WORLD ECONOMIC FORUM

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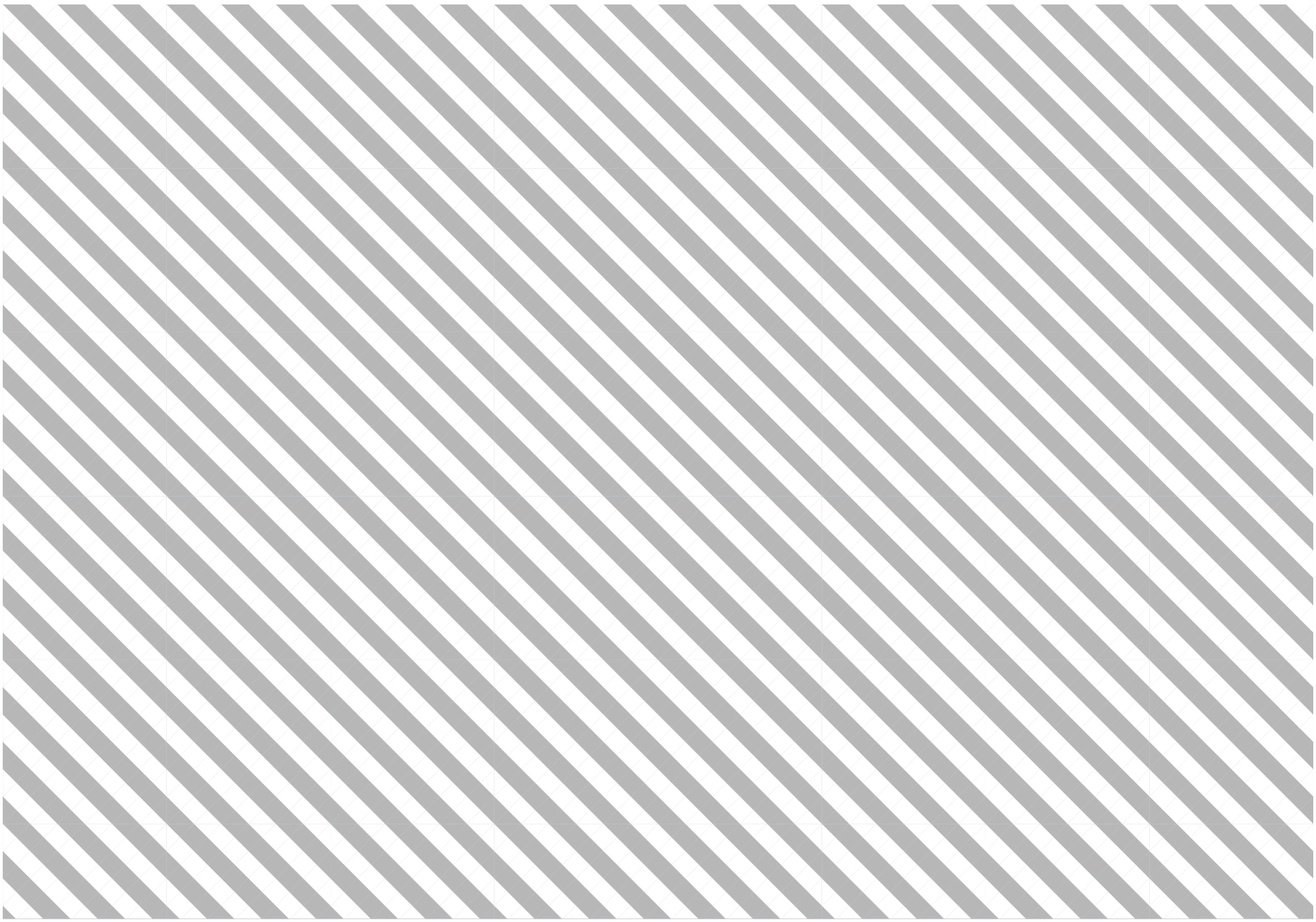
White Paper

Transformational Investment: Converting Global Systemic Risks into Sustainable Returns

In collaboration with Mercer

May 2020



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Foreword

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The need to address the long-term global systemic risks facing our economy, society and the planet has arguably never been greater. This report – based upon casework done in 2019 predating the global COVID-19 pandemic – represents an important step on the journey to effective collective action by the institutional asset owner community and the financial services industry.

This work creates a context for asset owners by laying the foundations for consideration of the most challenging global investment issues of our time. As economies and markets evolve, so do the inherent complexities that create opportunity and risk for investors and asset owners worldwide. We believe more sophisticated, adaptable and precise financial service solutions are needed to achieve long-term sustainable economic development, and to do so without negative impacts for society or the environment on which economic progress depends.

The insights within this report reflect those of a global community of sophisticated universal shareholders convened throughout 2019 and represent diverse vantage points. The scale, sophistication and investment time horizons of these asset owners gives them perspective on where to access investment opportunity and how to address global systemic risks at a policy and investment level.

The impact of the COVID-19 pandemic, which is tangibly illustrating the interconnected risks and real-time nature of our global economy, is covered in limited ways given the rapidly evolving nature of the crisis. Thoughtful application of this paper's framework during 2020 and beyond will lead to new insights on how the global investment community can improve and support society and sustainable economic development going forward against the threat of evolving global systemic risks.

We want to thank the World Economic Forum and Mercer for their work in preparing this report, convening insightful investors from around the world and creating a tangible framework that investors can use when thinking through challenging investment trends.

Preface

Rich Nuzum, President, Investments & Retirement, Mercer

Maha Eltobgy, Head of Shaping the Future of Investing; Member of the Executive Committee, World Economic Forum

The members of the institutional investment community manage assets worth tens of trillions of dollars, wielding significant influence on global business practices. They engage with substantial risks and transformative opportunities and currently are also attempting to manage the economic and financial market impacts of COVID-19. The unfolding impact of the COVID-19 pandemic (the crisis is ongoing at the time of publication of this report) serves as a reminder of the critical importance of understanding complex, interconnected and systemic risks and their real-time effects on the global economy. In the decisions they make when allocating capital to countries, industries and individual businesses, the members of the institutional investment community have the collective power to champion long-term thinking, constructively tackle complicated problems and bring positive changes to our economy, society and the planet – all while pursuing attractive risk-adjusted investment returns.

The World Economic Forum has gathered key influencers from this community to further shape long-term perspectives and support a sustainable global economy. Through in-person meetings in Dalian, New York and Abu Dhabi throughout 2019 and at Davos in 2020, chief executive officers and chief investment officers identified some of the world's most pressing challenges and discussed their ability to act as champions of long-term thinking and action.

The World Economic Forum's multistakeholder platform and network positions it to contribute to this topic holistically. Collaborating with the World Economic Forum, Mercer acted as lead partner on this initiative, drawing insights from its investment clients and global investment research.

Produced as part of the World Economic Forum's Platform on Shaping the Future of Investing, this report explores real case studies of transformational investments and the governance practices long-term investors are already using to address global systemic risks. It draws on previous World Economic Forum work, including Thinking Strategically: Using Resource Revenues to Invest in a Sustainable Future.

This work explores forward-looking investment practices that provide leaders with the tools, networks and scale to address the most critical risks and challenges that confront our global economy, society and the planet. We would like to thank the investors, policy-makers, academics and other experts who have contributed to this work.

1. Executive summary

1.1 Transforming through uncertainty

The impacts of a specific corporation's behaviour on the environment, the economy and society have historically been viewed as "externalities". In the absence of explicit regulation (such as fines, taxation or subsidies), these "ancillary" or "indirect" impacts have generally not been factored into the pricing of individual securities because they are not expected to "show up" in the near-term cash flows of that security.

Global stakeholders – governments, corporations, individuals, universal shareholders (see inset) – have a vested interest in these externalities. Collective behaviour produces, or fails to mitigate, long-term global systemic risks that threaten the continued smooth and sustainable operation of our society, the economy or the planet.

Perhaps the most obvious of these risks, one that has already been the subject of substantial research, is climate change driven by human-initiated carbon emissions. Water security, geopolitical stability, technological evolution, demographic shifts and low and negative interest rates can also be evaluated as long-term global systemic risks.

All of these risks have characteristics in common. In particular, adequate responses require more than changing the behaviour of one government, one corporation or one individual. Collective action is necessary. As will be demonstrated through the specific case studies and more general qualitative discussion in this report, universal shareholders have great capacity to pursue transformational investments to mitigate these risks, while capturing attractive risk-adjusted investment returns. They are doing so in practice now, and these efforts are scaling as larger numbers of investors become better aligned and more involved. When individual universal shareholders act collaboratively, they can produce greater impact, faster; and this dynamic is driving a growing recognition of the importance of collective action by institutional asset owners.

In this paper, we focus on transformational investment from the viewpoint of the institutional asset owner community – the investor perspective. Recipients of transformational investment can include countries and cities that require capital and technology transfer to address these risks locally, and thus our conclusions are also relevant for these stakeholders – the investee (or "recipient") perspective.

Universal shareholders

We define a "universal shareholder" as an investor who holds a well-diversified portfolio of securities, with a long-term investment time horizon.

For this type of shareholder, a negative or positive externality produced by one corporation becomes a cost or benefit in terms of the productive capacity of society as a whole. The extent of its positive or negative impact ultimately affects the future cash flow of other corporations whose securities are held by the universal shareholder.

As a result, activities that were historically viewed as externalities at the level of an individual security need to be "internalized" or factored into investment decisions explicitly as relates to the owner's overall portfolio. This is necessary because these "externalities" have a direct impact on the sustainability of investment outcomes within the universal shareholder's broadly diversified investment portfolio.

Transformational investment

We define a "transformational investment" as an investment that is intended to derive an attractive risk-adjusted expected return within the context of a given asset owner's overall portfolio, and at the same time is expected to help mitigate or address one or more long-term risks.

Evaluating any one of the long-term global systemic risks on its own is a challenge, but taking interrelationships between the risks into account makes the task harder still. In addition, investors may be affected in different ways by a given risk depending on their specific circumstances and context. The effects of a risk can go beyond its impact on the fund's investment returns, as the funding entity and individual beneficiaries may also be affected directly or indirectly by the risk, separately from the investment outcomes. There is therefore a need to consider and analyse the appropriate approach for any specific investor holistically and broadly, as we will illustrate.

The challenges are magnified by the fact that conventions for the measurement and disclosure of most of these risks are either undeveloped or in the early stages of adoption.

If any of this were easy or simple, the available returns would be lower. With that said, the most sophisticated transformational investors have blazed a clear trail, which other investors can follow to potentially garner sustainable returns while mitigating systemic risks. Because of the growing recognition of the potential benefit of collective action for universal shareholders, the pioneers of transformational investment generally welcome other investors following in their footsteps. Being early, and then being proven right is a recipe

for sustainable outperformance in investing in general. For early adopters of transformational investment, seeing other asset owners follow isn't just an instance of the adage that imitation is the greatest form of flattery; following in this way provides liquidity, helps drive the cost of investment down through scale and helps produce the positive externalities that helped motivate the early adopters to pursue the investment in the first place – or mitigate the negative externalities. In short, transformational investment is one of the areas of economic activity in which collaboration helps produce better results.

Global systemic trends identified as most relevant to long-term investors, for the purposes of this report

- Climate change
- Water security
- Geopolitics
- Technological evolution
- Demographic shifts
- Low and negative real long-term interest rates

Case study contributors

- British Columbia Investment Management Corporation
- Ireland Strategic Investment Fund
- Mubadala Investment Company
- New Zealand Superannuation Fund
- Sunsuper
- USS Investment Management

Other contributors

- Asset owners
- Asset managers
- Financial institutions
- Academics

The interrelationships between risks, while introducing complexity, also make it possible to address some risks simultaneously through a single investment action. For example, some types of infrastructure, venture capital and cleantech investments can serve as transformational investments for mitigating the risks associated with climate change, geopolitical stability and/or technology evolution.

While transformational investment may be moving from the cutting edge towards an acknowledged best practice, there remains substantial scope for further innovation on the product development side. We believe there is a shortage of available products and opportunities for sovereign wealth funds (SWFs) and other large asset owners to implement or execute their investment policies to mitigate these risks. An applicable example is the need to increase the supply of sustainability-related products and opportunities in a way that enables investors to find attractive risk-adjusted rates of return while mobilizing the needed volumes of capital to address climate change. The scope for deploying additional capital against these risks remains large. "Transformational investment gaps" can be estimated for each of the different risks. For example, we believe at least $6.2 trillion per annum is needed for the combination of climate, water and demographics transition strategies alone.

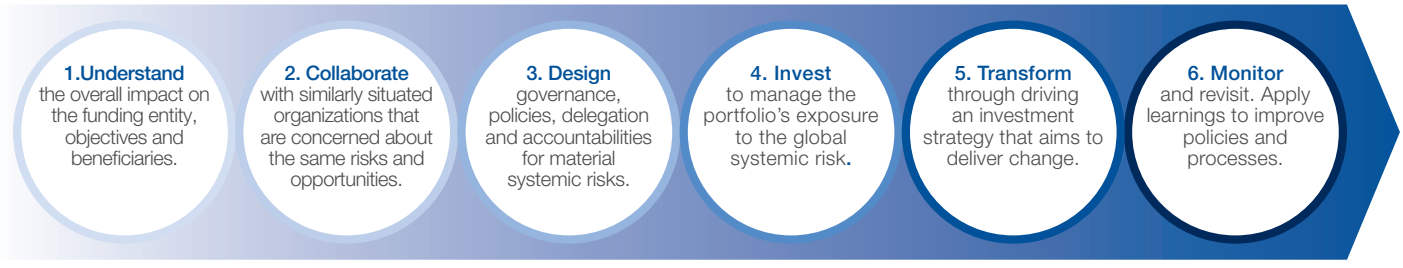
From the investee (or recipient) standpoint, demand for transformational investment is particularly evident among emerging and frontier countries. However, most of these countries continue to struggle to attract the required capital for planned sustainable development – particularly in infrastructure. A growing supply of capital is available to invest in transformational investment opportunities that offer long duration profiles and diversification, but investor and beneficiary alignment remains lacking in most countries due to an inability to mitigate local political risk, ensure protection of ownership rights for investors and otherwise give investors confidence about the "rule of law". Unfortunately, some of the geographies that most need transformational investment, and which could produce the strongest risk-adjusted returns for investors if political risk could be effectively mitigated, are the least able to attract investment.

Through interactive sessions and the development of illustrative case studies with sophisticated investors around the globe, this report has been produced to support efforts to allocate capital to positively affect our planet and society while earning strong risk-adjusted investment returns. Specifically, the report documents an established pathway for long-term investors to convert systemic risk uncertainty into sustainable investment opportunities.

This report:

- Identifies **six global systemic risks** that affect global asset owners (additionally, pandemic risk with the specific example of COVID-19 is addressed in a paper supplementing this report)[1]
- Summarizes **case study insights** from large asset owners
- Introduces a **governance and decision-making framework** (see illustration below), providing a pathway for investors to become experienced in translating risks into opportunities, while imposing discipline through holistic risk management – including a robust monitoring framework
- Describes potential future **industry initiatives** that will further improve governance and enhance the ability of long-term investors to respond to these six systemic risks

1.2 Governance framework



2. Global systemic trends

2.1 Introduction

Asset owners and investment managers face an evolving set of long-term risks and challenges, accompanied by opportunities for transformational investment. Some of these risks are not easily captured within conventional investment and risk management frameworks. These risks share characteristics including:

1. A long time horizon with widespread, sometimes global, impacts
2. Lack of accepted standards for measurement, and
3. Potential for adverse impact on:
   - Ability of long-term investors to achieve their objectives and/or
   - Economic stability of the funding entity

The World Economic Forum Global Risks Report 2020[2] highlights the most significant risks faced by the world today. From this report, we focus on six key global systemic risks identified as most relevant to long-term investors. These six risks have varying importance to different asset owners based upon each fund's objectives, policy mandates, capital adequacy and governing structures.

Climate change	Need for governments and businesses to address climate change, protect populations and adapt.
Water security	Exposure to declining quality or quantity of fresh water, affecting human health and/or economic activity.
Geopolitical stability	Implications of rising global inequality, populism, protectionism, interstate conflict and threats to free trade.
Technological evolution	Risks and opportunity associated with technological advances, inadequate infrastructure and networks, and cyberattacks.
Demographic shifts	Implications of ageing populations globally, demographic imbalances between rapidly ageing regions, those entering demographic transition and the impact of migration.
Low and negative real long-term interest rates	Implications on monetary policy and return requirements for investors and stakeholders of sustained near-zero or negative real long-term interest rates.

Multiple potential outcomes are possible for each risk, ranging from the benign to the catastrophic. Universal shareholders have strong incentives to find transformational investments to respond to these risks. Effective transformational investments can support a smoother transition of society, economies and markets towards favourable outcomes, while generating attractive risk-adjusted investment returns for investors.

2.2 Case study insights

Some global investors are already practising transformational investment. Leading investors are responding to these risks in numerous ways despite hurdles, including lack of measurement and inadequacy of traditional risk/return analysis. Proactive engagement is visible in many areas:

- Top-down stress and scenario testing to quantify exposures to systemic risks within portfolio investments. In many cases, this has required the development of, or collaboration to build, the underlying risk models and a commitment to evolve these over time
- Getting granular in the level of detailed analysis carried out on industry sectors and individual investments, including adapting investment processes and tools to incorporate consideration of systemic risks
- Diversifying exposure to potential stranded assets – for example, by reducing allocations to high carbon industries
- Actively and visibly engaging with investee companies to promote resilience in the face of systemic risks

The actions and conclusions reached by leading investors illustrate unique approaches to systemic risks, often achieved through collaboration with other global stakeholders. Examples across the six risk areas are highlighted below.

Climate change

The Guardians of New Zealand Superannuation, which manages the NZ Super Fund, concluded that ignoring climate change in investment decisions constitutes taking "undue risk".

- If markets are underpricing climate risk as the Guardians believe, then reducing exposure to the most at-risk assets will improve returns. If in fact the risks are being fairly priced, then one fairly priced asset is being traded for another. The Guardians believe reducing exposure to climate risk offers a low-cost insurance policy.
- The Guardians decreased the fund's passive equity exposure to climate risk in 2017, by reallocating NZD 950 million in passive investments away from high carbon exposure companies. Passive equities represented 40% of the fund. Since then, the fund has applied its methodology to active parts of the portfolio. As at June 2019, the portfolio's carbon emissions intensity was 43% lower than the original benchmark portfolio, and exposure from reserves was 52% lower.
- The Guardians actively seek transformational investments. Opportunities reviewed include: green buildings; meat alternatives; agricultural technology; wind and solar energy generation; waste management; and technology platforms and transformational infrastructure.

Water security

British Columbia Investments (BCI) has identified water risk as a top engagement issue. BCI:

- Recognizes that it needs to be selective in how it uses its internal research resources. Water risks are one of three core focus areas because they are prevalent and material across most industry sectors; data is available to assess the risks and BCI believes it has the ability to influence change.
- Uses water security as a lens to view sector-based impacts and opportunities. It carries out detailed research to understand technological developments providing adaptive capacity to mitigate the risk of water stress.
- Uses a physical climate change risk tool that provides location-specific information on water stress for specific geographies for real estate assets. It is developing comprehensive environmental, social and corporate governance (ESG) risk measurements and monitoring tools in which water risk will be one of several key focus areas.
- Engages and advocates for better disclosures on water use and efficiency and for investee companies to adopt strategies to help alleviate and manage water stress-related risk to the business.

Geopolitical stability

Trade and connectivity is an enabler for many industry clusters in Singapore. Sea transport, aviation and logistics account for roughly 170,000 jobs in Singapore, or roughly 7% of GDP. As an owner-investor in these industries, ***Temasek evaluates the impact of geopolitical risk and the potential risk-adjusted returns to its portfolio through various stress scenarios.***

- This forms part of Temasek's intrinsic value discipline. The Singapore-headquartered investment company refers to this as the fundamental earnings impact that rides out short-term market volatility and focuses on generating sustainable long-term returns (different from a shorter-term trough impact).
- In addition to a central case, Temasek identified various alternate scenarios, three of which were mentioned in its annual review last year and evaluated under 20-year return expectations. These were: a China hard landing with an extended economic slowdown; severe escalation in trade and tech tensions; and secular stagnation.
- For each scenario, Temasek estimated the sustained impact on the intrinsic values of individual investments, in comparison to their original investment theses. The aggregate of these informed Temasek's view of the potential risk-adjusted returns of the overall portfolio value.

Technological evolution

Mubadala responds to technological evolution through its investment strategy, internal processes and initiatives with employees across its organization:

- As a predominantly direct private investor, it works to ensure existing assets innovate to remain relevant and new opportunities afforded by technology are uncovered – for example, by seeking early-stage exposure to new technology ventures. All investment decisions have an explicit consideration of resilience, adaptability and capability for technology adoption and innovation.
- Mubadala is developing an approach to value data and technology and factor that into asset and portfolio valuations. This approach also guides initiatives for value protection (e.g. cybersecurity) and value creation (e.g. business process improvement).
- Given the fast pace of change and the multiple interconnected risks and opportunities created by technology, Mubadala focuses on risk culture, diversity and capability within its own organization. Initiatives are in place to continually develop competencies such as innovation, adaptability, resilience and promoting ethical behaviour. Varying perspectives and experiences are valued, because these promote cognitive diversity, which is essential to understanding and responding effectively to technological change.

Demographic shifts

Sunsuper considers demographics to be a key input into the fund's investment objectives.

- Sunsuper conducts quantitative measurement and workforce growth modelling globally, based on published population tables, and uses this to help guide its long-term investment and risk management.
- Long-term investment returns are bounded by potential economic growth, which is a function of demographics (change in the scale of the workforce) and productivity (output per worker). Productivity is challenging to predict, while demographics are quite predictable. Sunsuper believes the reduction in population (and workforce) growth will reduce forward-looking growth expectations, leading to lower return expectations.
- Sunsuper subsequently reduced the long-term investment objectives across its suite of funds, consistent with lower forecast workforce growth (Sunsuper's objectives do not change with valuations).
- Slower global population growth has directed the fund towards diversifying opportunities in alternative assets, anticipating lower forward-looking returns as economic growth becomes muted.

Low and negative real long-term interest rates

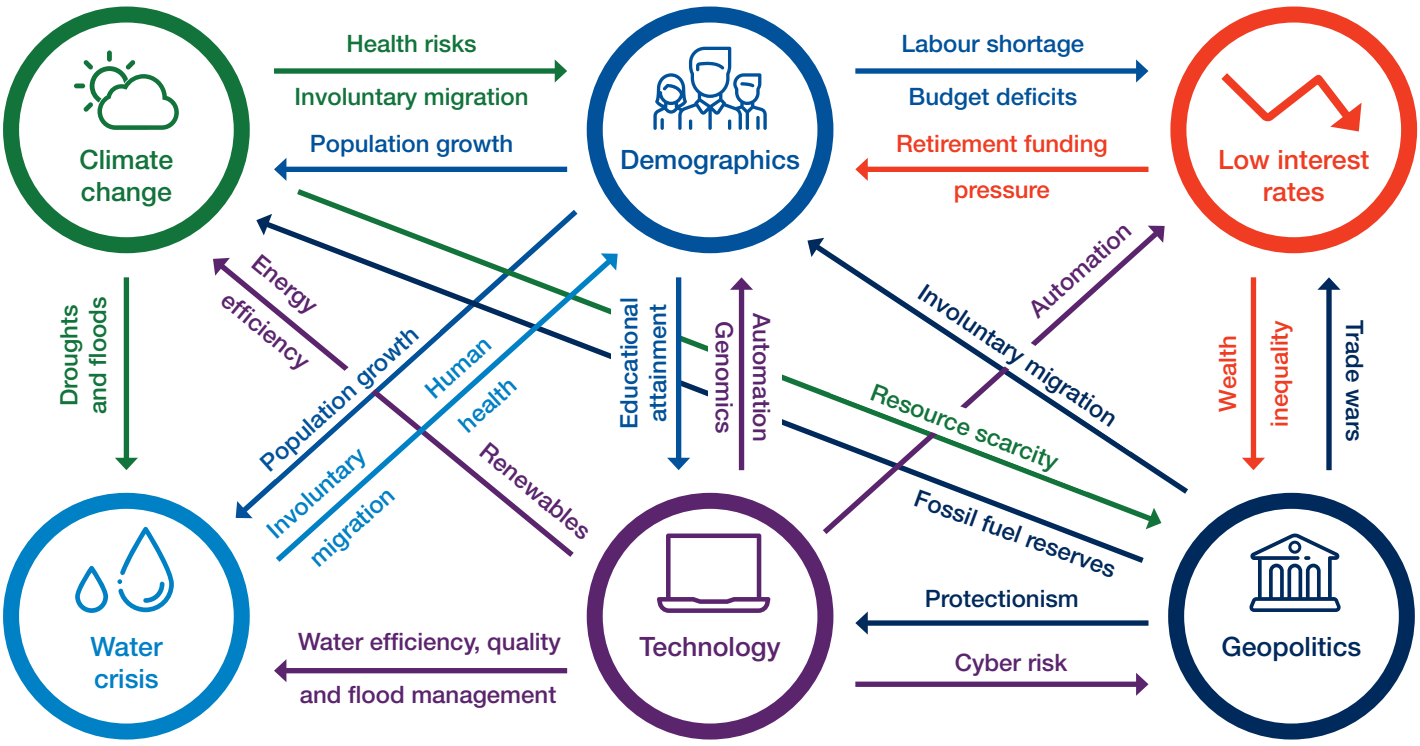
The Ireland Strategic Investment Fund (ISIF), managed and controlled by the National Treasury Management Agency, has a "double bottom line" mandate to support economic activity and employment in addition to delivering commercial returns. The ISIF is required to seek to generate a return over the long term in excess of the cost of Irish government debt.

***The persistence of low and negative interest rates has benefitted the ISIF as its benchmark commercial return has reduced through time. In addition, the ISIF has taken a number of portfolio actions to address portfolio implications. The ISIF*:**

- Increased the focus on alpha and absolute return strategies in the fund's global portfolio (invested outside of Ireland). Loose monetary policy adopted by central banks has pushed up asset prices, bringing forward future returns and lowering expected returns (pre-COVID crisis) across asset classes.
- Reconsidered its strategic asset allocation given reduced return expectations from the lowered risk-free rate and spreads, and the negative total fund return implications of negative cash rates, which previously had made a positive contribution to return expectations across all asset classes.
- Measures each investment/asset against the fund's commercial and economic objectives, including a semi-annual economic impact survey for the entire portfolio and an annual scorecard of output versus economic impact.
- Re-evaluated the cost of liquidity, which is no longer free when interest rates are negative.

2.3 Where trends collide

The interrelated nature of global systemic risks can make it more difficult to identify and quantify drivers of risk and sustainable returns. The following diagram illustrates just some of the interrelationships and complexity that make measurement, pricing and actionable response more difficult for long-term investors. We believe that understanding these relationships and proactively managing investment programmes that reflect these correlations drives success.



The complicated interrelationship of risks calls for a holistic approach to strategy development and risk management – one that is well suited for long-term investors such as SWFs, insurers and other large asset owners. Their multi-decade time horizon positions them to look further into the future than typical asset managers when making investment decisions, considering the impacts of risks and opportunities and leveraging their capabilities to uncover, stimulate and manage investments that aim to achieve their transformational objectives and policy mandates.

2.4 A roadmap and decision-making framework for governance

The six global systemic risks challenge conventional investment and risk management practices. At best, investors can only partially observe their effects as they have limited historical experience. Despite the ability of systemic risks to compound economic and financial system stresses, the risks are often not identified effectively, priced efficiently or measured and managed.

The following six-step governance and decision-making framework equips long-term investors with a governance process and set of actions intended to transform the global systemic risks into sustainable return opportunities. The roadmap builds on successful collaborative industry initiatives, such as the Santiago Principles for SWFs,[3] and the Financial Stability Board (FSB) Task Force on Climate-Related Financial Disclosures (TCFD) designed for all entities.

The particular potential benefits of this framework include:

1. **Pathways** for investors aspiring to become market leaders in addressing global systemic risks
2. **Discipline** in achieving holistic management and addressing global systemic risks
3. **Collaboration** to tackle and adapt to challenges:
   a. Identifying stakeholders with aligned interests
   b. Developing encompassing approaches that solve risk interdependencies
4. **Monitoring** through measures that establish foundational understanding of risk impact

1. Understand

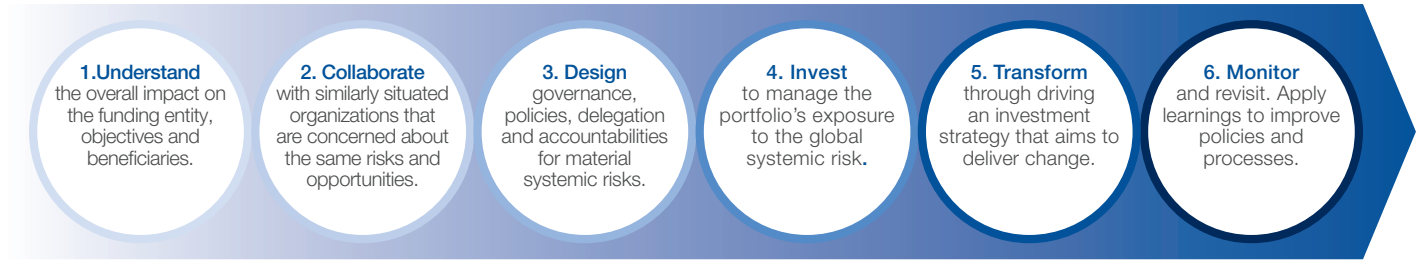
- **Prioritize global systemic trends that:**
  - Affect stakeholder economic and investment objectives, over the medium and long term
  - Represent potential risk, either in failure to meet objectives or other adverse outcomes
  - Are unrewarded risks that are not adequately addressed within the existing investment process

2. Collaborate

- **Coordinate with:**
  - Peers, industry groups, regulators and finance system leaders
- **Leverage:**
  - Peer policies and practices
  - Engagement with regulators for market reform
  - Public commitments, disclosures and reporting
  - Best practices in transformational investment
  - Portfolio research that aims to create resilience in the face of these structural trends

3. Design

- **Educate leaders and executives**:
  - Impact and risk for stakeholders and beneficiaries
  - Fiduciary responsibility as per country legal requirements and global best practices
  - Implementation approaches and case studies
- **Align investment beliefs** with risk considerations
- **Adapt governance frameworks** via policies, procedures and ongoing indicators for monitoring
- **Align accountabilities** across the organization



4. Invest

- **Build/update processes based upon risk research, scenario analysis, etc.**
  - Strategic asset allocation
  - Geographic/sector/stock-specific
  - Investment manager and direct investment selection
  - Stewardship policy
  - Sustainability/thematic investing

5. Transform

- **Create target portfolios designed to deliver benefits:**
  - Construct portfolios using methods such as thematic, pure play, impact
  - Embed processes for selection of "companies of the future" that build resilience into the portfolio within fund risk and return tolerances
  - Recast roles/mandates of investment managers or investment teams to meet metrics and targets
  - Consider innovative structures/ instruments

6. Monitor

- **Maintain/sustain focus, measure impact and evolve:**
  - Apply monitoring framework at various levels of the organization
  - Benchmark and report policy compliance
  - Report internally/externally to stakeholders
  - Create culture of ongoing learning and improvement that captures trend evolution

2.5 Progress towards governance for global systemic risks

The level of progress in establishing a governance framework to address global systemic risks varies among investors. The largest current challenges in addressing these risks across the governance process appear in two areas:

- Transform:
  - There are significant challenges in finding investments to suit risk appetite.
  - The market offers incomplete visibility into the universe of investment opportunities.
  - Securitized products/investment vehicles for investors who are unable to make direct investments are lacking.

- Monitor:
  - Data capture is, at best, nascent, providing thin datasets for predictive analytics.
  - Robust quantification frameworks are yet to be developed and tested.

The table below illustrates Mercer's assessment[4] of the progress for each risk across the six governance steps.

The progress of governance for global systemic trends

Governance steps

Global systemic trend	Understand 1	Collaborate 2	Design 3	Invest 4	Transform 5	Monitor 6
Climate change	●	●	●	○	○	●
Water security	○	○	○	○	○	○
Geopolitical stability	◉	○	○	◉	◉	◉
Technological evolution	●	○	●	●	○	●
Demographic shifts	●	○	●	○	◉	◉
Low and negative real long-term interest rates	●	◉	●	○	◉	○

● = Significant progress by some investors ○ = Some progress ◉ = Limited to no progress

Key progress takeaways from case study reviews, in-person meetings and interviews include:

On **climate change** issues, leading investors have established beliefs, processes and portfolio allocations. Some have made significant allocations to renewable energy or "cleantech" investments. However, material change is not yet apparent in investor responses to the major drivers of carbon emission increases, including among the highest carbon-producing countries – e.g. China, the US and India. Downside shocks in oil prices (e.g. to prices below $30 per barrel) will make renewable energy less competitive in the near term but do not change the long-term outlook for fossil fuels. Finding enough attractive risk-adjusted investments to gradually reduce overall emissions of portfolio assets to align with the Paris Agreement by 2050 (in accordance with the Net-Zero Asset Owner Alliance)[5] continues to be a challenge.

Water security is sometimes not viewed independently from climate change. Climate change risks often manifest as water risks – for example, through larger storms, greater flooding and longer droughts. However, societal and funding entity effects from water risk emerge locally, meaning that the risk impacts and transformational solutions are often different from those of climate risk. Collaboration to address water security includes the Ceres Investor Water Hub; working groups of the United Nations-supported Principles for Responsible Investment (PRI); and the Interfaith Center on Corporate Responsibility (ICCR). Some investors are actively monitoring water risk and investing for sustainable return outcomes.

Geopolitical stability implications are hard to predict, measure and capture, particularly due to interrelationships with other global systemic trends – for example, climate, water and demographic risks can lead to geopolitical instability and conflict. However, investors (especially those funded by sovereign entities) with higher exposure to global trade are incorporating analysis into portfolio return expectations.

Technological evolution often appears in leading investors' current investment strategy through venture capital and private equity investments. They are also assessing risks and opportunities through alternative data analysis, new systems and governance processes for improving workforce capabilities and to accelerate efficiency.

Demographic shifts and associated risks are often considered more predictable, as past fertility, mortality, education and migration trends set future population growth and structure. However, few investors explicitly consider how to translate insights into ongoing portfolio implementation beyond the impact on their own liabilities.

Low and negative real long-term interest rates are typically captured within leading investor strategic asset allocation processes and are translated to investment objectives and strategy. Strategic asset allocation processes often measure the implications of low and negative interest rates, using scenario analysis to connect current and forward-looking market environments to ongoing strategy, investment policy and the probability of achieving objectives. However, some investors don't see addressing the causes of low interest rates as within their scope or abilities.

Common challenges faced by investors in transitioning to a more effective governance framework are highlighted on the following page.

The fund's governance structure and ability to represent the **material impact** of very long-term risk concerns **on fund objectives**, **beneficiary outcomes and the mandates of other stakeholders**

Pace and scale of **adoption of** useful **metrics and target outcomes**

Ability to identify, assess and **make long-term risks a priority** over short-term pressures

Availability of data, models and tools that, where applicable, quantify risks and opportunities on a forward-looking basis – **or established conventions** for the assessment of these risks

Access to solutions. The range of solutions is not fully developed, and the instruments are nascent in some areas and not yet widely understood and adopted. Governance around some investment solutions has also been mixed, affecting their broader adoption

2.6 Active industry initiatives – next steps to continue progress

The scale of systemic risks requires collective action and individual efforts to set in motion or accelerate positive transformational change. A broad number of active industry initiatives are already enabling long-term investors to work through aspects of the governance process. While stakeholder collaboration levels and experience vary, in general collective action and transfer of knowledge allows for improvements to the investment ecosystem. Industry initiatives are helping investors constrained in terms of liquidity, fees and time to benefit from access to required knowledge, help with established practices and new investment opportunities. Areas specifically requiring a combination of further collective and individual efforts include:

Measurement conventions Ability to assess exposure and impact of global systemic trends on portfolio and stakeholder outcomes	– Adoption of improved consistent measures, transparency and consistent reporting on financial and non-financial impacts of global systemic risks and opportunities by governments, corporations and investors
Transformational solutions Systematically identify and match investment solutions with long-term investor objectives	– Identification of transformational opportunities that offer potential for attractive long-term returns (e.g. direct investment opportunities, private market funds and traded securities) – Communication of asset owner investment criteria for investment partners to actively pursue transformational opportunities
Government intermediation Establish regulations and policies that protect long-term investors	– Investors need experience and support to engage with governments, whether foreign or their own, to reduce political risk associated with transformational investments – Establishment of realistic risk-sharing guidelines and procurement procedures, to ensure process certainty and a clear pipeline of investment opportunities – The collective power of large asset owners provides direction and influence

3. Transformational investment opportunities and challenges

3.1 Introduction

The opportunities and challenges faced by universal shareholders cut across government jurisdictions and often require cooperation between nations, states/provinces, cities, corporations and asset owners. Shoots of innovation and hope are strong in some places: Governments and asset owners are already pursuing broader stakeholder objectives, including many that address long-term trends.

They are investing in segments that enhance economic development and working to overcome and address regional tensions and resource imbalances in the process.

That said, we have far to go and the numbers speak for themselves. Based on various studies, the table below provides a directional sense of the scale of investment needed to address today's most significant global challenges – quantifying the investment "gap" or opportunity and identifying examples of transformational investments.

Global systemic risk	Investment gap (per annum)	Transformational investment examples
Climate change	$2.4 trillion[6]	Cleantech infrastructure, renewable energy, sustainable natural resources
Water security	$670 billion[7]	Food production, energy production, water quality infrastructure
Geopolitical stability	Cross-trend opportunities	Infrastructure, renewable energy, climate-resilient infrastructure, automated manufacturing
Technological evolution	$1.7 trillion[8]	Tech-related venture capital, electric vehicles, renewable energy, global connectivity, battery storage, mobile networks, fintech
Demographic shifts	$1.5 trillion[9, 10]	Education, healthcare, infrastructure, care of ageing populations
Low and negative real long-term interest rates	Cross-trend opportunities	Venture capital, distressed debt, infrastructure
Total*	**$6.27 trillion**	

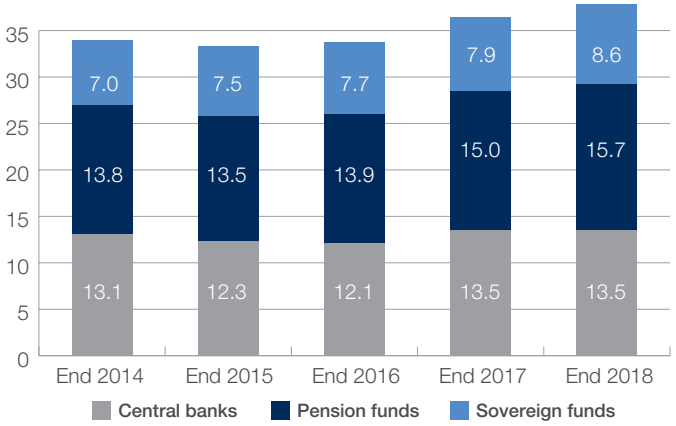
*Not accounting for overlap between trend opportunities.

The amount of capital required to effect change across the global trends is daunting. Numerous examples from the past 20 years (e.g. recycling infrastructure, solar power, vehicle electrification) illustrate how government support and regulations combined with private investments can transform society. We believe that unlocking the potential of transformational investments and addressing global systemic trends will require further securitization, structuring and product development.

A separate study estimated a $10 trillion investment opportunity to 2030 in emerging countries, across three Sustainable Development Goals (SDGs) – clean water and sanitation; affordable and clean energy; and industry, innovation and infrastructure.[11] This compares to a 2018 estimate of total assets held by public pension funds, central banks and SWFs of at least $37.8 trillion.[12]

Total global public assets up by $1.4tn

Assets under management by institution type, $tn



Source: Official Monetary and Financial Institutions Forum (www.omfif.org/gpi-2019/)

Many investors already consider global systemic risks according to their organizational profiles. For example, the energy transition is of heightened importance to SWFs financed by commodity income, while demographics largely affect the sustainability of public-sector pension funds. Other long-term investors such as insurance funds, endowments and foundations represent another significant pool of capital with multi-decade investment horizons. They, too, are exposed to the long-term impact of global systemic risks and are increasingly looking for transformational opportunities with attractive risk-adjusted returns.

The remainder of this section provides context for each global systemic trend, summarizing the state of play and transformational investment required.

3.2 Climate change

State of play

Addressing the challenge of global climate change requires investors to support a transition to a low-carbon economy and to mitigate the physical damage caused by global warming. While climate-related regulation and policy may slow emissions growth, insufficient collective action by governments and universal shareholders in general continues to limit progress towards net-zero carbon by 2050.[13]

The UN's Intergovernmental Panel on Climate Change (IPCC) identifies a need for average annual investment of $2.4 trillion into the energy system alone until 2035, to limit temperature rise to below 1.5°C from pre-industrial levels (approximately 2.5% of global GDP).[14] The IPCC estimates the global economic damages of climate change to 2100, for 1.5°C and 2°C scenarios, to be $54 and $69 trillion respectively.[15]

Slow progress reflects numerous factors, such as the unique challenges of implementing climate-related financial disclosures, metrics and targets, including each country's economic context, Nationally Determined Contributions (NDCs)[16] and development stage. For example, Kuwait and the US face very different situations. Kuwait is focused on reducing economic dependency – roughly 37% of GDP – on oil and gas production, while the US has a much smaller economic dependency, and instead requires major investment to shift infrastructure and fossil fuel dependence towards renewable energy sources.

Meanwhile, governments, universal shareholders and global investors are investing in less carbon-intense activities for more impactful outcomes such as solar, wind, batteries and storage, copper and agricultural productivity. Renewables are beginning to compete with conventional power generation – for example, solar bids have been as low as $19.97/MWh in California and $17.90/MWh in Saudi Arabia (as of 2019, with storage data as of 2017).[17]

We are now seeing the beginnings of decarbonization as a response in markets. For example, in the MSCI ACWI Index, 45.5% of companies in the Utilities sector reduced their carbon intensity between 2014 and 2019. In the Energy sector, 19.8% of companies and in Materials 24.6% of companies have reduced their carbon intensity in the same period.[18] Significant capital is required to transition to sustainable long-term solutions.

Transformational opportunities

Global transformational investors are active at many levels, restructuring investment policies, working to change beliefs and revising governance frameworks from the top down to create a climate context for entire organizations; bottom-up scenario analysis and climate stress-testing is being used to define return impacts at the asset class, sector and portfolio levels. Sustainable themed equities (including renewables), green bonds, sustainable infrastructure, green private equity and low- and zero-carbon indices represent expanding areas of investment activity.

Bottom-up company analysis and portfolio construction is focused on decarbonization and reallocation of assets to sustainable ventures in both public and private markets. Examples include:

- Information technology focused on climate solutions
- Cleantech infrastructure and renewable energy, including onshore wind and solar, hydro, geothermal
- Sustainable natural resources such as seed development, water, fertilizer, food and nutrition, production of crops
- Aquaculture assets
- Materials such as copper, because wind and solar installations are more copper-intensive than conventional power plants and copper is critical for electric grids, battery-charging infrastructure and electric vehicles
- Implementation approaches, including pure play and sustainable themed strategies, and portfolio tilts and overlays

Despite improvement in recent years, continued progress is needed towards net-zero carbon by 2050. The continued translation of climate considerations into policy and governance frameworks is expected to accelerate the search for climate change investment opportunities, notwithstanding the effects of the recent oil price declines and the economic stress from the COVID-19 pandemic.

3.3 Water security

State of play

All life on Earth and most economic activity and industry depends on abundant and clean water. Cross-sector dependency on water by households, agriculture, industry, energy and transport make water scarcity and threats to water quality a significant investment risk.

Governments are increasingly partnering with institutional investors to protect functioning natural resources and to develop water infrastructure to secure the supply and distribution of clean water. These investors provide the knowledge, technology and capital that focuses development on long-term sustainable solutions.

Additional investment needed to achieve the SDG of ensuring availability and sustainable management of water and sanitation for all is approximately $1.7 trillion until 2030 – about three times the current investment levels. However, the broader needs for water infrastructure range from $6.7 trillion by 2030 to $22.6 trillion by 2050.[19] In addition, water-related losses in agriculture, health, income and property could result in GDP declining by as much as 6% by 2050 in some regions of the world.[20]

Investors in water infrastructure and solutions must be sensitive to the human, cultural and social dimensions of water. With increasing population growth and growing competition over scarce water resources, we are likely to see other day-zeros as we did in Cape Town in 2018,[21] when municipal water supplies narrowly avoided being shut off, and government-enforced rationing caused residents to stand in line for water supplies. In many regions, vulnerable populations (low-income communities, women and children) have had to pay the most and travel the furthest to access water.

In 2010, the UN declared water to be a human right.[22] More generally, the private sector must be aware of the social dimensions to water security. Ways to mitigate water security risks include understanding historic regional water conflicts and issues, working with water regulators to provide water lifeline rates to protect vulnerable communities and working with regional stakeholders (including hydrologists, investors, businesses and water managers) on diversifying supply, sustainable water management and long-term planning.

The multiplicity of stakeholders, including investors in water-related assets, requires robust governance to align investment time frames. While local organizations may be best placed in terms of local experience and perspective, the scale of transformational water investment demands collective effort. There are 286 transboundary river and lake basins and 592 transboundary aquifers shared by 153 countries.[23] As just one example, the River Nile – 6,500km (more than 4,000 miles) long – flows through 11 nations.[24] Water risk may sometimes necessitate partnering with individual governments and country stakeholders but it often requires collaboration between governments that can be facilitated by large asset owners.

Other challenges faced by long-term investors can include contract renewal uncertainty due to changing governments, and droughts that can temporarily dislocate the supply and demand of clean water, among other factors. Long-term asset owners are finding ways to engage investee companies on better water stewardship, to build sustainable solutions intended to support sustainable water management and to deliver clean water over multi-decade time horizons. Acting as responsible stewards and building trust with governments and citizens can be rewarded with attractive risk-adjusted investment returns.

Transformational opportunities

There are many opportunities and solutions related to water security. A large number are related to ways of making food and energy production more efficient and mitigating water pollution. Food production takes up 70% of human water use globally.[25] The agricultural sector is transforming how it uses water and how it affects water supplies. Solutions include drip irrigation, satellite monitoring, precision soil moisture and nutrient monitoring. Likewise, energy production has traditionally required vast amounts of water. Newer forms of energy production using less water and limiting pollution are gaining share.

Other opportunities focus on water quality, human health or providing water infrastructure to communities and industry. Innovative developments include distributed small-scale water utility solutions for individual sites or buildings and energy production from waste water.

The oil and gas, semiconductor and chemicals sectors all consistently rank high in terms of water-intensive operations and weight in the major global indices, and are likely to affect the quality and quantity of local water resources.[26] PGGM, in partnership with UBS and the City University of New York, recently conducted a collaborative study, mapping where fresh water resources are under the most threat and creating opportunity maps to inform where investments would have the largest potential positive impact; this is a good example of investment industry collaboration.[27]

3.4 Geopolitical stability

State of play

Income and wealth inequalities around the globe are fuelling populism, protectionist policies, trade tensions and the risk of further economic fragmentation.

Global inequality is drawing increased attention as nearly half the world's population (3.4 billion people) are living on less than $5.50 per day – while the world's richest 1% have more than twice as much wealth as the other 6.9 billion people do in aggregate.[28]

A slowing or reversal of globalization, which has been important to economic development, can be observed through the stagnation of global trade. Between 1970 and 2008, international trade increased as a share of global GDP at an average rate of approximately 3% per annum. By contrast, since 2008 it has stagnated.[29] The 3% growth that has been lost represents approximately $2.8 trillion per annum in today's terms. Similarly, net inflows from foreign direct investment have collapsed back to pre-2000 levels.[30]

Governments face these challenges simultaneously with fiscal indebtedness and other economic tests, such as labour reskilling as traditional industries and occupations become obsolete.

At a macro level, the strong interlinkages of global capital markets have created real collective exposure to asset losses from geopolitical tensions, even though investment strategies across universal shareholders can vary substantially. The highly correlated collapse of markets in 2008 and 2020 (albeit caused by different factors) illustrates the collective investment risks across portfolios.

We believe universal shareholders are uniquely positioned to effect change through targeted investing or restrictions (e.g. country, industry or stock prohibitions). However, the tendency often is not to engage in geopolitical dialogues, and such considerations may come into play only peripherally when researching and developing an investment thesis.

Strategy processes should incorporate monitoring of geopolitical risk indicators, such as policy uncertainty, as part of dynamic risk management. Scenario testing that captures the likelihood and impact of specific geopolitical risk events can be more helpful in identifying the range of risk-mitigating investment strategies required. These can differ according to the scenario considered, ranging from non-specific broad market risk protection strategies to more tailored solutions such as specific cross-currency hedges.

Investors who are consistently exposed to geopolitical uncertainty, particularly through local/regional mandates and reliance on regional trade and currency exposures, have progressed through explicit policies and processes that transform the risks sufficiently. However, adoption of such practices is not yet common.

Transformational opportunities

Efforts to maintain geopolitical stability represent a meaningful opportunity for universal shareholders to contribute to a multifaceted, highly coordinated policy framework that engages governments and other global organizations.

To help identify targets for engagement, investors can employ macroeconomic risk analysis techniques similar to those employed in the integration of ESG in sovereign debt funds management. The UN's PRI Practical Guide to ESG Integration in Sovereign Debt 2019[31] provides an overview of E, S and G factors to consider: (E) energy security and transition risk to (S) living standards, income equality and education standards, to (G) institutional strength and the rule of law.

Positive outcomes from public/private partnerships have consistently demonstrated the potential benefits from developing industry and infrastructure, particularly through cross-border trade and intergovernmental connectivity. Opportunities overlap with other global systemic trends (e.g. water and demographics), for instance, providing security for essential services – thereby reducing the impact on quality of life, and related unrest or involuntary migration.

Helping regions currently reliant on fossil fuels transition successfully by investing in renewable energy and climate-resilient infrastructure can reduce the risk of energy price wars. Investing in the development of automated manufacturing hubs to replace manual manufacturing hubs – for example, in parts of South-East Asia – may be crucial in maintaining economic stability and trade balances as countries face the combined effects of increased protectionism, technological development and ageing demographics. Targeted transformational opportunities also exist at the company level by engaging corporations with low wage scales, unsafe working conditions and poor labour standards – which can potentially create company value and deliver long-term sustainable returns.[32]

3.5 Technological evolution

State of play

Technology is revolutionizing industries, processes and habits through rapid innovation and change. During the past two decades, technology has destabilized the foundations of traditional industry (e.g. computing, the internet, driverless vehicles) and required increasing flexibility and adaptability on the part of economies, governments, individuals and investors.

Accelerated change through technological evolution is visible today at every level of society, in how we interface, transact and enjoy life. Yet, activity hotspots (cybersecurity, artificial intelligence, energy, healthcare, biotechnology) still require massive capital deployment, investments that will further accelerate innovation, structurally changing public markets and destabilizing portfolios.

The evolution of technology in public markets is illustrated by S&P and MSCI renaming the telecommunications services sector as communication services in September 2018. Within the S&P 500, companies valued at approximately $2 trillion were reclassified into communication services, with $1.24 trillion moved from information technology and $620 billion from consumer discretionary. This is a result of a transformation in the ways in which people communicate and seek information.[33]

In recent years, the dominance of technology has been a factor in the contraction of public market listings. The low capital intensity of tech firms enables them to remain private entities for longer, without the need to tap public markets. However, we believe public markets remain a valuable source of liquidity.

Transformational opportunities
Characteristics of investors successfully positioning to potentially benefit from technological evolution include:

1. Commitment to early-stage private market investing and participation in additional investment rounds
2. Using data aggregation/translation tools to develop insights
3. Increasing the capacity to execute transactions more quickly
4. Establishing corporate cultures that support tech-related agility and innovation

Investments in technological innovation at an earlier stage, such as via venture capital, can produce attractive returns and hedge against losses associated with stranded assets and obsolescence. They also create opportunities for later (larger) rounds of investment and the capacity to learn from, invest in and adopt technology early. To the extent that an asset owner is concerned that an entire industry sector may be vulnerable to technological disruption, the owner can attempt to hedge the risk of a loss of value in its publicly traded exposure to this sector, by investing through venture capital and private equity in the companies that are driving the attempt at disruption.

Asset owners need to be able to attract, develop and retain specialized teams that enhance the organization's capacity to properly understand the unique investment considerations of specialized areas (e.g. artificial intelligence, healthcare, business systems, etc.), and to invest effectively at earlier stages. Investment teams and approaches need to be highly dynamic to manage the rapidly changing environment of technology, and recognize the potential for apparent disruptors to become disrupted themselves (in this regard, diversification of investments is also crucial). In some cases, partnering with external specialists in disruptive technology may be a preferred option.

Many asset owners focus attention on technological "solutions" to climate change. Innovations in electric vehicles, energy efficiency, battery storage, solar paint and tiles, and carbon sequestration are just part of the evolving technological response to the challenge of climate change. However, large-scale investors have a particular role to play with regards to nationally or supra-nationally meaningful, transformational technological infrastructure projects, particularly in the areas of battery storage, grid expansion or supercharger networks, the lack of which may be a major constraint on transition.

The misuse of technology threatens nation states and individuals. Apart from asset owners themselves needing robust cyber-risk management processes, there is a broader role for universal shareholders to collaborate globally to further technology-related solutions with adequate ethical, compliance and regulatory standards. The size and dominance of mega-tech naturally attracts regulatory attention, and asset owners can influence change where it is needed.

Technology is perceived by some as having contributed to income inequality. However, technology has clearly opened doors for some of those living in extreme poverty by connecting them to the global economy in ways not seen before. Provision of the practical technology that is needed in areas in which extreme poverty remains prevalent renewable energy – battery storage, mobile networks, fintech solutions, for instance – can transform communities.

3.6 Demographic shifts

State of play
The past 50 years have seen a period of strong economic growth, fuelled broadly by expansion in the workforce (primarily though population increase) and rising productivity.[34] The global population increase is slowing, and therefore analysis has focused on the impact of an ageing population on growth for the future, with the proportion of over-65s projected to more than double over the next 30 years alone.[35]

In contrast, sub-Saharan Africa and South Asia are at much earlier stages of demographic transition. For example, over the period to 2060, the population of Africa is projected to more than double to 2 billion people, but it will still have less than 10% of the population aged over 65, compared to 32% in Europe and more than 40% in Japan.

These changes to the global population age structure will have profound implications for national, regional and global economies. To put this into context, one study estimated that with no change to current levels of productivity growth, global GDP growth will be 40% lower (1.5% per annum on average) over the next 50 years, compared to the past 50 years. This would represent material resetting of global economies, if not mitigated.[36]

The availability of extensive demographic data enables investors to project these changes far in advance. However, it is not easy to fully understand the impact of ageing populations on key factors that affect asset performance, such as long-term inflation and interest rates, and thus assess the appropriate hedge to these risks. This is likely to be exacerbated as independent central bank-driven inflation-targeting gives way to coordinated monetary and fiscal stimulus in environments such as those we are now seeing.

Pension fund asset owners have developed highly sophisticated risk management approaches to reflect the demographic changes in their own liabilities, but there has been far less focus on investing to address the risks relating to global demographic changes more broadly.

Actions to counter the impact of ageing populations on economic growth focus on improving workforce participation and productivity – through investment in innovation, skill development and improving infrastructure capacity and efficiency. Indeed, the impact of improved educational attainment on the future workforce should not be underestimated as a powerful mitigant to the ageing population. Many countries will have a smaller but vastly more educated workforce in the next 30 years, due to the much higher levels of educational attainment already achieved by younger-age cohorts. In 2015, approximately 30% of the world population above age 25 achieved at least post-secondary education, but by 2060 this number is expected to double.[37] The investment in employees that is already taking place will likely result in productivity improvements.

The demographic imbalances between these rapidly ageing regions and those entering demographic transition are a source of opportunity and tension. Despite the benefit of population growth from the regions at the early stage of demographic transition, governments risk missing the opportunity to fully benefit from the demographic dividend of the increase in the working-age population. In Africa and South Asia, in particular, there is a need to ensure that there is employment available for the pool of increasingly educated workers and to provide adequate healthcare and education to support the growing population.

Transformational opportunities
Asset owners should be well positioned to quantify demographic-related risks through available data and incorporate the impacts into their investment decisions.

Opportunities for transformational investment exist in education, healthcare and infrastructure – particularly in economies experiencing positive population growth in Africa and South Asia. Governments need the assistance of private capital to invest in areas that support the demographic transition. To put this in context, global estimates suggest an $18 trillion gap in infrastructure investment compared to the long-term SDGs, or around $700 billion per annum required over the next 20 years, of which circa $135 billion per annum is required in Africa.[38]

Opportunities also exist within Europe, North America and East Asia through allocating capital that supports innovation and technology, as well as sectors that can transform the delivery and funding of provision for an older population.

3.7 Global low and negative real long-term interest rates

State of play
For 40 years, declining interest rates have not only fuelled monetary policy, providing central banks with a tool to stimulate and constrain economies, but also generated positive price appreciation for more conservative investors. Rates are now near zero or negative in many regions, a dynamic recently made worse because of actions to address the COVID-19 pandemic – by March 2020 more than 70% of global treasuries traded at yields below 1.0%.[39] Coinciding with this, debt held by governments, corporations and the private sector has steadily increased, and again this is being exacerbated by stimulus in response to the pandemic.

Negative yields have created numerous challenges and negative impacts for corporate business models dependent upon positive credit spreads: retirees needing to save more to fund retirement and increasing medical expenses, investors with capital growth targets, banks and private savings accounts, etc.

Lower expected returns discourage corporate investment, and coupled with low borrowing costs, have fuelled buybacks on a massive scale. This has increased risk in the system, a risk that is exacerbated by the current environment, as evidenced by blowouts in corporate debt yields.

For investors, the prospect of lower returns encourages “risk creep” into lower-quality, less liquid and higher-volatility investments to maintain returns. Greater allocations to higher-risk assets – public equity, private equity and other long-term alternatives such as infrastructure and real estate – have become more common, and until the COVID-19 crisis, valuations reflected the higher demand. Examples could be seen within asset classes, as well. For instance, within equities, valuations of low-volatility equity have proved popular with those investors seeking equities for return, but who still want to manage risk.

Today, the COVID-19 pandemic is driving valuations lower and pushing economies into recession. To rescue financial markets and the global economy, governments are turning to the 2008/2009 playbook, intervening using fiscal stimulus through tax reductions and "helicopter money" – pumping liquidity into markets via asset purchases, and pursuing aggressive monetary policy stimulus.

While these tactics worked during the 2008/2009 crisis and may help today, they risk creating long-term problems. By acting as both an issuer and purchaser of their own debt, governments may distort the balance of supply/demand curves across capital markets and undermine investors' capacity to accurately quantify and respond to market risks. With interest rates already near zero, central banks are left with limited capacity to stimulate economic growth, which increases the pressure on governments to respond with fiscal stimulus. If excessive, this increases longer-term inflation risk – even though deflation is arguably more of a concern currently.

Universal shareholders play a unique role as both benefactors and influencers in their capacity to interface with government and quasi-government stakeholders, asset managers, academics and other forward-looking parties. They also have an incentive and the resources to research and resolve capital market stabilizing mechanisms.

Transformational opportunities

Maintenance of public and private financial stability has a long-term societal benefit by allocating capital to worthwhile activities, safeguarding effective decision-making through rewarding risk appropriately and instilling the confidence required to make long-term investments.

By addressing the shortcomings of the current top-down government intervention approach, transformational opportunities would create stabilizers that incentivize long-term investment and benefit global society. Flexibility to withstand shocks, rebuild economies in periods of crisis and provide adequate incentives for risk takers to re-engage would be fundamental components of a more effective system.

Specifically, some asset owners are responding to low long-term real interest rates by increasing their allocations to:

- Venture capital investments that are expected to produce a positive externality by stimulating economic growth within sectors through the spread of useful innovation
- Investment in distressed companies

In addition, global low interest rates, together with low productivity growth, presents an environment that we believe is ripe for infrastructure investment. Following short-term-oriented stimulus to support households and companies through the COVID-19 crisis, future waves of stimulus may feature substantial infrastructure investment. Some transformational investors have invested heavily in infrastructure as a long-duration substitute for publicly traded fixed income, and also because they recognize that infrastructure investment can help stimulate productivity growth, which in turn can help drive real interest rates higher.

4. Navigating the roadmap

4.1 Critical questions and practical examples

The governance steps and critical questions set out below enable investors to integrate considerations of global systemic risks into existing frameworks. Examples, assessed through case studies, in-person meetings and other interactions, show established applications.

Governance step	Critical questions	Examples
1. Understand **… the overall impact on the funding entity, objectives and beneficiaries**	a. How does the systemic risk materially affect stakeholder economic and investment objectives? b. Are methods of risk measurement and transparency of reporting adequate? c. Is the systemic risk one that is not already adequately addressed within the existing investment process (e.g. by asset managers), due to a mismatch in the investment time horizon or possibly some other principal/agent or structural challenge? d. Is investment return the only measure of risk and impact associated with this systemic risk?	– The NZ Super Fund (NZSF) has a public funding formula which determines that the fund will not peak in size as a percentage of GDP until the 2070s, making it a genuine long-term investor. It recognizes and addresses climate change as a material long-term investment risk over the fund's investment horizon. – Norway's SWF, the Government Pension Fund Global (GPFG), was funded in 1996 to shield the economy from volatility in oil revenue.[40] In its 2020–2022 strategy, it acknowledges that trends and disruptions in the global economy such as increased trade barriers, low global interest rates, changing technology paradigms and climate change will affect the fund, and stakeholders need to be prepared for large potential fluctuations in the fund's value.[41] – Sunsuper, being a defined contribution fund, primarily focuses on the delivery of real investment returns to members, with economy-wide demographics influencing potential long-term real returns. In addition, fund member demographics are an important consideration within the fund's broader corporate strategy, influencing product design, financial metrics, member communications and financial advice.
2. Collaborate **… with similarly situated organizations that are concerned about the same risks and opportunities**	a. Is the fund identified as a transformational leader, contributing positively to mitigating the systemic risk? b. Is the fund collaborating with industry groups, communities or other initiatives? c. Has the fund participated in initiatives that estimate the value of investment required in its jurisdiction to support resilience to the trend and associated risks? d. How does the fund map its stakeholder landscape, establish priorities and communicate as part of engagement?	– Norges Bank Investment Management (NBIM), which manages GPFG, has been studying and leading on water risk within the investment community and produced a public report on *Water Management: Expectations to Companies*.[42] – Three leading pension funds – the Government Pension Investment Fund of Japan (GPIF), California State Teachers' Retirement System (CalSTRS) and USS Investment Management (USSIM) – jointly released a collaborative statement agreeing on principles for asset owners acting as stewards for sustainable capital markets. It highlights their commitment to integrating systemic risk into their investment activities. Similarly, they indicate their preference to work with asset managers that integrate ESG throughout their entire investment process and urge the partners and companies with which they work to enhance their disclosures, using frameworks such as the TCFD and Sustainability Accounting Standards Board (SASB), to help drive sustainable economic growth for customers, beneficiaries and society.[43]

3. Design **… governance, policies, delegation and accountabilities for material systemic risks**	a. Are fiduciaries equipped to assess and manage the impact of the systemic risk? b. Has the fund designed governance systems that establish fund principles and policies that reference material systemic risks? c. Has the fund developed governance accountabilities, authorities and delegation processes for systemic risk management and reporting? d. How are material risks elevated and controlled as part of the fiduciary entity's responsibility?	– BCI's thematic investing team has undertaken significant research on water scarcity and the investment implications that are driven by this theme – the focus is on identifying, tracking and potentially investing in companies that could perform well given the long-term increase in water scarcity and the opportunities that water crises may provide. – USS investment beliefs explicitly focus on holistic risk assessment ("Risk is multifaceted: It is best understood and managed using multiple approaches and at all times with respect to the liabilities") and the risk-reduction benefit of responsible investment and engagement. – The Ireland Strategic Investment Fund (ISIF) has fully integrated economic impact into its investment process and assesses the expected economic impact prior to all investments. All investments must be in line with the ISIF's statutory double bottom line mandate of commercial return and economic impact. The ISIF's investment strategy has evolved to take account of specific issues in the Irish economy; for example, housing was established as a core pillar of the ISIF's investment strategy in response to the reduced level of housing construction post global financial crisis. Likewise, Climate was also set as one of the five pillars of the ISIF's investment strategy in order to assist Ireland in meeting 2030 and 2050 EU targets.
4. Invest **… to manage the portfolio's exposure to global systemic risks**	a. Which asset classes, sectors and markets are likely to outperform or underperform within the identified risk? b. How does the fund tilt its benchmarks and passive exposure away from risk and towards opportunity? c. How does the fund seek opportunities or engage in themed, targeted or "impact" investments?	– NZSF integrates material climate change impacts into its valuation model for new and existing investments by adjusting cash flows including revenue, costs and capital expenditure (capex) of companies held (where information is available). – Sunsuper's Dynamic Asset Allocation framework is grounded in relative valuation, comparing the price of markets with an assessment of fundamental value using a discounted cash flow approach. For each economy, an assessment of demographic risk underpins growth expectations, and subsequent interest rate expectations and earnings growth expectations. Where risk is mispriced, the fund tilts the portfolio to take advantage of the opportunity that mispricing presents.
5. Transform **… through driving investment strategy that aims to deliver change**	a. What transformational or innovative investments and structures can the fund deploy in response to systemic risks? b. Are there specific criteria, metrics or targets for investment selection to build the portfolio's resilience to the systemic risk? c. How can targeted engagement with corporate management through initiatives with other asset owners, asset managers, regulators and governments benefit stakeholders?	– NZSF recently put forward a proposal to the New Zealand government to set up a public-public partnership to invest in infrastructure in New Zealand (the light rail in Auckland). If the proposal succeeds, the light rail would be a transformational project demonstrating a carbon-efficient improvement to public transport in Auckland. – BCI seeks solutions in regions and sectors in which water supply is anticipated to decrease, while increased demand is required to sustain established and growing economic activity. This could come in the form of technological solutions, value chain investments (distribution, treatment, purification, reuse), water utilities, and engineering and consulting services.
Monitor **… and revisit. Apply learnings to improve policies and processes**	a. What performance measures compel investment managers and teams to focus the investment horizon of the fund, rather than short-term returns? b. What are new experiences teaching us? c. How should we revisit or adjust our analysis or actions in any of the prior steps?	– Mubadala continues to explore and test the use of alternative data, various data analytics approaches and technologies to support risk assessment, due diligence, deal evaluation and assurance.

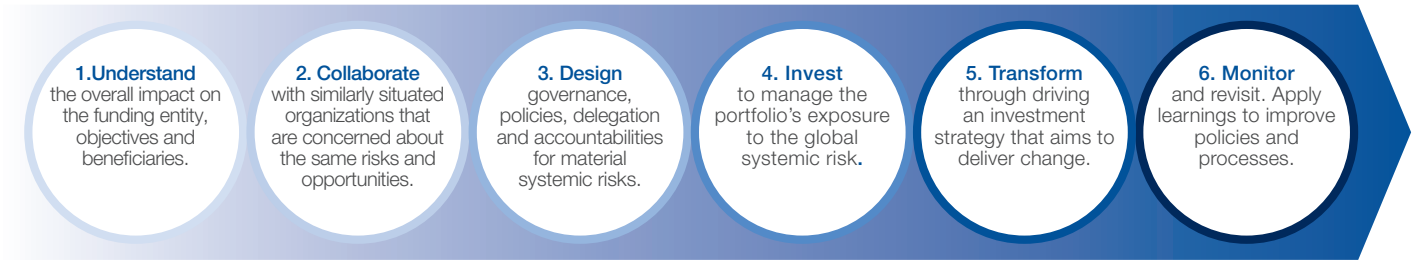
5. Conclusion

Climate change, water security, demographic shifts, technological evolution, increasing geopolitical uncertainty and global low and negative real long-term interest rates are likely to continue to have a major effect on long-term expected returns. Case studies show that SWFs and other long-term investors are already positioning themselves to respond to the impact of these global systemic risks on investment. However, greater innovation in practice and commonality of action is still required in most areas.

While interrelationships between these trends create complexities, such interrelationships also make it possible to address some of the trends simultaneously. For example, certain types of infrastructure, venture capital and cleantech investments can be transformational investments for climate change, geopolitical stability and technological evolution. Meanwhile, we believe the capital needed to address the global systemic risks likely exceeds $6.2 trillion per annum.

Identifying, measuring and managing global systemic risks tests conventional investment and risk management practices. Investors have made varying levels of progress, because each faces unique challenges. Approaches to climate change and long-term low real interest rates are relatively well developed, with accelerating adoption and implementation. Geopolitical stability has attracted substantial new attention, especially now with COVID-19, due to global trade and connectivity impacts. Uncertainty driven by technological evolution is compelling asset owners to think more about investment in venture capital. While demographics and water security have drawn some focus, adoption of sophisticated investment practices globally as relates to these trends remains in its early stages.

Industry initiatives, such as the Santiago Principles and the TCFD, form a basis for successful governance and policies, and the following six steps provide a roadmap to integrate global systemic risks into investment policy:



We believe the significant capacity of universal shareholders to pursue transformational investments while capturing attractive risk-adjusted investment returns is critical to further progress. To enable progress, robust governance is needed. The potential benefits of the six-step roadmap include:

1. **Pathways** for investors aspiring to become market leaders in addressing global systemic risks
2. **Discipline** in achieving holistic management and addressing global systemic risks
3. **Collaboration** to tackle and adapt to challenges:
   a. Identifying stakeholders with aligned interests
   b. Developing encompassing approaches that solve risk interdependencies
4. **Monitoring** through measures that establish foundational understanding of risk impact

By deploying capital in transformational investments, universal shareholders are influencing many of these trends already, but accelerated improvement requires scale. Collaboration and individual actions are both essential for the advancement of pragmatic innovation and large-scale change. Transformational initiatives expected to progress and improve the state of the world include:

1. Developing **measurement conventions** to assess exposures to, and the impact of, global systemic trends on portfolio and stakeholder outcomes
2. Systematically **identifying and matching transformational investment solutions** (e.g. direct investment opportunities, private market funds and traded securities) with long-term investors
3. Encouraging further **intermediation with governments** to establish policies and best practices that protect long-term investors and reduce political risk associated with transformational investments

6. Appendices

6.1 The governance roadmap – steps explained

This section outlines the six steps of the governance roadmap for approaching global systemic risks. It explains each step of the process and then identifies areas of impact.

Understand

… the overall impact on the funding entity, objectives and beneficiaries

Governments establish SWFs for a variety of policy purposes, including stabilization, savings, reserve management and economic development. Their mandate, investment horizon, liquidity position and the economic context of their funding entity will directly affect their prioritization of different risks. To determine the materiality of the impact of global systemic risks and associated insecurities, it is necessary to establish whether individual risks:

1. Threaten the continuation of funding
2. Negatively impact the fund's ability to achieve investment objectives
3. Create undesirable outcomes for beneficiaries, separate from the impact on investment returns

Collaborate

… with similarly situated organizations that are concerned about the same risks and opportunities

Long-term asset owners can benefit from collaborating with peers and partnering with asset managers, data providers, financial institutions, non-profits and governments to build resilience to material global systemic risks. Collaboration can help reduce individual fund costs and open investment opportunities, while helping to drive systemic change and market reform. Examples of collaboration include the PRI, the Organisation for Economic Co-operation and Development, the International Forum of Sovereign Wealth Funds, One Planet Sovereign Wealth Funds and the TCFD. The scale of global systemic risks can be better addressed through the pooling of collective capital and alignment of voices – which can help drive a market for transformational investments offering attractive returns.

Design

… governance, policies, delegation and accountabilities for material systemic risks

Funding entity objectives should be clearly addressed through policies, processes and systems, recognizing the impact of global systemic risks. Sustainability of future funding commitments, distributions and potential withdrawals can have a material impact on the capacity of a fund to meet its objectives. Alignment of the accountabilities and control of the funding entity, appropriate oversight, delegation processes and incentives for investment managers and teams promotes efficient capital allocation. This includes the evaluation of existing resources to efficiently identify internal capabilities and opportunities to delegate externally for implementation assistance.

Invest

… to manage the portfolio's exposure to global systemic risk

The varying impacts of global systemic risks across asset classes, regions, sectors and markets suggest actions for investors to consider in allocating assets, constructing portfolios and other investment decisions. Investors can adjust their portfolio exposure across areas that are expected to outperform and/or underperform to optimize returns at the total portfolio level. For example, many very large diversified asset owners are effectively universal shareholders. As such, they have significant exposure to global systemic risks through passive investments and market beta from active investments.

Benchmarks for actively managed strategies can also be adjusted to optimize or limit risk due to specific themes; for example, low-carbon equity indexes. Meanwhile, long-term investors should think about allocating to opportunities created by long-term structural trends within actively managed investment strategies, with the view of systemic disruption as a source of alpha. Approaches may include integrating the consideration of themes into investment processes or carving out dedicated buckets for thematic or impact investing.

Partnerships with asset managers and other financial institutions should be philosophically aligned, particularly in terms of the investment time horizon. Asset managers and investment teams are typically given incentives to optimize performance over short-term periods due to basis risk against market capitalization benchmarks and against their peers. Longer-term incentives are typically structured around managing performance through business cycles. However, global systemic trends have much longer time horizons. By creating stronger alignment in terms of compensation, incentives and benchmarks, asset owners can act as a bridge between the time horizons of long-term trends and those of asset managers and investment teams.

Transform

… through driving investment strategy that aims to deliver change

SWFs and other large asset owners can manage negative externalities and help create value by partnering with governments to identify opportunities in global or regional issues, such as climate change or water scarcity and supply. Transformational investors engage with policy-makers and regulators to understand the potential impact of policy and regulation change on the financial system, to reduce the risk of permanent system disruptions. Scenario modelling and reference portfolios that chart the transition pathway to a net-zero carbon economy are examples of important frameworks for investors to develop a staged response to climate risks and to harness other sustainable growth opportunities. Similar approaches can be taken to other systemic risks to support the transition to favourable demographic outcomes, technological advancement and so on.

Monitor

… and revisit. Apply learnings to improve policies and processes

These global systemic risks are typically long term and align differently against the investment horizons of different asset owners. However, interactions between systemic risks make the accurate measurement and monitoring of risks challenging. Increased data and technology are enablers of better risk management and are needed to generate more effective insights into risks and opportunities, guiding activities such as due diligence, valuation, monitoring and engagement. Through experience and learning, effective feedback loops help improve governance, policies and processes.

6.2 Case studies

The case studies below come from a cross-section of leading SWFs and other large asset owners and serve as examples of how these institutions are addressing the identified systemic risks. In each case, we have focused on their approach to one of the risks to illustrate it in more detail, but it should be recognized that they are all incorporating most of the risks into their governance and investment processes to some extent.

New Zealand Superannuation Fund

About

The New Zealand government uses the New Zealand Superannuation Fund to save now in order to help pay for the future cost of providing pensions. In this way, the fund helps smooth the cost of superannuation between today's taxpayers and future generations. It operates by investing government contributions – and returns generated from these investments – in New Zealand and internationally in order to grow the size of the fund over the long term. The fund is a long-term, growth-oriented, global investment fund. As at June 2019, the fund managed NZ$43 billion (~$25 billion). The NZSF is managed by the Guardians of NZ Superannuation (the Guardians), a Crown entity.

Approach to climate change

The New Zealand Superannuation and Retirement Income Act 2001 requires the Guardians to apply best practice portfolio management, maximize return without undue risk to the fund as a whole and avoid prejudice to New Zealand's reputation. As a result, the Guardians have developed strong and responsible investment strategies, including a climate change strategy.

The Guardians believe carbon risk is being underpriced. This is partly because the time horizon over which the effects will manifest is too long for most market analysts – but it is relevant for the time horizon that matters for the fund (on current projections, the government will not make significant withdrawals from the fund until the 2050s).

The Guardians take the view that if markets are underpricing carbon risks, then reducing exposure to the most at-risk assets is likely to improve the portfolio's long-term risk-adjusted returns. On the other hand, if it turns out that markets have been efficiently pricing these risks all along, then some fairly priced assets would have been sold and swapped for other fairly priced assets. The impact on returns will be minimal over the long term, with the main cost being a minor reduction in portfolio diversification. Accordingly, the Guardians consider that ignoring climate change in investment decisions would constitute taking "undue risk" and climate change must be factored into investment decision-making at a portfolio level on an ongoing basis.

In addition, the Guardians believe climate risk is important as it:

- Is different from other investment themes, such as demographics. It has multiple drivers and uncertainties in the time horizon over which the impacts will play out. It encompasses both listed and alternative assets, but it affects them in different ways and requires a shift in the source of energy that influences all sectors. It is an intergenerational and cross-boundary issue, one that requires (and is seeing) significant coordination between countries
- Offers opportunities for investment as well as risk; for example, with the development of more energy-efficient and alternative technologies

In 2016 the Guardians launched their climate change investment strategy (CCIS). The goal of the CCIS is to make the portfolio more resilient to climate-related risk. The strategy has four core work streams – reduce, analyse, engage and search.

As part of the CCIS, the Guardians announced a whole-of-portfolio climate change expectation to reduce the fund's carbon exposure by 2020: a 20% reduction in carbon emissions intensity and 40% reduction in potential emissions from reserves. These are measured relative to the original reference portfolio.

As part of the *reduce* strand of the CCIS work stream, in 2017 the Guardians "decarbonized" the reference portfolio by reallocating NZ$950 million in passive investments away from companies with high exposure to carbon emissions or reserves and into lower-risk companies. The Guardians developed a bespoke methodology to make these reductions for the reference portfolio using MSCI's carbon metrics.

Since 2017, the methodology has been applied to the active part of the portfolio, including active equities, to externally managed mandates, and to private or unlisted assets. It is also applied to the portfolio via derivatives.

The Guardians use carbon footprinting as a measure to monitor their carbon reduction efforts. At the end of June 2019, the fund's carbon footprint showed that portfolio carbon emissions intensity was 43% lower than the original reference portfolio and exposure from reserves was 52% lower, exceeding the targets originally set (20% and 40% reduction respectively). The Guardians are now reviewing the reduction targets and refining the carbon methodology, based on improvement in carbon measurement tools and better understanding of company carbon exposures.

Under the *analyse* workstream, the Guardians have developed a climate change valuation framework and integrated material climate change impacts into the valuation models for new and existing investments. The approach depends on available information, with the preferred method being through adjusting cash flows including revenue, costs and capital expenditure. If sufficient information is not available, the next preferred approach is to run a peer analysis of listed companies within the same sector, ranking them using the climate change factors identified, to infer

an appropriate increase or decrease to the discount rate or multiple based on its climate change ranking relative to its peers. Lastly, where it is not possible to easily or reliably quantify the impact of climate change on the business, but where there is likely a material impact on value, discount rates are adjusted. However, this is not a prescriptive mechanical solution and the Guardians do not yet have an "in-house" view on what climate change scenario(s) (and associated consequences) should be assumed.

As part of the *engagement* work stream, the Guardians engage with companies, managers and policy-makers to seek better climate risk management, adaptation and disclosure in investee companies. With the External Investments and Partnerships teams, the Responsible Investment team has reviewed the climate engagement work conducted by listed equity investment managers. The Guardian are also part of the CA100+ climate engagement initiative, engaging with the worst emitters globally to reduce emissions; and are a founding member of the One Planet Sovereign Wealth Fund initiative, which aims to provide leadership on climate change within the SWF community. The Guardians established voting guidelines on climate change and now vote all shares globally in a consistent way.

Under the *search* workstream, the Guardians seek to identify opportunities arising from the global transition to a low-carbon energy system. In assessing new opportunities, as part of the CCIS *search* work stream, the Guardians continue to maintain investment discipline, as they would with any potential investment. The Guardians have:

- Reviewed new climate change investment opportunities, including green buildings, protein replacement and agricultural technology
- Invested in developing wind and solar generation in the US, and in energy efficiency opportunities through an electrochromic glass producer and an alternative energy producer, which produces alternative fuels from waste gases
- Invested in waste management and technology platforms, with a vision to divert waste from landfill to recycling. Environmental benefits include a reduction in landfill methane emissions
- Sought and assessed opportunities in energy efficiency, transformational infrastructure, transport, resource and land management. This includes a proposal to government to set up a public-private partnership to invest in infrastructure in New Zealand (light rail in Auckland). If the proposal succeeds, light rail would be a transformational project that would improve public transport and be carbon-efficient

In continuing to evolve the approach, work is underway to integrate climate change scenarios in valuation analysis, with the Guardians' investment professionals drawing on guidance on 2ºC (or lower), 3ºC or 4ºC scenarios to apply in climate change assessment.

In 2019, the government gave the Guardians oversight of a second fund, a venture capital fund. The purpose of the new mandate is to support the development of early-stage capital markets in New Zealand, while similarly avoiding prejudice to New Zealand's reputation. A supplementary policy statement notes that one of the reasons to support early-stage capital markets is to help the low-carbon transition.

Summary
Climate change is an investment risk that the Guardians believe must be addressed in the management of the New Zealand Superannuation Fund. The Guardians adopted a climate change investment strategy in 2016 aimed at making the portfolio more resilient to climate-related risk. The CCIS is based on three principles:

- Whole of portfolio: manage climate risks and opportunities of the whole portfolio
- Consistency: be as consistent as possible across all investments (listed and unlisted, active and passive)
- Best tools: use the full range of tools available. There is no single solution

The four workstreams (reduce, analyse, engage and search) seek to apply these principles to all aspects of the Guardians' investment activities. To date, the Guardians have exceeded the portfolio carbon reduction targets set in 2016 and the CCIS has had a positive impact on returns of the reference portfolio.

British Columbia Investment Management Corporation

About
British Columbia Investment Management Corporation (BCI) is a provider of investment management services for British Columbia's public sector and one of the largest asset managers in Canada, with CA$153 billion (~$117 billion) in assets under management as at 31 July 2019. BCI seeks global investment opportunities across a range of asset classes.

Approach to water security
BCI recently revised its ESG investment strategy to recognize the fund's role as a universal owner. BCI understands that as global systemic risks affect markets generally, the fund and its beneficiaries will also be affected. BCI relies on well-functioning and sustainable markets in order to generate the returns needed to pay long-term liabilities and as such it supports efforts to make markets more transparent and sustainable that will add long-term value to all market participants. BCI also embeds the evaluation of non-traditional risks such as water security across all forms of investment decision-making.

For the fund's long-term investments and asset allocation decisions, BCI considers the potential impact on the expected value of the assets and the portfolio through the lens of both market and global systemic risks. Global systemic risks are considered at various stages in BCI's investment processes:

1. ***Evaluation to inform management*** of the impact that global systemic risks have on the overall investment approach, including any strategies to mitigate or manage these risks

2. ***Strategic asset mix decisions*** – for example, scenario analysis related to economic/political regimes and possible future climate change outcomes
3. Within each ***asset class***, teams focus on areas of disruption that are most pertinent to their mandates
4. For ***individual direct investments***, risks are evaluated as part of the due diligence process and ongoing asset management process
5. Through a ***dedicated team*** that monitors and models the implications of macroeconomic shocks/regimes

BCI is invested in sectors globally that rely heavily on water, such as utilities, energy, construction and oil and gas. These industries are naturally exposed to water-related risks such as quality, demand, supply and regional needs. Their operations also have an impact on regional water availability and water quality, potentially exposing them to reputational risk and regulatory restrictions. Hence, BCI wants to know that its invested companies are prepared for challenges in a world in which water is an increasingly constrained resource.

Water risk is considered specific to each type of investment decision, and assessment of water risk varies depending on the sector and its reliance on low-cost supply – particularly where real assets are geographically tied to the specific water supply of the region. There are opportunities in regions and sectors in which water supply is anticipated to decrease while economic activity is increasing: These could be technological solutions, value chain investments (distribution, treatment, purification, reuse), water utilities and engineering and consulting services. Consumer preferences and choices point to a growing demand for higher-quality water purification, rather than just low-cost opportunities. Demand is informed by metrics of water contamination and quality concerns. The private equity team recently announced an investment in a global point-of-use drinking water purification company, the evaluation of which considered the risks and opportunities described above.

BCI currently looks at water crisis from a bottom-up perspective and uses it as a lens to understand sector-based impacts and opportunities. For example, its thematic investing team has undertaken significant research on water security and its investment implications – the focus is on identifying, tracking and potentially investing in companies that could perform well given the long-term increase in water risk and the opportunities that water crises may provide. Water security is also an important focus of the fund's infrastructure team – both on the investment risk and opportunities side, as BCI owns several water utilities; and in terms of other assets, such as electric utilities that rely on the availability and low cost of water in order to operate.

BCI uses third-party data providers to identify water risk and company-specific water consumption. It has developed a physical risk tool that provides location-specific information on water stress and other physical risk factors such as flooding and heat stress for specific geographies for real estate assets and is working to expand it to other asset classes. At a very high level, the key metrics used to determine water risk are the net of supply and demand for fresh water in any economically relevant geographic boundary.

BCI also conducts sector-specific research to understand technological developments that may give industries and communities the adaptive capacity to better mitigate the risk of water stress. For example, it conducted a detailed research project into desalination technologies last year; this included looking at data on new technology adoption and cost reduction over time to better understand where there were investible opportunities.

BCI is selective, specific and pragmatic about its engagement priorities, given the limited resources and the size of its public markets portfolio. The fund's engagement priorities result from the assessment of four factors: materiality; ability to influence; research and data; and exposure. Water crisis risk has been identified as one of BCI's top engagement objectives (climate change, water, human rights and governance), recognizing that most industries are exposed to water risks in terms of both quantity and quality, as well as the impact of droughts and floods.

Where applicable, BCI engages with companies in which it has invested in order to advocate for better disclosure on water use and efficiency and the adoption of strategies to help alleviate and manage business risk related to water stress.

BCI is evolving its approach and is currently developing an in-house systemic ESG risk framework that identifies and measures the most material global systemic risks facing the fund. This framework will focus on the global systemic risks that are pervasive across all of BCI's investments. It uses sector-specific analysis to understand the fundamental nature of the investment risks to determine where the fund is exposed to these risks and to highlight ways to mitigate these risks if possible. As these risks are long term and forward-looking, BCI is developing scenario-based top-down assessments of identified risks alongside bottom-up sub-sector modelling. This is to ensure the top-down and bottom-up analysis can be used to understand how decisions at both an asset mix and individual investment level are potentially affected by identified global systemic risks.

USS Investment Management

About

USS is one of the largest occupational pension schemes in the United Kingdom, managing approximately £64 billion (~$85 billion) as at December 2018. The scheme operates as a hybrid pension scheme, providing defined benefit (DB) and defined contribution (DC) pension benefits. USS has an active investment strategy and innovative approach to portfolio management, which are implemented by an in-house investment management team.

Approach to systemic risks

USS Investment Management (USSIM) acts as both principal investment manager and adviser to USS. Governance does not explicitly include global systemic risks in formal documentation, but investment beliefs explicitly focus on holistic risk assessment and the risk reduction benefit of responsible investment and engagement. Risk is viewed as multifaceted – "it is best understood and managed using multiple approaches and at all times with respect to the liabilities". This approach to risk creates accountability and

explicit consideration of global systemic trends, primarily through measures of investment performance. Advice from USS to USSIM's boards and committees compels investment teams to consider the potential long-term and reputational risks and confirm if proposals are within risk appetite.

USSIM has a dedicated responsible investment team whose members consider the impact of global systemic risks (such as climate change); assessment is also included in strategic asset allocation analysis carried out by the investment strategy team. Broad macroeconomic/financial regime changes are considered of primary importance; for example, changes to monetary and fiscal policy "rules" and the institutional framework (e.g. risks to independence of inflation-targeting central banks). Geopolitical tensions that affect global trading relationships fit into this category, while technological changes that might have a material impact on productivity growth are also important.

Strategic asset allocation attempts to incorporate the assessment of risks to baseline forecasts, both market and systemic. Assumptions are made for generating long-term expected returns for the assets in USS's investment universe. USS's large size allows for broad diversification, but also limits the fund's capacity to change the portfolio quickly in response to global systemic risks – that is, the fund cannot generally make tactical asset allocation decisions on global systemic risks. The fund's ability to take illiquidity risks allows holdings in a wide range of assets, which should enable better management of global systemic risks.

In principle, USS's investment horizon is very long; however, managing drawdowns over shorter periods might be just as important as long-term objectives. Stress-testing the portfolio and qualitative scenario analysis of the sensitivity of different risks is used to manage volatility over shorter periods. USS is currently developing a process to incorporate quantitative macro scenarios into USS's investment tools.

Thematic analysis (e.g. of geopolitics) guides asset choices (especially in private assets due to long holding periods), along with more qualitative inputs used in portfolio construction. The fund has holdings across a wide range of investments, and global systemic risks are considered by asset class specialist teams during investment selection. At a minimum, the impact is considered relative to other investments within the same asset class. Benchmarks are generally chosen to be representative of the intended investment strategy; however, USS recognizes the limits of benchmarking analysis and the danger of encouraging short-termism. There are also specific challenges to private markets benchmarks in which the fund often opts for "opportunity cost" public markets benchmarks.

Mubadala Investment Company

About

Mubadala is a global investment company with a mandate to create sustainable financial returns, furthering the strategic objectives of its shareholder – the United Arab Emirates (UAE). Mubadala is investing across the world to transform the UAE into a globally integrated and diversified economy and to create lasting value for its shareholder, partners and future generations. The fund had $229 billion in assets under management as at December 2018.

Approach to technological evolution

Mubadala is an active and long-term investor and has a significant stake in many of its investments. It believes technology-related investment has the potential to destroy or create value in the portfolio. Disruptive technologies and business-model innovation can replace well-established incumbents. Organizations that fail to innovate and take advantage of technology can lose their competitive edge and become obsolete. On the other hand, technology provides opportunities to create more efficient technology-driven markets and businesses. Data and analytics can create value for existing businesses, through improvements in processes, increased efficiencies, and in some cases the monetization of data.

Mubadala believes that the risks and opportunities of technology must be considered beyond the boundaries of the technology sector. Technology has implications for all sectors and asset classes. Mubadala invests in technology-driven companies (primarily through private equity and venture capital teams) but also in sectors and companies in which value can be created through the adoption of technology (in healthcare, real estate, agribusiness and energy).

Mubadala addresses technology-related risk at two levels:

– Institutional (organizational)
– Portfolio and investment

Within Mubadala as an investment company, policies, guidelines and processes are created and improved to enable technology risks to be considered in activities and decisions by the organization – in particular, portfolio strategy, investment and asset management teams. The technological focus is on the adoption of improved systems, data and skills/capabilities, and the main risks considered are operational, cyber, regulatory and business ethics. In addition, attracting and retaining much sought-after talent with technology skills (data science in particular) combined with a good understanding of investing remains a challenge for the industry.

Given the fast pace of change and the multiple interconnected risks and opportunities created by technology, risk culture, diversity and capability are essential. To this end, Mubadala places significant emphasis on raising awareness of risks, defining acceptable risk levels and principles for managing risk. Specific training is provided on technology-related risks such as ethics, compliance and business continuity. Cognitive diversity also plays an important role, because technology presents several

interconnected risks and opportunities that are better understood and managed by bringing together different perspectives and experiences.

At the portfolio and investment level, risks and opportunities are considered in the context of value protection and creation. They guide the development of portfolio strategy, capital allocation and management of assets for the purpose of value creation. Risks arise both pre- and post-investment decisions; however, the main risk analysis is prior to investment as this affects the allocation of capital to potential portfolio companies. The analysis assesses the resilience and adaptability of portfolio companies and their capability for technology adoption and innovation. Post-investment decision, risk arises in maintaining the appropriate level of oversight and control of the portfolio company to promote value creation. Similarly, there is a risk of failing to anticipate or respond to changes in the business context, positioning or performance of the portfolio company, such as technology disruption.

Qualitative risk assessment focuses on the concentration and correlation of technology risk, strategic, financial, operational, compliance and reputational risks. Quantitative measures are based on scenarios and sensitivity analysis of key drivers of value, using a deterministic approach as historic data on technology and innovation is scarce. In addition, for technology-related risks, the past is unlikely to be a good indicator of the future, especially for more disruptive or transformational risks and opportunities.

Mubadala is a long-term investor, able to accept volatility in the short term in the belief that this will generate sustainable returns over the long term. A long-term investment time horizon also enables Mubadala to develop a thorough understanding of the companies in which it invests and promotes innovation and sound management of risks with a view to protecting and creating value. By investing mainly in private markets, Mubadala is able to pursue superior returns and to seek to capture an illiquidity premium through investment selection and value creation. Liquidity risk is managed mainly by maintaining a risk-assessed cash buffer and an allocation to liquid assets, supplemented by external sources of funding as required. Mubadala's size enables it to take more complex risks, such as those presented by technology. It also provides Mubadala with greater access to deal sources and partners. Access to quality technology-driven deals is restricted to a small number of investors. Size plus performance, trust and relationships are important aspects in deal sourcing and sustainable returns.

Mubadala is currently working on the adoption of risk information management technology to enable more efficient collection and analysis of risk-related data, together with greater collaboration across the organization to generate insights and guide better-informed decision-making. It is developing an approach that values data and technology (factoring that into asset and portfolio valuations) and guides initiatives for value protection (cybersecurity) and value creation (e.g. business process improvement). In addition, Mubadala is looking at developing its approach to incorporating data, technology, innovation, agility and cultural factors into due-diligence processes. Mubadala continues to explore and test the use of alternative data and various data analytics approaches and technologies to support risk assessment, due diligence, deal evaluation and assurance. It is continuing to develop an organizational risk culture, developing the awareness and capability of deal teams and asset managers to identify, assess and manage risks and opportunities arising from technology.

Sunsuper Superannuation Fund

About

Sunsuper is one of Australia's largest superannuation funds, with 1.4 million members and AUS$70 billion (~$48 billion) in assets under management as at October 2019. It helps 100,000 businesses across the country manage their employees' retirement savings through a range of products and services. It has no shareholders, and profits are returned to members through low administration fees, product innovation and enhanced services.

Risk management at Sunsuper

Sunsuper's investment goals and beliefs are intentionally concise and targeted and individual risks are not specifically identified. The fund's focus is on maximizing reward for all risks, both market and systemic. A risk can manifest in two ways: either increased investment risk (typically by reducing diversification) or a reduction in long-term returns.

Sunsuper's Risk Management Framework (RMF) is fund-wide and covers a range of administration-related risks as well as investment risk appetite/tolerance. The RMF classifies investment risks into four areas: Investment Performance, Liquidity, Counterparty and Investment Operations.

Approach to demographics

Demographic shifts are inevitable. Decline in the working-age population presents a risk of potential reduction in long-term economic growth and expected returns, which will reduce accumulated assets and potential retirement benefits.

Demographic considerations are a key input into Sunsuper's investment objectives. Long-term investment returns are bounded by potential economic growth, which is a function of demographics (change in the scale of the workforce) and productivity (output per worker). Productivity is challenging to predict, and while Sunsuper recognizes the potential for a range of factors (including technological change) to have both positive and negative impacts, it looks to the long-term trend for a guide. Demographics, however, are highly predictable, and Sunsuper believes the reduction in population (and workforce) growth will reduce forward-looking growth expectations, leading to lower return expectations.

Sunsuper measures demographic-related risk quantitatively and models global workforce growth based on published population tables. It has confidence in workforce growth projections for the next 20 years because that workforce has already been born and, barring mass human migration or large-scale mortalities from a war/pandemic, those figures are considered reliable.

While potential growth is the focal point, second-order considerations are not ignored. For example, the extent to which persistently lower inflation affects future productivity is considered; however, the linkage between an ageing population and lower inflation has not yet been sufficiently proven to warrant an adjustment. Similarly, the persistence of real interest rates below potential growth is another possible depressor of future productivity; however, in this case it is not yet clear that real interest rates can and will be sustained indefinitely at these levels.

Scale and long-term ownership enables the fund to focus on management for long-term outcomes. Sunsuper's long investment horizon leads it to invest in more illiquid investments, directing it to consider global systemic risks over a longer time horizon. Sunsuper can support investment to future-proof a business in a way that a listed company or minority investor cannot due to short-term metrics. Scale is also a positive as the ability to drive down fees while accessing diversifying opportunities in alternative assets becomes more critical as forward-looking returns (due to demographic shifts) become lower. However, being large limits the fund's ability to justify the work required to access small-scale opportunities with an appropriate level of due diligence and reduces the capacity to be nimble and easily exit "stranded" businesses when that risk becomes apparent.

Sunsuper reviewed and reduced its suite of fund investment objectives four years ago by 0.5–0.75% per annum. This was consistent with the anticipated impact of ageing populations, with forecast workforce global growth being lower by a similar quantum.

Sunsuper is also focusing on: climate change; geopolitics and inequality; technology-related risk; the changing nature of currency markets; the implications of the growing scale of the Australian superannuation industry on domestic stock markets; and frameworks for investing large-scale pools of assets efficiently and effectively.

Ireland Strategic Investment Fund

About

The Ireland Strategic Investment Fund ("ISIF", or the "fund"), managed and controlled by the National Treasury Management Agency, is a sovereign development fund, with €15 billion[44] (~$17 billion) in assets under management as at December 2019. This case study focuses on the ISIF discretionary portfolio, which comprises the fund excluding public policy investments.

The ISIF has a "double bottom line" mandate that requires it to invest the discretionary portfolio in a manner designed to support economic activity and employment in Ireland, in addition to delivering commercial returns. As regards commercial returns, the ISIF is required to seek to generate a return over the long term in excess of the cost of Irish government debt.

Approach to sustained low interest rates and demographic shifts

The ISIF's high-level investment themes (regional development, housing, indigenous businesses, climate and Brexit) have been determined in consultation with relevant government ministers. The ISIF's ability to create economic impact (i.e. supporting economic activity and employment in Ireland, while not "crowding out" private capital) is central to the development of fund-level investment themes. The ISIF has a "double bottom line" mandate which requires that all investments are designed to generate both a commercial return and an economic impact.

The size of the ISIF is large in the context of the Irish economy and it still has significant uncommitted capital. Therefore, the fund has heightened sensitivity to economic impact risk with a view to ensuring that its investment activities do not contribute to overheating of the Irish economy. The investment strategy for the fund reflects its size and nature, with particular focus, through its high-level investment themes, on specific risks such as demographic changes and climate change.

Ireland has one of the youngest population structures in Europe and relatively high levels of fertility and immigration, and is therefore ageing more slowly than its neighbours. These demographic trends in Ireland and the reduced levels of housing construction post-global financial crisis have resulted in insufficient housing stock, with elevated house prices and a high cost of renting. As a result of this, housing is one of five priority investment themes of the ISIF.

More broadly, analysis and assessment of demographic changes are vital for real estate investment – residential housing, commercial real estate and other real estate. Global demographic trends are also incorporated into the fund's investment strategy and mainly focus on export-orientated sectors. For example, the rising population and income changes predicted for Asia positively affect investment in food and agriculture in Ireland.

The ISIF's commercial return objective in respect of its discretionary portfolio is set out in legislation; however, the persistence of low and negative interest rates may have an impact on the fund's ability to achieve its long-term return target. In the fund's "global portfolio" portion of its discretionary portfolio (which is designed to gradually transition from global commercial investments to a more Ireland-focused portfolio as investment opportunities that meet the ISIF's "double bottom line" mandate are executed and drawn down), there is an increased focus on alpha and absolute return strategies given the short- to medium-term time horizon for this portfolio and given the low expectations for beta returns going forward. A review of the global portfolio's investment strategy is ongoing as at the date of this paper. The low interest rate environment has affected the returns achieved to date for this portfolio. A significant portion of the fund's "Irish portfolio" is in private, illiquid assets that are funded from the global portfolio assessing liquidity. Ensuring high levels of liquidity is therefore extremely important.

The ISIF has developed a scorecard to measure economic impact. It is fully embedded in the wider investment process and assessed as part of any investment decision. This outlines quantitative projections (Gross Value Added [GVA] and employment forecasts) and qualitative projections. An economic impact risk score is assigned to each individual investment, which assesses the probability of additionality arising from the investment. The ISIF carries out an economic impact survey process for the entire Irish portfolio on a semi-annual basis, plus an annual review of output versus the relevant economic impact scorecard. Each investment/asset is also measured against the fund's commercial and economic objectives, i.e. IRR is the measure for commercial return and GVA/employment for economic impact. The assessment of each investment is conducted against the expectation set out when the investment was made.

The fund's investment horizon is long term, allowing scope for the ISIF to consider, where appropriate, equity investments and assessment of the evolution of underlying risk over the long term.

The ISIF's experience to date has been that the physical presence of an investment manager in Ireland is a strong positive indicator of whether relevant Irish capital deployment targets will be met. Typically, an entity with an established Irish office tends to deploy capital at a faster rate than one with no physical Irish presence. Where possible/appropriate, the ISIF therefore seeks investment opportunities where the relevant investment partner/ manager has established (or is establishing) an Irish office.

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Endnotes

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44. The ISIF is comprised of the discretionary portfolio (€8.1bn) and the directed portfolio (€6.9bn). The discretionary portfolio has a “double bottom line” mandate to invest on a commercial basis in a manner designed to support economic activity and employment in Ireland. The directed portfolio (primarily public policy investments in AIB and Bank of Ireland) continues to be held within the ISIF pursuant and subject to direction from the minister for finance.

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