to *prepare*, *prevent*, *respond* to and *recover* from climate shocks and stresses by:



instead provides illustrative and non-exhaustive examples. The principles point towards assessment of the growth potential of a company, line of business or product market. Given that the adaptation market is evolving with new and unknown impacts, the framework leaves room for solutions and technologies yet to be envisioned and developed and explicitly calls for periodic reassessment and evaluation.

This framework is intended to be:

- **A dynamic and flexible tool**, evolving over time along with existing and emerging international sustainable finance frameworks.
- **Complementary** to existing frameworks, standards, and regulations with high-level guidelines for how the framework and principles can be applied in different contexts.
- **Inclusive**, without prescriptive pre-defined lists of solutions because the range of technologies, products and services are wide ranging and fast evolving.
- **Agnostic to growth stage, sector, and geography** of adaptation solutions to allow for both new innovative solutions and business models as well as the uptake and transferring of existing ones to new contexts.

Identification Framework

Fundamentally, an adaptation solutions company has a significant business line in a technology, product or service that prevents or reduces the impacts before, during or after a climate hazard. Figure 5 provides a more detailed description of a climate adaptation solutions company and the elements to consider from the new 2024 CRISP framework.

Adaptation solutions are wide-ranging across physical risks and impacts and across multiple sectors and already offered by many large, publicly traded companies. Identifying opportunities by sector requires understanding the range of impacts, and solutions existing or in development.

Considerations for Listed Equity Investors

Investors in listed equities will have special considerations when pursuing adaptation as a growth theme for their portfolios.

- **Engagement** – Many adaptation companies can be identified through analytical methods using publicly available information such as earnings calls, investor presentations, sustainability reports, and annual reports. However, increased insights gained from direct engagement with investees can be important to understanding the growth strategy for prospective adaptation solutions including the company's view of market size, competitive position, and unique value proposition for realizing growth potential. The depth of assessment, information available and degree of active engagement all can factor into identifying adaptation companies and help them, their supply chains and their customers see their role in this market.

- **Thresholds** – For large companies involved in a range of activities, the threshold of revenue coming from adaptation products or services within a business is key consideration. Investors can consider both current and potential future value of revenue derived from the resilient product or service business line based on the broader corporate strategy and growth potential. For example, even if the current level of revenue or percentage of assets under

management is minimal, this might be offset by future plans, competitive positioning, research and development budgets. A company's patent portfolio may also be used as leading indicator of future growth potential. Where further engagement is possible, investors can incorporate deeper assessments of market capacity, competitive position, and unique product/market fit in making their determination.

- **Consideration of net carbon impact of solutions** – The framework suggests that adaptation solutions should be sensitive to minimizing net carbon impacts. However, the net impact may be difficult to assess, and complete data may not be available. Engagement with investees at every stage of the investment process from screening and due diligence to investment and monitoring will be helpful to this determination.

Example 1

Technology Company, New York Stock Exchange

$122 billion publicly traded multinational conglomerate offering products and services related to building and industrial automation, energy solutions, and aerospace technologies. Adaptation solutions include air purification systems, air quality monitoring devices, refrigerants, power grid resiliency, and Internet of Things urban communication networks. We estimate 18% of the company's 2022 revenue is from adaptation and resilience products.

Example 2

Pharmaceuticals Company, New York Stock Exchange

$76.6 billion publicly traded multinational pharmaceutical and biotechnology company. Adaptation solutions include medication and research and development on new vaccines, drugs and treatments to prevent and combat the spread of known and emerging diseases that warming temperatures and extreme weather events may exacerbate. Also invests in respiratory health medication to mitigate the impact of air pollution. The company does not delineate product-level revenues. We estimate approximately 20% of its total 2022 revenue is from products that alleviate or combat climate-induced diseases and conditions.

Example 3

Engineering Company, Tokyo Stock Exchange

$3.5 billion publicly traded global engineering and technology products company. Business segments include manufacturing of semiconductors, automotive parts, medical devices and environmental monitoring and measuring equipment. Adaptation solutions include water and air quality measuring devices. An estimated 2% of the company's 2022 revenue is from adaptation and resilience products.

Spotlight on Emerging Markets – Identifying Companies

The consideration set of emerging market companies may include both those domiciled in emerging markets, and those domiciled in developed markets that may be selling into emerging markets or have foreign subsidiaries based in emerging markets to better serve local needs.

Starting with this broad universe of companies, investors can apply GARI's 2024 CRISP framework to identify companies that offer relevant adaptation solutions, and may loosen or tighten criteria to expand or focus the results. These criteria may include thresholds for the amount of revenue from specific geographies, especially for companies not domiciled but selling into emerging markets.

Adaptation solutions are driven by local context, especially in emerging markets. Investors need to understand geographical, climatic, and social specifics such as exposure to physical risks, infrastructure gaps, and population trends.

Priority sectors for adaptation in these markets may include agriculture, water, resilient infrastructure, and health due to the higher economic dependence in emerging markets on natural resource management. For example, solutions may include irrigation technologies, water metering, and disease prevention drugs. In addition to these sectors, intelligence, monitoring, digital finance, and warning systems are all in demand.

IV. Approaches to Portfolio Construction for Thematic Exposure

Armed with an understanding of which sectors and technologies are most relevant for the resilience solutions thesis, and a framework for identifying which companies are in the business of resilience, how can investors identify the specific companies in the investable universe? This section describes the results of an analysis undertaken by the MSCI Sustainability Institute.[36] It focuses on public markets, using over 9,000 constituents of the MSCI ACWI (All Country World Index) IMI (Investible Markets Index)[37] as of December 2021, as the starting universe of potential companies.[38]

Pilot Analysis Methodology

The approach to developing a universe of "adaptation solutions" companies started with identifying climate hazards and impacts, and then identifying the current solutions available based on various adaptation and resilience taxonomies and frameworks.[39] Companies domiciled across 47 countries, including all major stock exchanges were considered in the analysis. An understanding of existing products and services was imperative to ultimately identify their providers. Various methods were tested to determine the methodology best suited for this exploratory exercise, including the use of natural language processing (NLP) and artificial intelligence (AI). Ultimately, the method used employed a Large Language Model (LLM) to identify companies that offer products and services related to climate adaptation or resilience. An LLM's ability to contextually understand text was an advantage over prescriptive approaches that use key words or phrase searching. Company descriptions from annual reports were used to determine if the product offering may be classified as an adaptation and resilience solution. The methodology employed the LLM to classify the companies based on a set of questions to determine if the company's offering was an adaptation solution. Preliminary analysis was run on smaller sets of companies, with manual validation determining the quality of answers. Correct classifications were identified, and fed to the LLM to be used as prototype responses.

The analysis did not involve any direct interaction with the companies in the analytical set but required high levels of manual validation with sector analysts. The process was an iterative, discovery-based approach to refine the methodology, in order to reasonably discern the nuance and complexity of climate adaptation solutions offered by publicly listed companies.

First Cut Identification of Investible Universe

Initial analysis suggests that over 800 publicly traded companies exist that could potentially serve as an investible universe of companies for a variety of public markets investment approaches (see Figure 6). This represents about 11% of the overall MSCI ACWI index, by number of issuers, after screening out companies that did not pass the

Multi-Use Products in the Context of Adaptation & Resilience

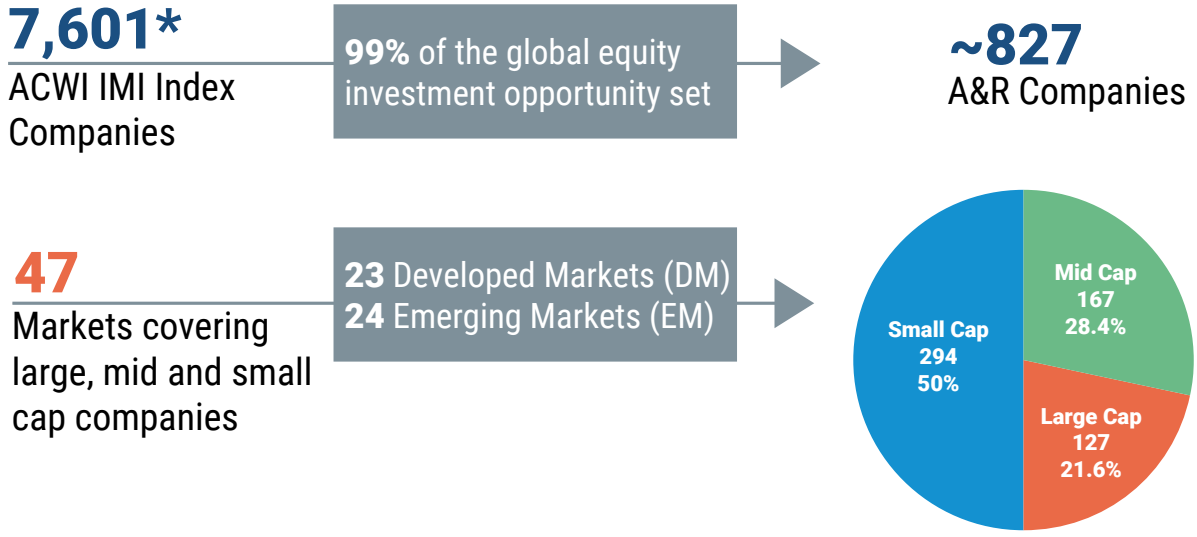
Products and technologies can have more than one use case. The end-use may define the service as one that enables adaptation or, in extreme cases, contributes adversely to climate change. As a hypothetical example for why investors should pay special attention to multi-use products: pipes have end-uses for storm water drainage or irrigation – a critical product to improve adaptation and resilience in key markets; pipes can also have end-use for oil field work.

Producers and sellers of such multi-use products are included the first cut universe of adaptation-enabling companies. The classification and ultimate inclusion of such multi-use products in an adaptation-enabling portfolio would require the portfolio manager to better understand the use cases or develop guidelines to guardrail investment decisions.

How investors treat such dual-use products has well-established precedents in responsible and sustainable investing. For example, in the context of screening for weapons, investors confront the challenge of dual-use items, whereby goods and services, such as aluminum pipes and navigation technologies, can be used for both civilian and military applications. Different investment institutions have different investment policies and statutory obligations. Additional data that can indicate the degree of involvement in the target activity, such as direct provision of goods and services or indirect contribution through the value chain (e.g. distributor or retailer), may be applied such that each investor can best match the level of involvement with the stringency of its policy.[40]

Figure 6: First Cut of Resilience Company Universe

*ACWI IMI Index as of Dec 2021. This sample set already excludes companies flagged under MSCI's EU Do No Significant Harm (DNSH) criteria.



European Union "Do No Significant Harm" filter, as determined by MSCI ESG Research's EU Taxonomy methodology.[41]

The data analysis is limited as first cut findings, yet the demonstration case provides a market-based approach to assessing the investment opportunity set in listed equities. The initial universe of adaptation companies identified, and the process for classification, lays the groundwork to identify companies that provide exposure to climate resilience solutions via both fundamental, quantitative, and qualitative methods.

Figure 7: Resilience Companies by Sector - First Cut

Resilience Companies by GICS Sector

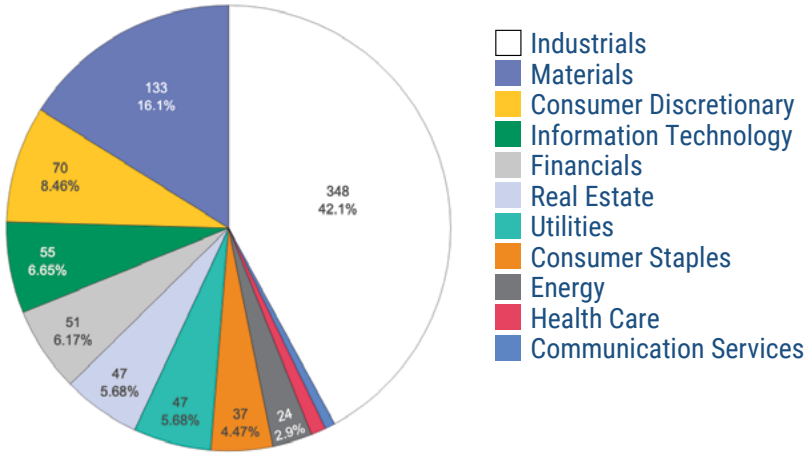
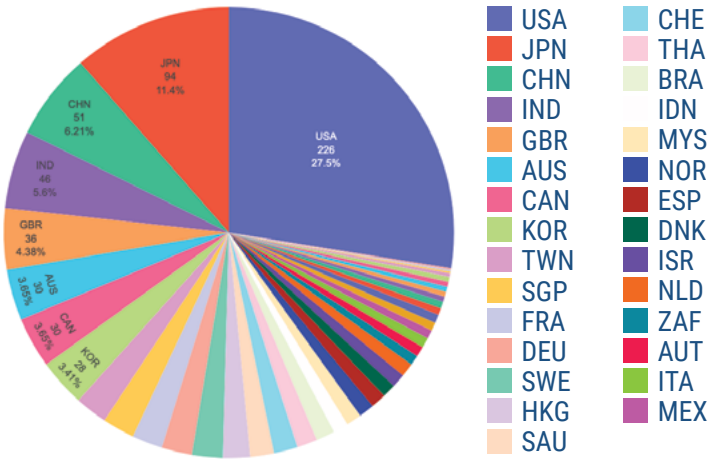


Figure 8: Resilience Companies by Country

Distribution of Resilience Companies per Country



Further analysis indicates that industrials and materials Global Industrial Classification Standard (GICS) sectors constituted approximately 58% of the identified set of companies, as shown in Figure 7.[42] Compared to the sector distribution of the MSCI ACWI IMI Index, these two sectors are over-represented in the first-cut adaptation universe (based on the number of companies), driven by the focus on infrastructure and materials inputs for adaptation and resilience products.

The analysis also indicated that two-thirds of resilience companies are domiciled in developed markets, as shown in Figure 8. These 590 companies represent a little over 11% of the total universe of developed markets included in the MSCI ACWI IMI Index.

Approaches to Portfolio Construction

Taking this framework for identifying adaptation companies, investors can apply these insights in a range of ways to their investment strategies. However, gaining exposure to the adaptation theme in portfolio construction is nuanced and does not apply consistently to all strategies. This section provides specific insights and considerations pertaining to opportunities and limitations for a range of investment strategies including concentrated thematic to

broad tilts; fundamental and systematic; equities and fixed income; public and private markets.

For example, concentrated strategies may be too limited for a specific adaptation growth theme in public markets. Listed equities are unlikely to be "pure play" adaptation investments at this stage due to the size of the companies on major stock exchanges. Therefore, attempts to identify pure play adaptation companies would dramatically narrow the opportunity set for investment. Over time, large, diversified companies may opt to spin-out adaptation-specific business units, similar to how some energy and industrial companies have spun out businesses targeting climate mitigation.

Broad tilt strategies may be better suited to incorporate companies with some adaptation business opportunities. Here, assumptions on the significance and growth potential of adaptation business lines, relative to other lines of business, are crucial to assessing the potential exposure of the portfolio to the target adaptation themes of interest and their financial impact. Investors can use their own analysis to set thresholds for relevance of the theme to potential impact on stock price or corporate strategy. In other words, each investor would need to express a view on where to draw the line for the level or percentage of revenue or other metrics to qualify as having exposure to the target theme of interest.

Similar to other emerging growth areas, **fundamental analysis** is important to evaluating investments in this area. Investors can determine where they see growth opportunities, where value is underappreciated and alpha undiscovered in companies offering adaptation solutions. High conviction for investments in adaptation companies are more likely to be driven by assessment of the underlying business models and outlook for growth, rather than from current revenues.

Systematic investing, driven purely on quantitative signals, would be difficult to implement at this stage of development because insufficient data and contingency of any adaptations solutions on the market context presents challenges to rules-driven processes. Likewise, passive investment strategies for resilience are not yet in sight, due to these needs for fundamental analysis, high engagement and focused investments.

For all equity investors into adaptation themes, **seeking alpha while controlling risk** remains a critical consideration. Hence, investors may lean towards sector allocations that hew to standard benchmarks, rather than a highly skewed sector distribution.

Fixed income is outside the scope of this paper, but we note that it is an important opportunity for adaptation investing as well. These investments are more likely to lean into project finance or corporate bonds, and may benefit from some of the existing frameworks such as the Climate Bonds Taxonomy[43] for identifying solutions and considerations for portfolios.

Potential Areas of Expansion

This initial analysis is just that – a starting point for consideration by investors. Other data sources for analysis could include investor presentations, corporate websites, earnings call transcripts, ESG reports and other sustainability and impact reports. Data from company reports may range from total market capitalization to revenue by product line, geographies and research and development budgets.

Active portfolio managers interested in opportunities with this investment theme should bring insight into their investment decisions where possible with investee engagement to deepen their understanding of the potential market size for new adaptation technologies, competitive positioning for adaptation solutions, fit within overall company strategy, secular trends that are creating growth opportunities and how these companies are positioned to take advantage of growing needs and demands.

Spotlight on Emerging Markets – Portfolio Construction

Equities in emerging markets have potential for tremendous scale, with their share of the global equity market projected to eclipse developed countries in the coming years.[44] Major investment houses such as Wellington, JPMorgan Chase, and Nuveen feature both emerging markets funds and climate funds. Impact investors such as Sarona and Lightsmith are on the forefront of investing in climate solutions specifically in emerging markets. A growth investment theme around adaptation and resilience in emerging markets represents a new universe of investments that is already gaining traction.

Mapping of adaptation solutions by MSCI identified at least 231 emerging market-domiciled publicly-traded companies offering adaptation solutions in these markets – a number expected to grow as demand for solutions accelerates. This group represents 9.5% of the total emerging market companies in the MSCI ACWI IMI Index. Details of where the companies are based and a distribution of the sectors represented are provided in Figures 9 and 10.

Figure 9: Emerging Markets Resilience Companies by Nation

Source: MSCI Sustainability Institute

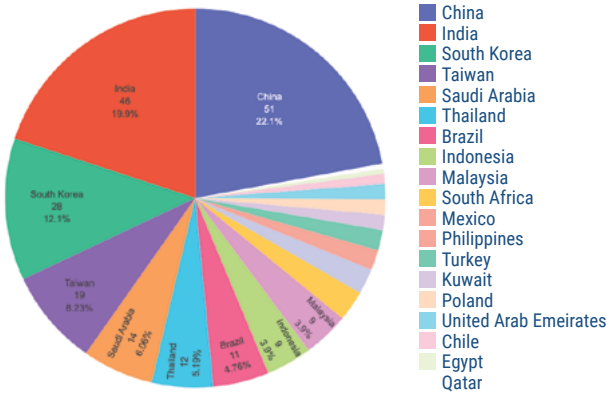
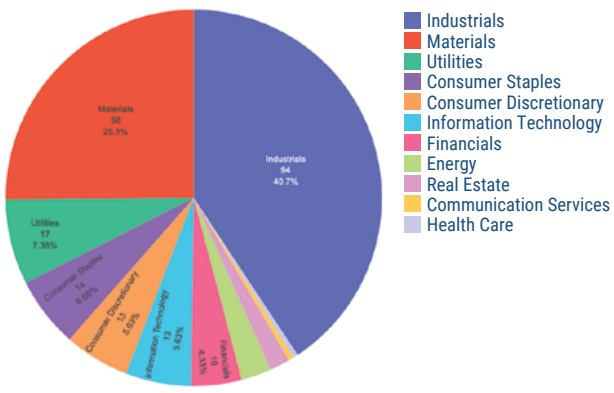


Figure 10: Emerging Markets Resilience Companies by Sector

Source: MSCI Sustainability Institute



V. Conclusion

Climate resilience investments can be made at scale, including in publicly traded companies.

Climate resilience is an attractive growth theme investment opportunity, with investment prospects on par and in tandem with decarbonization. Investors have a significant opportunity to be on the forefront of investing in adaptation, anticipating market needs, fueling demand for solutions and enabling readiness for the future across markets, sectors and portfolios. Relevant and attractive companies in this space can be identified through market-standard analysis, identifying potential for investment at scale that fall within the framework of the adaptation thesis. An explicit focus on "climate resilience" as a growth investment theme capitalizes on rising demand for critical solutions to current and future climate impacts that are certain to occur. Investments in adaptation are growing, although remain nascent compared to the market potential and overall global needs. Climate resilience investments are ready to be made at scale in publicly traded companies.

This framework can help facilitate investment in adaptation solutions offered by large companies, and offers a pathway to deploying large-scale allocations at pension funds, actively managed funds, index funds or other public markets investment strategies.

We invite you to access the new 2024 Climate Resilience Investments in Solutions Principles (CRISP) on the GARI website and carefully consider opportunities in this market. This is a roadmap for investors to identify solutions and invest.

VI. About

Bezos Earth Fund is transforming the fight against climate change with the largest ever philanthropic commitment to climate and nature protection. The fund is investing $10 billion to protect nature and drive systems-level change, creating a just transition to a low-carbon economy. By providing funding and expertise, the fund partners with organizations to accelerate innovation, break down barriers to success and create a more equitable and sustainable world.

ClimateWorks Foundation is a global platform for philanthropy to innovate and scale high-impact climate solutions that benefit people and the planet. We deliver global programs and services that equip philanthropy with the knowledge, networks, and solutions to drive climate progress for a more sustainable and equitable future. Since 2008, ClimateWorks has granted over $1.8 billion to more than 850 grantees in over 50 countries.

Global Adaptation and Resilience Investment Group, Inc. (GARI) is a private sector, private investor-led initiative that was announced at Paris COP21 in conjunction with the UN Secretary General's Climate Resilience Initiative. The working group brings together private and public sector investors, bankers, lenders and other stakeholders to discuss critical issues at the intersection of climate adaptation and resilience and investment with the objective of helping to assess, mobilize and catalyze action and investment. GARI aims to provide education, research, and resources to build awareness and capacity in the private sector towards the mission of catalyzing investment in resilience. To learn more, visit garigroup.com.

MSCI Sustainability Institute has a mission to drive progress by capital markets to create sustainable value and tackle global challenges such as climate change. Our goal is to align data, analysis, policy, and action. We do this by drawing upon MSCI's experience and expertise as a leading provider of sustainability data and metrics to the investment industry to spur collaboration across finance, academia, business, government, and civil society. For more information and to engage with us, visit msci-institute.com.

The Lightsmith Group is a sustainable private equity firm that invests in companies that address critical societal needs. Lightsmith invests in growth-stage companies providing technology-enabled business services and solutions in the areas of energy, water, food and agriculture, and climate resilience. For more information on The Lightsmith Group, please see: lightsmithgp.com.

VI. References

[1] https://www.msci.com/documents/10199/c0db0a48-01f2-4ba9-ad01-226fd5678111

[2] https://www.goldmansachs.com/intelligence/pages/emerging-stock-markets-projected-to-overtake-the-us-by-2030.html

[3] Ibid.

[4] https://wmo.int/media/news/economic-costs-of-weather-related-disasters-soars-early-warnings-save-lives

[5] https://www.aon.com/weather-climate-catastrophe/index.aspx

[6] https://www.whitehouse.gov/wp-content/uploads/2022/04/OMB_Climate_Risk_Exposure_2022.pdf

[7] https://www.nrdc.org/stories/ipcc-climate-change-reports-why-they-matter-everyone-planet?gclid=Cj0KCQjw7JOpBhCfARIsAL3bobdcV5cHMADgOKMhgignUm6VinLZPaHKHFIDknmTB5WdHbfcRc5jdR4aAjdzEALw_wcB#sec-latest

[8] https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2023/

[9] Ibid.

[10] Ibid.

[11] https://www.ncei.noaa.gov/access/billions/time-series

[12] UNEP Adaptation Gap Report 2023

[13] https://www.un.org/en/climatechange/science/causes-effects-climate-change

[14] https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf

[15] Ibid.

[16] https://www.soa.org/globalassets/assets/files/resources/research-report/2019/12th-emerging-risk-survey.pdf

[17] https://www.cdp.net/en/articles/media/worlds-biggest-companies-face-1-trillion-in-climate-change-risks

[18] https://www.cdp.net/en/research/global-reports/global-climate-change-report-2018#83de191c-12c3c109006c4593128d8bb612c3c109006c4593128d8bb6

[19] https://www.pge.com/pge_global/common/pdfs/safety/emergency-preparedness/natural-disaster/wildfires/wildfire-mitigation-plan/2022-Wildfire-Safety-Plan-Update.pdf

[20] https://www.blackrock.com/corporate/literature/whitepaper/bii-megaforces-december-2023.pdf

[21] https://www.blackrock.com/corporate/literature/whitepaper/bii-megaforces-december-2023.pdf

[22] https://www.energy.ca.gov/sites/default/files/2019-06/Californias_Drought_Impact_on_Hydroelectricity_FS.pdf

[23] https://www.eia.gov/todayinenergy/detail.php?id=56920

[24] https://energycentral.com/news/maui-fire-will-reshape-hawaiian-electric

[25] https://www.state.gov/reports/united-states-strategy-to-respond-to-the-effects-of-climate-change-on-women-2023/

[26] Examples: JPMorgan Chase, Nuveen, Wellington

[27] https://www.msci.com/documents/10199/97e25eb7-9bd0-4204-bea9-077095acf1d3

[28] https://www.imf.org/external/pubs/ft/fandd/2021/06/the-future-of-emerging-markets-duttagupta-and-pazarbasioglu.htm

[29] Please see MSCI's classification criteria and the current list of countries classified as Frontier Markets, versus Emerging Markets: Market Classification - MSCI

[30] https://www.alliancebernstein.com/corporate/en/insights/investment-insights/dont-look-back-the-next-emerging-market-decade-will-be-different.html

[31] https://www.ssga.com/library-content/pdfs/insights/building-an-optimal-em-portfolio.pdf

[32] https://www.temit.co.uk/resources/education-how-to-guides/how-risky-are-emerging-markets

[33] https://tech-action.unepccc.org/wp-content/uploads/sites/2/2021/04/report-on-taxonomy-of-climate-change-adaptation-technology-including-factsheets-finalbrief-tna-adaptation-taxonomy.pdf

[34] https://documents1.worldbank.org/curated/en/757291604041567018/pdf/Resilient-Industries-in-Japan-Lessons-Learned-in-Japan-on-Enhancing-Competitive-Industries-in-the-Face-of-Disasters-Caused-by-Natural-Hazards.pdf

[35] https://www.globalresiliencepartnership.org/wp-content/uploads/2023/12/from-risk-to-reward-report.pdf

[36] https://www.msci-institute.com/

[37] The MSCI ACWI Investable Market Index (IMI) captures large, mid, and small cap representation across 23 Developed Markets (DM) and 24 Emerging Markets (EM) countries. With 9,084 constituents, the index is comprehensive, covering approximately 99% of the global equity investment opportunity set. For the full list of DM and EM countries, please see https://www.msci.com/documents/10199/4211cc4b-453d-4b0a-a6a7-51d36472a703

[38] https://www.msci.com/documents/10199/4211cc4b-453d-4b0a-a6a7-51d36472a703

[39] The list of literature reviewed included the EU Taxonomy, UNEP TNA, ASAP Adaptation Solutions Taxonomy, CBI Taxonomy, GTC UDP Brief: Taxonomy of Climate Change Adaptation

[40] For an example of how investors can treat dual-use products, please see MSCI ESG Business Involvement Screening Research. Available at https://www.msci.com/documents/1296102/10259127/MSCI+ESG+BISR_Methodology+Guidebook.pdf

[41] For details of MSCI's EU Taxonomy Do No Significant Harm (DNSH), please see Sustainable Finance FAQs | December 2021. Available at: https://www.msci.com/documents/1296102/21626434/Sustainable-Finance-FAQ.pdf

[42] GICS® is an industry analysis framework that helps investors understand the key business activities for companies around the world. MSCI and S&P Dow Jones Indices developed this classification standard to provide investors with consistent and exhaustive industry definitions.

[43] https://www.climatebonds.net/files/files/CBI_Taxonomy_Jan2021.pdf

[44] https://www.goldmansachs.com/intelligence/pages/emerging-stock-markets-projected-to-overtake-the-us-by-2030.html

Disclaimer

This paper is not intended to reflect a comprehensive view of adaptation and resilience investment landscape, nor to recommend specific solutions, but rather to serve as content and context for other discussions in this emerging area of investment.

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