Communicating Climate Change: How Learning, Language and Leadership Can Impact Institutional Investment Decisions in Australia and the United Kingdom

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Abstract

Institutional investment portfolios are currently, and will increasingly be, affected by the risks and opportunities resulting from climate change. In addition, capital from the institutional investment system is needed to help finance the mitigation of and adaptation to climate change globally. Despite this, most investment decisions continue to be made without due consideration of these issues. An empirical analysis of investors' learning strategies, investment practices and understandings of climate change is thus developed to explore communication and integration methods that could facilitate greater awareness of climate change within the institutional investment systems of the UK and Australia.

In-depth interviews and a global investor survey identify an audience for climate information but the slow uptake of existing material. Contributing factors included a language barrier between climate scientists and investors, insufficient leadership within the investment chain, and a failure to fully comprehend the materiality of climate change to investment returns. The novel approach of combining Communication theory to highlight the importance of formal and informal, social and asocial learning opportunities, and Systems theory to identify leverage points that could catalyze a shift towards climate-aware investing is utilized to contribute to existing literatures on integrating climate change into investment decisions.

Key Words:

Climate Change; Communication; Information; Institutional Change; Institutional Investment; Learning; Responsible Investment; Systems Theory.

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List of Abbreviations

A4S: The Prince's Accounting For Sustainability
ACSI: Australian Council of Superannuation Investors
AM: Asset Manager
AO: Asset Owner
AUM: Assets Under Management
CCC: Committee on Climate Change
CDP: Carbon Disclosure Project
CDSB: Carbon Disclosure Standards Board
CEO: Chief Executive Officer
CFO: Chief Financial Officer
CIO: Chief Investment Officer
CISL: Cambridge Institute for Sustainability Leadership
COIN: Climate Outreach and Information Network
COP: Conference of the Parties
CUREC: Central University Research Ethics Committee
CSR: Corporate Social Responsibility
DB: Defined Benefit (pension scheme)
DC: Defined Contribution (pension scheme)
ESG: Environmental, Social and Governance
EUROSIF: European Sustainable Investment Forum
GIC: Global Investor Coalition on Climate Change
GRI: Global Reporting Initiative
GSIA: Global Sustainable Investment Alliance
ICGN: International Corporate Governance Network
IEA: International Energy Agency
IGCC: Investor Group on Climate Change
IIGCC: Institutional Investor Group on Climate Change
IMF: International Monetary Fund
IPCC: International Panel on Climate Change
NAPF: National Association of Pension Funds
NGO: Non-Governmental Organization
OECD: Organization for Economic Co-operation and Development
OXWFD: Oxford World Finance Digest
PF: Pension Fund
PRI: Principles of Responsible Investing
RET: Renewable Energy Target (Australia)
RI: Responsible Investment
SAA: Strategic Asset Allocation
SF: Superannuation Fund
SRI: Socially Responsible Investment
TAI: The Australia Institute
UNEP FI: United Nations Environment Programme Finance Initiative
UNFCCC: United Nations Framework Convention on Climate Change
WBCSD: World Business Council for Sustainable Development
WRI: World Resources Institute

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Chapter 1. Introduction

Institutional investors are likely to be key actors in combating climate change, as they are exposed to both the risks and opportunities of climate change and represent a large pool of capital that could help finance the $53trillion of investment needed develop a low carbon economy (International Energy Agency, 2014). Furthermore, recent discourses around 'carbon budgets', 'stranded assets' and 'divestment' have increased socio-political pressure on investors to engage in more 'Responsible Investment' (Covington and Thamotheram, 2014). Recognition of these issues within investment institutions appears to be increasing, with membership to groups such as the Principles of Responsible Investment (PRI) growing rapidly (UNEP FI, 2014). However, the understanding that climate change will have a financial impact on investment portfolios is far from universal (EUROSIF, 2014; Dlugolecki and Mansley, 2005). Research into how climate science and its relevance to investment performance is being communicated and learnt is important if climate change is to be integrated into decision-making; while communicating the climate science is not sufficient in itself to spark change, it is a necessary and important step in the right direction (Pidgeon and Fischhoff, 2011).

This thesis analyzes findings from 58 in-depth, semi-structured interviews with a range of individuals to explore the current state of formal and informal learning about climate change within the investment system in the UK and Australia. The UK and Australia were chosen because of the high level of climate change exposure in their asset markets, and their differing institutional investment structures. The investment institutions interviewed accounted for almost 30% of Australian Assets (A$700bn) and 24% of European/Middle Eastern Assets (£6.5tr). A global survey of 154 investors provides additional insight into existing practices and beliefs around the incorporation of climate change in the investment process.

These research methods seek to answer key questions regarding the sources and scale of information being used by investors, their learning strategies, the relevance of language used in climate communications and perceptions of the amount of information available. The empirical results identify opportunities for improving communication and learning processes through greater knowledge sharing and the

translation of climate science into suitable language that emphasizes the materiality of climate change to investment decisions. Drawing on Communication theories, including social and peer-learning (Bandura, 1963; Hara, 2009), this empirical analysis highlights the importance of formal and informal, social and asocial learning. The importance of informal groups of peers forming 'communities of practice' (Brown and Duguid, 1996) to facilitate knowledge sharing and the integration of climate considerations is explored and found to be critical.

Furthermore, this thesis applies an 'outside view' of Systems theory (Meadows, 1999) to identify leverage points and critical actors within the investment chain that might further the integration of climate change into investment beliefs and asset allocation. This builds upon empirical analysis of the roles that different actors are playing, and investors' existing perceptions of climate change and integration strategies. The capacity and incentives for further integration appear to rely upon strong leadership within the investment industry as well as supportive Government policies. While individual investor efforts can do some good, and are being encouraged through investor groups on climate change, this thesis identifies a need to scale-up existing collaboration and self-organization, particularly among Executives, to create the momentum and pressure necessary to finance a low carbon transition and safeguard capital against long-run risks and externalities inherent and undervalued in current markets (Kaminker and Stewart, 2012).

Chapter 2 reviews the relevant academic and business literatures, while Chapter 3 identifies the methodological approaches used. Chapter 4 reports the empirical results obtained through the Global investor survey and UK and Australian interviews in order to provide an analysis of communication and learning strategies used to incorporate climate change into investment decisions. Chapter 5 further assesses participants' insights in the context of Systems theory to establish key leverage points for better integrating climate change into investment decisions. Chapter 6 offers conclusions and recommendations for investors and those communicating the materiality and urgency of climate change throughout the institutional investment system.

Chapter 2. Literature Review

This literature review explores the diverse and growing academic and business research surrounding the theory and practice of incorporating climate change into the institutional investment industry. In defining institutional investors, this study will focus on both Asset Managers (AMs) and Asset Owner (AOs), with a particular focus on Pension Fund (PF) and Superannuation Fund (SF) investors. This study does not extend to insurance companies, but this would represent an important extension of this research, given the inherent risks around climate change in the insurance sector (London Assembly, 2015). Throughout this thesis the terms 'investor' and 'institutional investor' are used interchangeably, although 'investors' are not a homogenous group.

Section 2.1 highlights the impact that climate change will have on investment portfolios and the investors' role in tackling climate change. Section 2.2 explores the economic and regulatory geographies of Australia and the UK to demonstrate the relevance and importance of comparing attitudes towards climate change within their investment industries. The rise of investor engagement on climate issues and the proliferation of networks and investor-led climate advocacy groups is discussed in Section 2.3. Section 2.4 examines existing literatures on the communication of climate science and some of the barriers to public understandings of climate risks. Section 2.5 outlines key social learning and communication theories based on diverse academic disciplines including geography, sociology, psychology and behavioral economics. Section 2.6 explores belief crystallization and the importance of this for catalyzing changing investment behaviours. Section 2.7 identifies Systems theory as one way of understanding and identifying the leverage points available to shape investment behaviours and beliefs around climate change. Section 2.8 explores the gaps in the literature that this thesis seeks to address.

2.1 Investors and Climate Risk

Climate change is, and will increasingly impact investment portfolios (Kaminker and Stewart, 2012; World Bank, 2012; Wolf, 2014), meaning institutional investors should have a direct interest in adapting to and mitigating climate change (Fox, 2015;

Mercer, 2015). The scale of the financing needed to tackle climate change is so large that, whilst international agencies, such as the World Bank and International Monetary Fund (IMF), and national governments have key roles to play, private sector finance from institutional investors will also be needed (UNEP FI, 2014; Hobley, 2015). However, many institutional investors remain focused on companies that maximise their current quarterly earnings and short-term performance (Eccles and Serafeim, 2013; Sievanen, 2014), even if this potentially reduces companies' long-term ability to generate value-creating long-run growth and/or pay future dividends to shareholders (Rappaport, 2005; Bauer et al. 2007). Some investors also struggle to know how to respond to climate change information and fear lower returns and a fiduciary duty backlash from beneficiaries if practices change (Nelson and Pierpont, 2013; Minter Ellison, 2015). An imperative therefore exists to study institutional investors from an academic perspective in order to identify the best ways to encourage a shift in investment beliefs towards greater consideration of climate change throughout the investment decision-making process, and not simply within specialist RI funds.

2.1.1 Potential Impact of Climate Change on Investment Portfolios

Climate changes will be multiple and cumulative (International Panel on Climate Change (IPCC), 2014). Unless governments, businesses, investors and consumers take significant mitigation and adaptation actions in the coming years, we are unlikely to stay below the 2^{o}C target of 'acceptable' warming outlined by the IPCC. Beyond this point, feedback loops are likely to accelerate and exacerbate the negative consequences of climate change through a series of 'rolling collapses' within the economy, environment and society (Helm, 2012; Towers Watson, 2012; World Bank, 2012).

Investment returns are, therefore, likely to be affected directly and indirectly by a variety of climate-related risks (IPCC, 2014; UNEP FI, 2013). World Bank Group President Jim Yong Kim said that accounting for climate change is "…simple self-interest. Every company, investor and bank that screens new and existing investments for climate risk is simply being pragmatic" (The Australia Institute, 2014).

Mercer (2015) set out four (TRIP) variables of climate change impacts they believe will impact strategic asset allocations (SAA):

1. Technology: The development of new low CO_2 technologies
2. Resource Availability: Changes to the quality and availability of key resources
3. Impact: The extent of physical risk affecting investments (extreme weather events, sea-level rise, water shortages, etc.)
4. Policy: The implied costs of international, national, and sub-national targets and climate regulations

Climate risks and environmental management are thus likely to have a significant portfolio impacts (Klassen and McLaughlin, 1999). Mercer (2011) estimates that policy risk alone could contribute 10% to overall portfolio risk, with carbon pricing in particular likely to have a large knock-on effect throughout the global economy as it is introduced at local, national and regional scales (Watson, 2015; World Bank, 2014a). Institutional investors, in particular, are likely to be at risk from such changes, due to the long-term nature of their investment responsibilities and their role as 'Universal Owners' (Mattison et al, 2011). As institutional investors typically have large diversified portfolios, their performance is partly reliant on the performance of the economy as a whole, and this will likely be negatively affected by climate change if business as usual continues (Hawley and Williams, 2007; World Bank, 2012). While the timescales of climate change are long, some impacts are already being seen, including more extreme weather and rising sea levels (IPCC, 2014). Longer-term impacts are also relevant to PFs and SFs, as they must ensure returns for their beneficiaries over the coming decades (Mansley and Dlugolecki, 2001). Systemic risks such as climate change thus threaten institutional investors' ability to meet their fiduciary obligations (Urwin, 2011; Paulson Jr. 2014; Rubin, 2014), and can also affect their reputation and legitimacy (Bansal and Clelland, 2004).

A large body of academic work has focused on the relationship between the social and environmental legitimacy of a company and its financial performance (Orlitzky et al. 2003): investors are more likely to support sustainability-focused investment policies if they provide strong financial returns (Richardson, 2007; Porter and Kramer, 2006; Ioannou and Serafeim, 2014). A growing literature in both countries has suggested fiduciary duty should encompass environmental, social and governance

(ESG) factors to protect the long-term interests of beneficiaries and shield against corporate scandals and other large-scale losses (UK Law Commission, 2014; Minter Ellison, 2015; UNEP FI, 2009a). Furthermore, Porter and van der Linde (1995) explore the competitive advantages available through environmental innovation, Clark and Hebb (2005) point to the lower reputational and environmental risk factors involved in more responsible companies, while Nahal and Lucas-Leclin (2013) highlight the impact on supply chains from rising climate anomalies. Furthermore, UNEP FI (2004) demonstrates the benefits of strong environmental policies to corporate equity prices. While the results on the relationship between ESG performance and financial performance are not unanimous, Clark et al.'s (2014) review of existing literature found that 88% of relevant research shows solid ESG practices resulting in better operational performance, and 80% found that stock prices are positively influenced by good sustainability policies. Mercer (2015) calculate that adapting to a 2°C scenario should not negatively affect returns for long-term diversified investors, and should produce long-run outperformance beyond 2050. Consequently, a business case for investors to act now on climate change exists, with Stern (2006) saying that the benefits of strong and early action will considerably outweigh the costs.

2.1.2 The Carbon Bubble and Stranded Carbon Assets

In 2011, the Carbon Tracker Initiative highlighted a potential 'carbon bubble' within the global economy (Carbon Tracker, 2011), building on Krause et al (1990) who suggested that fossil fuel companies could be overvalued due to future climate regulation. Recent estimates suggest that between 60-80% of publicly listed fossil fuel reserves are 'unburnable' if the world is to avoid disastrous climate changes, potentially costing the fossil-fuel industry US$28tr revenues over the next two decades (Carbon Tracker, 2013; Kepler Cheuvreux, 2014). This would likely be reflected in lower share prices, but could potentially lead to a financial crisis, creating large economic losses for institutional investors. However, if these reserves are burnt the outcomes could be even worse, with the subsequent climate changes irrevocably altering the environment, affecting economic production and investment risk and returns (IPCC, 2014). Regardless of government policies, 'there are multiple pathways to stranding: the downward cost curve for renewables is another, the

pressure from investors, the pressure from students… there are many reasons' (Murray, 2015). The Australia Institute (2014) consequently described the valuations of fossil fuel companies as 'a fundamental intellectual 'fallacy of composition' – analogous to the traditional speculative bubble'. Institutional investors are therefore facing calls from beneficiaries and NGOs to calculate their exposure to 'stranded assets' risks whereby their investments may lose value prematurely due to a range of physical, regulatory or market risks linked to environmental change (Ansar et al. 2013; Generation Foundation, 2013). Campaigns for decarbonization and divestment from dirty fossil fuels have also gained momentum due to potential future financial losses and need for reduced carbon emissions (Flood, 2015).

2.1.3 Investors' Role in Tackling Climate Change

While one focus for climate scientists and investors alike should be reducing misinformation and skepticism around climate change, it is necessary to ask how investors can help tackle the issue (Sterman, 2011). UNEP FI (2013) highlights the growing pressure on investors to act, saying that 'increasingly, regulators, policy-makers, investee companies, pension beneficiaries and the public at large are expecting investors to fulfill precisely that responsibility'. The role of the capital markets is particularly important in the context of failures at the national and international level to deal effectively with the risks (Andresen and Agrawala, 2002; Nicholls, 2005). An Accenture / UN Global Compact survey (2013) found that only 12% of corporate CEOs currently see investor pressure as driving their sustainability policy, but 69% believe investor pressure is likely to be an important factor in the future, illustrating the need for greater investor activism on climate agendas, with the 'real economy' likely to follow their lead. Covington and Thamotheram (2014) have outlined three main ways in which investors can contribute:

1. Raise the cost of capital for companies or projects that contribute to increased greenhouse emissions.
2. Lower the cost of capital for companies or projects that will reduce greenhouse emissions.
3. Encourage legislators, regulators and corporations to take action to accelerate the transition from a high- to a low-emissions economy.

However, multiple pathways to integrating climate change into investment decisions exist (De Graaf and Slager, 2009). Clark and Urwin (2008) identify the need to balance change with stability, whereby long-term reform of institutional structures need not disrupt performance. Integrating climate change into the investment process needs to be undertaken holistically throughout the firm; Hirschhorn (2002) and Kotter (1995) suggest that such changes are difficult but feasible when viewed as a process, rather than a single event, and coordinated by an influential leadership group.

2.2 Economic Geographies of Australia and the UK

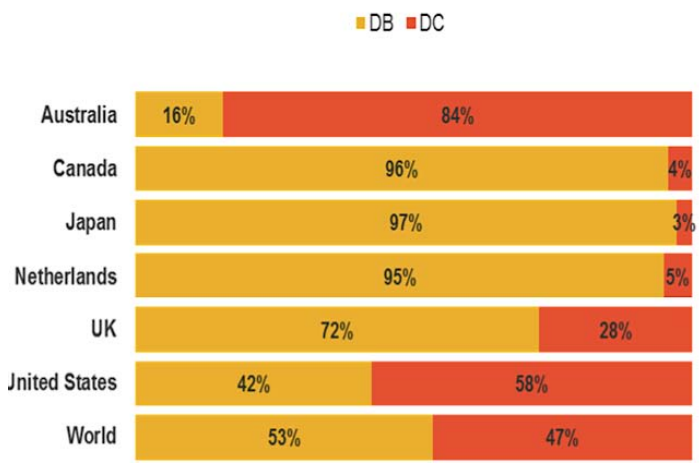
The core of this thesis is a comparative study between institutional investors in the UK and Australia. These two countries were chosen due to the contrast between the well-established PF industry in the UK and the rapidly growing SF sector in Australia. Both PF markets have significant carbon exposure and an activism surrounding Responsible Investment (RI). Both countries will require private sector financing for the low carbon transition, with private sector assets accounting for 89% and 84% of pension assets in 2012 in the UK and Australia respectively (Towers Watson, 2014). The different political and regulatory stances as well as their varied experience of and exposure to climate changes were also factors in determining the relevance and importance of this comparative study.

2.2.1 Pension Fund Systems

Institutional investors in the OECD had US$92.6tr Assets Under Management (AUM) in 2013: US$34.9tr from investment funds; US$ 26.1tr from insurance companies; US$24.7tr from PFs (OECD, 2014). Of the assets invested in PFs, the UK and Australia were second and third respectively (US$2.68tr vs. US$1.46tr), behind only the USA. In both countries, these assets were equivalent to the entire annual economic output: PF asset-to-GDP ratios were 103.3% in Australia and 100.7% in the UK (OECD, 2014). Given the size institutional investment assets in these two countries, more responsible management of these assets could, potentially, provide significant impetus in shifting capital towards lower carbon economies.

In 1992, Australia introduced compulsory superannuation contributions of 9.5% of earnings for all employees aged 18-70, which are then supported with government and employer contributions. In the UK, contributions are optional but encouraged through tax incentives, although mandatory pension plans are now being introduced. The Australian system has shifted towards a defined contribution (DC) system that requires a minimum contribution but does not guarantee the expected return, moving away from defined benefit (DB) schemes which are now being closed to new members (OECD, 2014). This shift towards DC schemes places the investment risk with the individual saver rather than the PF, as schemes no longer have to pay out a fixed amount upon retirement. DB schemes remain prominent in the UK, although there is an ongoing shift towards DC schemes as the country follows in the footsteps of the US and Australia where DC schemes are now dominant (Figure 1). However, individuals in each country have the option to move their pension to another provider, so the imperative to provide a competitive return remains.

Figure 1. Defined Benefit vs. Defined Contribution Pension Schemes by Country (Source: Towers Watson, 2014)



2.2.2 Exposure to Climate Change and Stranded Asset Risks

The UK and Australian economies have different exposures to the risks and opportunities presented by climate change. Exposure to stranded carbon assets varies geographically with the physical location of the assets (public/nationalised assets) and their listing on stock markets (private corporate assets) as well as the speed of developments towards a low carbon economy and the introduction of carbon

regulation (Bridge et al. 2013). Coal dominates the Australian economy, accounting for 63.9% of electricity generation in 2014 (BREE, 2014) and 16% of total export values (A$38.9bn; equivalent to 3.4% of GDP) in 2012-2013 (Caldecott et al. 2013). Combined with a small population, this means Australia's carbon emissions per capita are the highest of any major Western nation (Milman, 2013). Furthermore, a recent study found that 90% of Australia's coal reserves will be 'unburnable' if the 2°C target is to be met, so exposure to asset stranding is likely to be high (McGlade and Ekins, 2015). The UK's per capita emissions are half those of Australia, and below average for High Income and OECD countries (Figure 2). However, exposure to stranded carbon risk is also high in the UK stock market. UK PFs typically invest in other markets with high carbon exposure, and foreign reserves can be listed on the UK stock exchange. As such, UK investors are effectively importing climate risk through investments (London Assembly, 2015). Carbon Tracker (2013) showed that one third of the coal reserves listed in London were located in Australia meaning that investors in the UK stock exchange have a greater fossil fuel exposure than the Australian exchange (Figure 3).

Figure 2. Carbon Emissions Per Capita
(Source: World Bank Database, 2015)

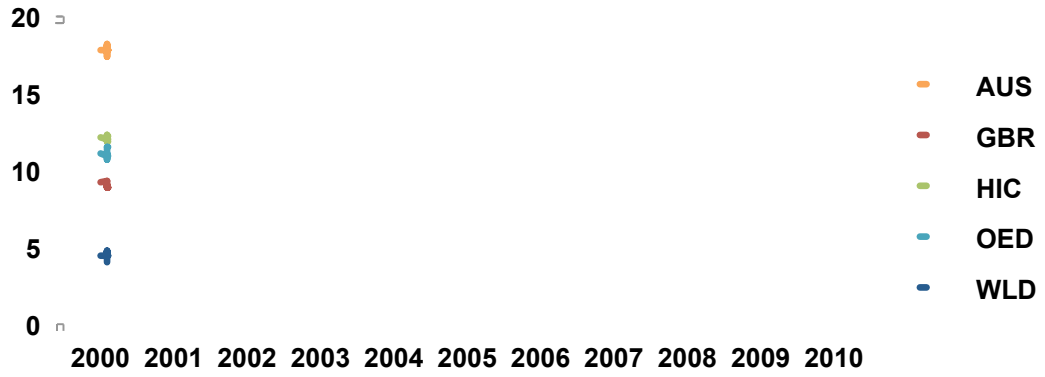


Figure 3. Potential Carbon Reserves on Global Stock Exchanges
(Source: Carbon Tracker, 2013)

Indices	Potential reserves intensity of index ($GtCO_2$ / US$ trillion mkt cap)
MICEX Index (Moscow)	395.61
Athens Stock Exchange General Index	101.44
FTSE 100 (London)	90.65
FTSE MIB INDEX (Italy)	74.42
S&P/ASX 200 (Australia)	67.14
FTSE/JSE Africa All Share Index	49.73

2.2.3 National Climate Regulations

The high financial and physical risks presented by future climate change will likely require regulatory and policy action to help reduce emissions and spark investment in alternative technologies. The Australian Institute (2014) identifies three 'public policy-related' drivers likely to affect investment returns while mitigating climate change: regulation aimed at reducing emissions; market competition from cleaner energy systems while reducing fossil fuel subsidies; and socio-political pressure. The impact of policies on investors will vary based on the location, efficacy and type of regulation, and large uncertainties remain over current and future policy frameworks. A recent survey of global investors on climate change found that policy uncertainty is delaying and discouraging mitigation and adaptation (Ceres, 2013). Investors are thus actively lobbying governments reduce uncertainty and strengthen climate policies, environmental disclosures and carbon markets (GIC, 2014; Watson, 2015).

Many climate change-related investments, such as renewable energy, have historically relied on government subsidies for economic feasibility, and uncertainty around such interventions can reduce the likelihood that investors will back alternative technologies, causing a feedback effect where a lack of investment keeps costs high and reinforces the dependency on subsidies. This has been the case in both the UK and Australia. The UK Conservative Government elected in 2015 announced cuts to wind and solar subsidies (Harvey, 2015). The Australian Government under Tony Abbot repealed a progressive A$25.40 per tonne 'carbon tax' (White, 2013) and reduced the popular Renewable Energy Target (RET) (Taylor and Hoyle, 2014). In Australia, the announcements have had a severe knock-on effect in the investment community, devaluing investments in renewables and green sectors initially sparked by RET in 2001 (Mercer, 2014; REN21, 2014). It is feared that the recent UK announcements could have a similar effect.

Despite recent decisions to reduce renewable subsidies, the UK has, historically, been more consistent in its climate change agenda and is expected to play an important role in the Paris COP whilst the Australian Government has been dubbed 'Public Energy Number One' of the climate talks (Davey, 2015). The UK has been a signatory of the Kyoto Protocol since 1995, and strengthened its position at the forefront of

international action by passing The Climate Change Act in 2008. The Companies Act 2006 introduced mandatory carbon emissions reporting, improving the disclosure of externalities and exposure to carbon risk (Blain and Lawrence, 2013). The Committee on Climate Change (CCC) report 'Building a Low-carbon Economy' set out 80% emissions reduction targets by 2050 from 1990 levels, with European Union targets to produce 15% of UK energy from renewable sources by 2020 (CCC, 2015). Australia ratified the Kyoto Protocol in 2007, but has been more modest in its carbon commitments; initially pledging 2020 targets of 20% renewable electricity but only 26-28% reduction of carbon emissions by 2030 compared to 2005 levels (Bamsey and Rowley, 2015; Sturmer, 2015). Strong commitments encourage companies and investors to reduce carbon emissions by indicating the likelihood of a low carbon economy, but need to be supported by stable and incentivizing policies (Nelson et al. 2014), and Australia appears to be falling behind its counterparts internationally.

As such, the comparison of UK and Australian investors attitudes should provide an important insight into what local factors are affecting investment decisions; including the role of policy, direct exposure to climate risks and the structure of institutional investment responsibilities.

2.3 Changing Investor Attitudes to Climate Change

Responsible investing and investor engagement on climate and sustainability issues have increased dramatically over the past two decades (Murray, 2012; PWC, 2010; Sullivan and MacKenzie, 2006). There has been a proliferation of membership to a range of organizations working to improve the transparency and commitment of companies to issues of sustainability and climate change, with the Global Reporting Initiative (GRI), Principles of Responsible Investment (PRI) and the Carbon Disclosure Project (CDP) leading the way internationally (A4S/GRI, 2014; Sadowski et al. 2010). Recent data suggests that 80% of investors and investment analysts believe that ESG data is important to investor decision-making, but noted the continued need for better, more integrated reporting of climate risks (A4S/GRI, 2014). Collaborations established between ESG service providers aim to alleviate survey fatigue and develop coherent ESG data standards that better provide for the needs of investors (CDSB, 2014).

2.3.1 Network Governance and the Proliferation of Investor Groups

Network governance refers to the style of coordinated action and learning among a group of state and non-state stakeholders to achieve common goals, and is evident in the environmental arena (Kinnear et al. 2013; Newig et al. 2010). Investor groups aim to build momentum and share best practices in climate related investing, with collaboration also able to create an influential voice to shape corporate and government policy (Guyatt, 2008; Bohmelt and Betzold; 2013). Guyatt (2013) divides these groups into a number of sub categories; this thesis focuses on 'climate change groups' and 'sustainable investment groups' (See Figure 4 for a list of key groups in the UK and Australia).

Figure 4. Investor Groups on Climate Change and Sustainability in the UK and Australia (Source: Author)

Climate Change Groups	Sustainable Investment Groups
Carbon Disclosure Project	UN Principles of Responsible Investing (UNPRI)
Investor Group on Climate Change (IGCC) in Australia/New Zealand	The UK Sustainable Investment and Finance Association (UKSIF)
Institutional Investor Group on Climate Change (IIGCC) in Europe	Responsible Investment Association Australia (RIAA)

However, recent work questions the efficiency of these groups with investors belonging to several different organizations, suggesting that better cross-collaboration between the groups would be beneficial (Guyatt, 2013; Sadowski et al. 2010). Conley and Williams (2005) also express concern at the rapid rise in the number of network actors within the CSR space, suggesting that issues of democracy arise as those who shout loudest have greatest influence in shaping the languages and practices of RI, rather than more socially-legitimate government agencies. Global coalitions have been formed between the four regional climate change groups (under the name Global Investor Coalition - GIC) and seven of the sustainable investment groups (Global Sustainable Investment Alliance - GSIA) to try and avoid repetitious work, increase the visibility of the organizations and better facilitate the transfer of knowledge and practices (GIC, 2014; EUROSIF, 2014).

These groups also act as intermediaries in the wider investment system. Amaeshi (2010) discusses the barriers that language and time frame differences create between SRI and mainstream investors; these groups promote interaction and dialogue to try and overcome these obstacles. Bohmelt and Betzold (2013) also discuss the environmental governance role that these networks play through their participation in national and international policy negotiations. They also disseminate the latest climate science, RI reports and case studies of investor practices through conferences, membership newsletters and websites. Participation in these groups exposes investors to different styles of learning, both social and asocial, via dialogue during conferences and group meetings (social), but also individual learning through report reading (asocial). This makes these groups important and interesting for understanding more about climate-related investor learning.

Growing network governance such as this can be seen in a variety of socio-economic and policy arenas, with analogous examples seen in climate policy negotiations (Keohane and Victor, 2010) and the low carbon transition (Khan 2013). Backhaus (2010) notes the importance of intermediaries as 'innovating actors' in the necessary transition towards a low carbon energy and economic system. Groups and networks are needed to better facilitate multi-scalar discussions between a range of actors, including finance and business communities, the public and policy makers (Bulkeley, 2010; Lemos and Agrawal, 2006; Ostrom, 2010). Di Gregorio (2012) suggests that such 'communicative networks' can alter belief systems and engender social change through the creation of alliances between social movements and the establishment of shared values and common discourses. Hill and Engle (2013) highlight the need for 'integrative knowledge networks' both within and between organizations to balance top-down and bottom-up action and knowledge-sharing, suggesting that such networks could be vital for the spread of climate knowledge throughout the investment system.

2.3.2 Integrating Climate Change into Investment Decisions

Numerous examples exist of AOs and AMs adapting their investment and engagement processes to better account for climate change risks: more than 550 institutional investors had made a climate commitment of one kind or another by early 2015 (Novethic, 2015). Hudson (2006a) outlines four key approaches to RI. Figure 5

gives specific examples of how these approaches can be used to take climate change into account in investment decisions.

Figure 5. Key Approaches to Responsible Investing
(Source: Author based on Hudson, 2006a)

Approach	Description	Example
Negative Screening or Exclusion	Firm or portfolio-wide avoidance of specific industries, sectors or companies. Often excludes sectors which are deemed to harm rather than help society, such as defense and tobacco. Increasingly discussions around the exclusion of or divestment from fossil fuels are taking place as the externalities of emissions become more visible.	Local Government Super: Expanded existing negative screen methodology to exclude companies with a material exposure (more than one-third of revenues) to 'high carbon sensitive' activities such as coal and tar sands mining, as well as coal-fired electricity generators. (LGS, 2014)
Best in Class	Ranking competing firms within a sector or industry according to their ESG performance as well as their financial performance. The investable universe is then defined by the top performers (e.g. top 10%, top quartile).	Allianz Global Investors: Take a 'best-in-class' approach on a thematic and sector basis through the application of internally generated sustainability ratings which helps inform the stock selection process. (Allianz, 2013)
Engagement	Productive two-way dialogue between shareholders and corporate managers. Investors can monitor the company closely and actively request greater transparency and operational action to reduce risks associated with climate change.	CCLA Investment Management: 'Engagement on carbon emissions with companies we invest in is a vital part of our commitment as responsible investors to support the mitigation of climate change.' (CCLA, 2014)
Advocacy/ Activism	Organized and often coordinated action supporting a particular set of issues, such as greater transparency around stranded asset risk. Often this approach is adopted if engagement does not have the desired effect, meaning that group pressure on companies or governments is needed to encourage change, but can also be used in conjunction with engagement.	Australian Council of Superannuation Investors (ACSI): ACSI's members represent more than AUD$400bn AUM. ACSI engages directly with companies on behalf of its members, and also actively contributes to government, parliamentary committees and other relevant public policy forums to promote desirable environmental legislative and regulatory outcomes (ACSI, 2012)

Engagement and screening practices in particular have become a more integrated part of mainstream investment processes (Sorensen and Pfeifer, 2011; GSIA, 2014), moving beyond the label of 'Socially Responsible Investment' (Arjalies, 2010). These different approaches are not mutually exclusive, with many institutions adopting multiple strategies. Clark and Monk (2010) present the case of the Norwegian Sovereign Wealth Fund which uses engagement and screening processes, publicly 'naming and shaming' unsustainable companies that have been delisted from

portfolios. Investors are increasingly introducing environmental and other non-financial considerations into initial stock- and asset-selection decisions, as well as developing designated portfolios, indices and investment products focused on avoiding risks and finding opportunities from climate change (EUROSIF, 2014; Hudson, 2006b). As concerns around stranded assets and divestment campaigns have gained momentum over the past few years, there has been a rise of shareholder activism and increasing direct corporate engagement (Dupré et al. 2015). For example, leading fossil fuel companies have faced shareholder resolutions to calculate and disclose their climate risk exposure (Srinivas, 2015). A number of climate action initiatives have also been established, such as the Carbon Asset Risk Initiative, the Portfolio Decarbonization Coalition, the Montreal Pledge and Carbon Action. Interest in climate exposure is also spreading across different asset classes, particularly in listed equities, private equity/infrastructure, green bonds, green real estate, forestry and land use (IIGCC, 2015).

Although ESG integration practices have grown by 65% between 2011 and 2013 (EUROSIF, 2014), the global sustainable investment market is only 30.2% of professionally managed assets and consideration of climate issues within that will be much lower (GSIA, 2014). A number of bottlenecks and barriers limit the uptake of RI (Sievanen, 2014), with Columbia University (2014) highlighting four barriers to PF investors integrating ESG issues into their decisions:

1. Industry Awareness and Education
2. Political Uncertainty and Lack of Regulatory Framework
3. Availability of Investment Vehicles
4. Data Availability and Measuring Climate Impacts

Even the best climate science and scenarios are necessarily incorrect due to uncertainty of future policy and societal actions (Yearley, 2009), meaning that calculating the impact of climate-aware strategies, or even the risks within portfolios is riddled with ambiguity and assumptions. Columbia University (2014) suggests that 'this ambiguity of cause-and-effect can reduce the urgency of and incentive to develop climate-sensitive investment strategies'. This thesis thus explores learning, communication and investment strategies that might help circumvent some of these barriers.

2.4. Communicating Climate Risk

The communication of scientific research is of increasing importance in the field of climate science where the decisions of policymakers, investors and the public will affect future planetary conditions. The IPCC has been instrumental in summarizing and publishing the latest climate science, being awarded a Nobel Peace Prize in 2007 for its efforts (Hulme and Mahony, 2010). However, their ability to communicate these risks effectively remains questionable, with a growing gap between the climate science, policy action and the public understanding of the risks (Sterman, 2011). Polls show that public understanding and certainty about climate change seems to have declined over time rather than increased in line with scientific understanding, including in the UK and Australia (BBC, 2010; Spence et al. 2010; Capstick et al. 2014).

A growing literature explores the psychological, social, institutional and political barriers to accepting climate science. Depledge (2006) suggests that the prolonged nature of the international negotiations has caused ossification (the negation of learning) even among climate negotiators and activists. To formulate the appropriate and most effective communication strategy the audience, the level of group participation, and framing strategies need to be considered (CRED, 2009; Moser, 2010; Pelling et al. 2008). Weigold (2001) argues that science communications should focus on specific audiences rather than addressing findings to the general public, as it appears that different groups have specific requirements in the information, language and level of detail required to best analyze the impact of the science on their everyday practices (Bostrom et al. 2013). Such efforts are beginning to be established in financial communities, with the Cambridge Institute for Sustainability Leadership (CISL, 2015) releasing briefings based on the IPCC report, giving concise sector-specific summaries for different industry and investment professionals. However, significant gaps in disseminating the importance of climate change to investors remains, with Eccles and Serafeim (2013) noting the continued lack of ESG information in quarterly earnings reports which are central to investor's learning about corporate strategy.

While communicating climate change has been a key facet of climate policy over the past decades, Corner and Groves (2014) explore the need for breaking the deadlock in effective communication strategies, with a deficit of climate knowledge no longer sufficient to explain the gap between scientific and social consensus. Moser (2010) suggests that for better communication, lay audiences need to 'receive ample, clear, sufficiently strong, and consistent signals that support the necessary changes. This clear signaling task cannot be underestimated given the hurdles of cognition, the human-nature disconnect, climate and societal system lags, and other matters competing for constant attention'. A range of alternative communication strategies have been suggested, such as creating climate narratives rather than simply presenting the facts (Jones, 2014), using notions of risk and reward to explain uncertainty (Painter, 2013; Pidgeon and Fischhoff, 2011) and focusing on climate 'knowns' rather than 'unknowns' (COIN, 2014). Simple framing devices can be adopted to increase understanding and alter behaviours, such as focusing on the avoidance of losses (Kahneman and Tversky, 1979; Morton et al. 2011), highlighting the immediate impacts (Gifford et al. 2009) and the use of exclusion task instructions instead of inclusion (McDonald et al. 2014). This thesis thus seeks to explore which communication strategies are currently influencing investment decisions, and how climate change communications could be better tailored to their information needs.

2.5 Theories of Social Learning and Communication

Theory, and theoretical assumptions, are present in any research so it is important to explore these explicitly rather than leaving them unproblematized and implicit (Gilbert, 2008). Figure 6 outlines approaches linked to Communication and Learning theory, and the following section comments on their utility in underpinning the empirics of this thesis. This thesis is interested in learning strategies that inform investment decision-making. Learning can be seen to occur in both social and asocial environments, and Haas and Haas (1995) suggest that the capacity to learn is based on the 'willingness to make use of available knowledge' that can be acquired through study, experience, or being taught.

Figure 6. Summary of Communication and Learning Theories (Source: Author)			
Theory	**Key Literature**	**Literature Linked To Climate And/Or Investment**	**Explanation**
Social Learning	Bandura (1963; 1973) Jarvis et al. (1998) Reed et al. (2010)	Bursztyn et al. (2014) Nilsson and Swartling (2009) Tabara et al. (2009) Hall (1993)	Learning as a cognitive process that occurs in a social environment rather than taught environment such as a classroom.
A-Social Learning	Rendell et al. (2011)	Pidgeon and Fischhoff (2011)	New information is learned by an individual through the private consumption of information, e.g. reading reports or media articles.
Peer Learning	Hara (2009) Boud et al. (1999) Elwyn et al. (2001) Pelling et al. (2008)	Bursztyn et al. (2014) Cambridge Network (2015)	Collaborative learning amongst peers is shown to expedite the learning process.
Group Norms	Abrams and Hogg (1988) Hornsey (2008)	Masson and Fritsche (2014) Whitmarsh et al. (2012) Dunlap and McCright (2008) Fielding et al. (2012)	Social and professional groups provide guidelines for appropriate behaviour through the internalization of accepted behaviours, and the transfer of accepted knowledges and learning techniques.
Communities of Practice	Wenger (1999; 2011) Brown and Duguid (1996)	A4S (2015a) Bursztyn et al. (2014) Guyatt (2007)	Groups of people who share a concern or a passion for something, and meet together to discuss and learn how to improve the situation through regular cooperation.

Social learning theory suggests that learning in a social environment can facilitate the rapid dissemination of best practices within an organization, especially when learnt from peers (Hara, 2009) and if practices are expected to have positive outcomes (Rotter, 1954). This suggests that investors acceptance of climate change investment beliefs is much more likely if espoused by their co-workers or peers, and also if low-carbon or climate-aware strategies offer good returns (financial and/or reputational). Nilsson and Swartling (2009) suggest that improving the potential for social learning in both institutional and individual contexts 'can be seen as a strategy for meeting the inherent complexity and uncertainty of global change'. Social learning is perhaps particularly useful for investors who have limited time and attention capacities due to the nature of their jobs (Peng, 2005; Peng and Xiong, 2006).

Rendell et al. (2011) explore the role of copying our peers in processing new information. While imitation can be an important cognitive process through which we adopt new behaviours, it is also potentially dangerous as the lines of social learning can become entangled in false information. Bursztyn et al. (2014) find that investors do adapt their own investment decisions when they learn that a peer has bought or sold an asset due to 'social learning' and 'social utility', but this can cause herding, whereby speculation about a company can spread through word of mouth or via stock price signals almost regardless of the actual value of a stock (Devenow and Welch. 1996; Kahneman, 2011). As such, we need to consider the goals and motivations behind any behaviour that we are copying from others (Fielding et al. 2014), suggesting asocial learning is important to ensure that up-to-date and accurate information is consumed, particularly when new information is regularly published as is the case in RI and investment markets (Rendell et al. 2011). This suggests roles for both social and asocial learning concurrently. While social learning is important for getting more investors to incorporate climate risks into their decisions, individuals need to learn about climate risks and opportunities from the best and most current sources of scientific understanding so as not to be misled by peer-learning (Pidgeon and Fischhoff, 2011).

Group dynamics also affect individual behaviour due to the impact of audience effects and social norms. According to Haas and Haas (1995), 'groups of like-minded professionals usually self-recruited around a particular issues/problem' are key to disseminating new knowledge. Both formal and informal 'communities of practice' thus act as vehicles for peer-learning but also the dissemination of norms and practices which can complement officially communicated or 'taught' behaviours within institutions. Such groups can be formed between colleagues within an organization or can be external groups promoting cross-collaboration and knowledge-sharing between peers, and between experts and non-experts (Smith and Mackie, 2007). In the case of climate change-related investor groups, these communities of practice also promote learning within and between different groups, with several members belonging to multiple groups, so that knowledges, identities and norms learned in one group setting can be transferred to the members of another group (Guyatt, 2007). Hull (2012) finds that investors respond better to consistent and customized communication from individuals discussing their own ideas and positions

rather than an institutionalized view. This supports the notion that face-to-face meetings play an important role in the social learning and practice (Schwartzman, 1989). In a survey of business people, 85% believed that face-to-face meetings are more likely to result in breakthrough thinking (Mullich, 2010). This suggests that to change investor behaviour towards climate risks, face-to-face meetings between peers will be key. Using these Communication theories, this thesis seeks to explore the different learning mechanisms and language that could increase investors' awareness of climate risks and opportunities.

2.6 Belief Crystallization and Overkill

'People are imperfect processors of information, and are frequently subject to bias, error and perceptual illusions' (Shefrin, 2002). This fallibility of human decision-making has formed the basis of the behavioural finance literature that has burgeoned in recent decades. However, Hebb (2011) notes the lack of academic literature on how and why investment beliefs (whether personal or institutional) are formed, changed and practiced. Koedijk and Slager (2007) suggest that an investment belief is 'generally formulated as an observation of a mechanism of human behaviour in the financial marketplace'. These beliefs guide investment decision-making and influence reactions to market buy-or-sell signals, and are based on subjective judgements, past experience and market knowledge. Research suggests that sound investment beliefs are materially beneficial to PF governance and performance (Clark and Urwin, 2010; Koedijk et al. 2010).

Differences in investment beliefs (explicit or implicit) will affect capital allocations. It is increasingly recognized that explicit (publicized) investment beliefs help create transparency and promote shared understanding between the beneficiary, the institutional investor and the fund manager of the underlying assumptions used in the investment process (Koedijk et al. 2010). Climate change can be seen as one potential agency problem for institutional investors that could be reduced through the introduction of clear investment beliefs that protect the interests of beneficiaries against short-termism (IIGCC, 2015; Gray, 2009; Koedijk and Slager, 2007).

Beliefs tend to coalesce and crystalize around dominant ideas. 'Belief overkill' refers to 'the tendency to bring all arguments into line with a favored conclusion' (Baron, 2009). Individuals are often inclined to develop and hold beliefs that are aligned to their preexisting philosophies and beliefs (Collie, 2015). Examples of this have been identified in a range of social issues, including individual beliefs around nuclear test ban treaties (Jervis, 1976) and capital punishment (Ellsworth and Ross, 1983). Individuals are also known to bias their assimilation of climate information in order to protect their existing identities and beliefs (Whitmarsh et al. 2011; McCright and Dunlap, 2011). Collie (2015) suggests that belief overkill can lead to polarized and bad investment decisions, as they may be based on preexisting biases rather than rational analysis.

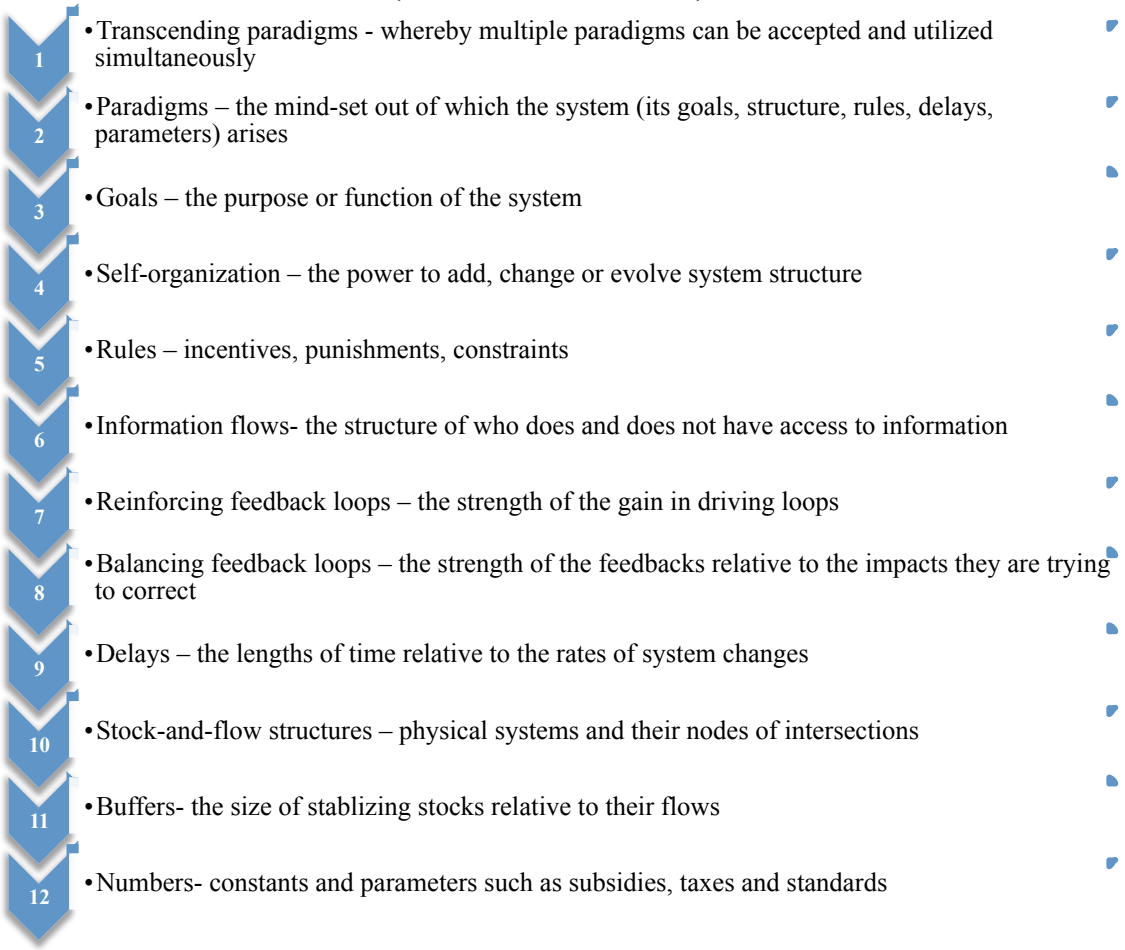
Hudson (2006a) argues that the development of SRI markets often reflects prevailing (and highly contextual) cultural beliefs, and that this helps to explain why RI consideration varies geographically. Research from Columbia University (2014) highlights five factors that can drive changes in belief crystallization, which could help integrate climate awareness into investment decisions: Board and Executive leadership; reputational risk; financial market volatility and new investment strategies; climate change regulation; and cultural norms.

2.7 Systems Theory: Changing Beliefs, Behaviours and Paradigms

Systems theory offers another perspective on how to influence and alter existing practices, beliefs and paradigms. Systems theory is an interdisciplinary approach to studying the world from a holistic and 'outside' perspective (Heylighen and Joslyn, 1992). Although widely relevant to both climate science and economics (Luhmann, 2012), relatively little literature has used systems theories to link the two. Meadows (2008) argues that 'There are no separate systems. The world is a continuum', and arguably the separation of economic and environmental analysis may have contributed to the financial and environmental problems of past decades (Crusto, 2005).

A system is an 'interconnected set of elements that is coherently organized in a way that achieves something. A system must consist of three kinds of things: elements, interconnections and a function or purpose' (Meadows, 2008). The institutional investment industry is a system with capital, stocks, portfolios, interconnected investors and beneficiaries, and the provision of pensions and investment returns as its goals, though it does not exist in a silo. 'Leverage points' are points of 'power' within a system that can affect system dynamics, alter behaviour and change beliefs (Meadows, 1999). Figure 7 demonstrates that the goals and paradigms of a system are the most effective intervention sites to alter system behaviour, but are the most difficult to change.

Figure 7. Places to Intervene in a System in Order of Effectiveness (Source: Meadows, 2008)



To understand our ability to alter the performance of systems, recognizing the interconnections between actors and elements within systems is imperative. Changing one element or actor can have an important impact by affecting the relationships or purpose of the system: i.e. changing one leader at the top can alter an entire system,

even if all other elements remain the same. This is evident in CSR literatures whereby firm-wide change can been instigated by new visionary leadership (Mirvis et al. 2010; Porter and Kramer, 2006; Godos-Diaz et al. 2011). However, systems can take time to react to changes; the stocks within a system (e.g. the availability of renewable energy) will change over time, but it is impossible to replace the entire energy system over night. Similarly, it has taken decades for the current levels of greenhouse gases to accumulate, and it will take decades for them to be removed. In systems with such 'delays', Meadows (2008) argues that foresight in recognizing a problem before it becomes too difficult to solve quickly is vital. Unfortunately, examples of myopia are common in financial and socio-political systems (Kay, 2012; Clark, 2011), as short-termism and information limitations result in systems outcomes that are sub-optimal. Despite this, a range of leverage points within the investment system can be identified and will be explored within this thesis.

Information flows are seen as integral to the operation and leverage of a system. Meadows (2008) explains that 'many interconnections in systems operate through the flow of information. Information holds systems together and plays a greater role in determining how they operate'. Information can limit the function of a system, but can also drive change: 'Its amazing how quickly and easily behaviour changes can come, with even slight enlargement of bounded rationality, by providing better, more complete, timelier information' (Meadows, 2008). Bounded rationality acknowledges that rational individual choices based on the available information can be irrational and undesirable when seen as part of the whole system (Simon, 1972). Investors systematically under and over invest due to imperfect and rapidly changing information (Grossman and Stiglitz, 1980), but are unlikely to alter their investment beliefs until new information questions their underlying assumptions, such as the value of subprime mortgages in 2007-8 (Kojucharov et al. 2008; O'Toole, 1999). Altered information flows may also help explain the dynamism and uncertainty of complex systems, with the potential for rapid and unforeseeable transformations (Norberg and Cumming, 2008; Nilsson and Swartling, 2009). This highlights why understanding the information flows around climate change is an important contribution to potentially changing investment beliefs and behaviours.

2.8 Gaps in the Literature

The UK Climate Impacts Programme identified a lack of research around the institutional constraints to changing behaviours relating to climate change (West and Gawith, 2005). This research seeks to contribute through a focus on the institutional investment system, as this remains an under-researched area in relation to climate change learning and communication strategies. Pelling et al. (2008) suggest that particular challenges to future climate action include the difficulty of working in regimes in which regulations, language and standards do not reflect the realities of climate change, there are few examples of best practice, and where climate action lacks strong support from senior management - all of which could be applied to investment institutions in the UK and Australia. This thesis thus seeks to explore how knowledge of climate is percolating through investment houses, investment beliefs and investors' particular set of social relationships and structures. While Godemann and Michelsen (2011) explore the range of academic theories that can be applied to the study of sustainability communication, this thesis seeks to use the 'outside view' of Systems theory to analyze the leverage points and network opportunities through which climate change can be better integrated and communicated.

Rayner and Malone (1998) identify social networks as a key variable explaining whether people change their behaviour in response to climate information. Membership to a climate change or RI group could provide significant benefits through shared knowledges and peer-learning opportunities in efforts to promote climate belief crystallization. However, little research has investigated the relationship between individual learning and the underlying methods of communication, language and institutional norms that engender behaviour changes around climate change (Pelling and High, 2005). Knowledge is inherently situated and partial (Haraway, 1991; Nightingale, 2003), so the findings of this thesis will be limited by the scope of the project, but seeks to contribute to academic understandings of the development of investors' epistemologies of climate change risks and opportunities, and the areas of leverage within the investment system.

Chapter 3. Research Methods

This section discusses the research methods used to 'generate research materials' to answer the key questions of this project (Whatmore, 2003). This research took place between November 2014 and August 2015. Primarily based on a comparative study of 58 in-depth interviews undertaken in the UK and Australia, this study also uses a broader global survey of investors to provide additional insight.

3.1 Theoretical assumptions

Methods should be consistent with the theoretical assumptions of the project, and should be directly relevant to answering the research questions (Silverman, 2013). This study uses both quantitative and qualitative methods, including a survey that will be predominantly quantitative in nature, and in-depth semi-structured interviews to provide qualitative nuance. These multiple methods should yield more complete answers to the research questions posed (Bryman, 2006): quantitative responses offer a focused insight into the communication methods, learning techniques and integration practices being employed by investors, while qualitative interviews offer a greater awareness of key issues, opinions and experiences. In addition, web-based research is used to triangulate participants' responses.

Institutional ethnography is used to explore the ways in which 'technologies of social control are increasingly and pervasively textual and discursive' (Smith, 1999). First developed in the early 1980s, institutional ethnography facilitates insight into the social organization of knowledge and its societal consequences. Texts are seen as mechanisms for coordinating and encouraging activity, and this framework offers a way of looking at society 'from the point of the people and their experience of it', focusing on the institution as a site of learning and power relations (Xenitidou and Gilbert, 2009). This approach is used to explore investors' experience of climate communications, and examines how key reports and discourses are affecting their investment decisions. Importantly, institutional ethnography allows a critique of objectified institutionalized knowledge, whereby 'frequently, and in systematic ways, the categories and conceptual frameworks of administration are inattentive to the

actual circumstances of the diverse lives people live in contemporary societies' (SSSP, 2015). This legitimizes the use of in-depth interviews and a survey to study the 'shadow spaces' and informal learning around climate change (Pelling et al. 2008), as a study of investment actions or communication outputs might overlook the diverse learning strategies and changing beliefs of investors, and could be limited by confidentiality and data limitations, or potentially be biased by group self-promotion.

3.2 Sample Selection

The large number of institutional investors in the UK and Australia, the diversity of actors throughout the investment chain, as well as my position as a graduate researcher (making me an 'outsider' to investment professionals) made sample selection an important process in this research. Gaining access to business-people, or 'elites', especially in the financial world, is often perceived to be particularly difficult, and various techniques were thus used to ensure an appropriate range of participants (Thomas, 1993; McDowell, 1998; Harvey, 2010). Rice (2010) suggests adopting a business-like or 'inside' approach, using 'gatekeepers' to gain access to initial interviewees. Existing contacts within the Oxford Smith School network acted as gatekeepers to facilitate access to those already interested in issues of sustainability and climate change. The economic consultancy Absolute Strategy Research provided both UK and Australian investor contacts who tended to be less exposed to set climate change communications. From these initial contacts, snowballing techniques garnered access to a wider sample (Atkinson and Flint, 2001), with participants often willing to suggest additional individuals to interview. Following web-based research, key individuals who were seen as important actors in this field were contacted directly. While these stratified sampling techniques are inherently biased and rely upon selective processes, I believed they would yield the most interesting and insightful results, with snowballing employed to gain access to more individuals to reduce subjectivity. This study is necessarily limited by the sample size and geographic limitations of my project.

The survey method relied upon web-based communication with members of the Oxford World Financial Digest (OXWFD), an online news outlet aimed at investment

professionals in order to gain as wide a response as possible. OXWFD has a Global membership of 95,524 investment professionals, largely focused in the US. Interviewees willing to distribute the survey through their own networks also aided in survey circulation. As such, this survey accumulated a rich data set from investors in the US, UK and Australia. While this research is primarily a UK-Australia comparison, this survey was designed to provide wider insights into current trends, climate knowledge and experiences of integration. The use of US responses can further add to the study as the country has a similar institutional investment system to the UK, is home to strong investment groups on climate change and has seen a similar recent rise of climate-related investment discussions including NGO divestment campaigns. However, a flaw in the survey design meant that the disclosure of location was not mandated, so just under half of responses were not attributable to a specific country (72 of 154); this means that the survey results cannot be usefully used to inform specific cross-country comparisons, but the results can support the interview comparisons of Australia and the UK by providing a broader insight into the global investment market.

3.3 Interviews

Corporate interviews can be used as a research method to better illuminate the 'complexities of capitalist processes' (Schoenberger, 1991). 58 interviews were conducted during this research, 29 each in the UK and Australia. 60 individuals from Executives to Analysts, NGO researchers to AMs took part (one interview in each country was attended by two individuals). While only a small sample of individuals involved in each investment system, the AUM of organizations interviewed in Australia equalled A$778bn, equivalent to almost 30% of total A$2.6tr AUM (Reserve Bank of Australia, 2015). Similarly in the UK, investor organizations interviewed accounted for £6.5tr compared to a combined market for Western Europe and the Middle East[1] of £26.8tr (24% of the market) (BCG, 2015). Corporate interviews are seen as an effective method of research (Hughes, 1999), especially as businesspeople are often reluctant, or have insufficient time, for in-depth participation

[1] Western Europe and Middle East used in calculations due to the geographic scope of interviewed organizations' AUM despite their investment office location in the UK.

method such as ethnographic research (McDowell, 1998). However, each individual is likely to be subjective in their views and offer incomplete representations of practices and opinions. Triangulation and comparison of interview answers and supporting web-based research was thus necessary to highlight 'inconsistencies and absences' (McDowell, 1998).

Ethical clearance was gained through CUREC (Central University Research Ethics Committee) prior to interviews. Written consent was gained from all participants using a consent form (Appendix 1). 55 interviews took place face-to-face in locations chosen by the participants (London, Oxford, Sydney or Melbourne), with 3 occurring via telephone. The duration of interviews ranged from 26 minutes to 1.5 hours. Interviews were semi-structured in nature, and varied depending on the individuals' profession (mainstream investor, RI professional or NGO/investor-facing intermediary). Pre-prepared questions and themes were used to steer the interviews (Appendix 2), but participants' responses, interests and experiences shaped the discussion (Longhurst, 2009). As such, no two interviews were the same. As is often the case in qualitative research, the interview process was an iterative one (Pope et al. 2000): issues raised in early interviews, including an initial pilot interview, provided additional prompts and questions for subsequent interviews and created further insights beyond those highlighted in initial literature surveys (Ziebland and McPherson, 2006). Written notes and digital recordings were taken, as agreed to by participants. Due to the sensitivity of the information discussed, particularly in relation to investment practices, quotations have been anonymized, with references based on their location and the order in which the interviews were conducted to reduce any bias (i.e. UK01 and Aus01 for the first interview in each country). Where relevant, I refer to the position of the individual and the type of firm, without using names of people or institutions. Appendix 3 lists interviewees willing to be included, to display my thanks and acknowledge their participation.

3.4 Survey

A structured web-based, invitation only, survey was a secondary research method employed in this study to provide broader insights into their learning and investment

practices regarding climate change. This provided access to the opinions of a larger number of investors than would have otherwise been available, and a consistent set of answers unavailable through semi-structure interviews. However, those who participated in the survey are perhaps more likely to be interested and aware of climate change issues than those not participating, although several participants commented that they did not believe in anthropogenic climate change.

Surveys are a common methodology in social science and geographical research, providing access to large populations and generating both quantitative and qualitative data (De Vaus, 2013). However, Payne (1951) argued that there is 'no magic way of reducing the complex matter of peoples attitudes, wishes, aspirations to some simple wording that will not bias the returns', highlighting that surveys are necessarily limited by the sample of individuals who participate, the questions asked, and the analysis/interpretation of the researcher. Pilot studies are vital to assessing the relevance and ease of comprehension of the questions (Bird, 2009). A pilot study of 9 individuals with varying knowledge of climate change and/or investment experience provided feedback on the content, length and readability of the survey, and this contributed to the non-linear process of survey creation. The final survey included 29 questions (Appendix 4).

The survey was sent via email with a covering letter giving a brief introduction to the research project and information about the confidentiality and anonymity of individual survey answers. Of the OXWFD membership, 5,277 opened the email, and 136 responses were garnered (a response rate of 2.57%). A further 18 responses were gained via other contacts, providing a total survey of 154 participants. 38.7% of survey respondents were Executives and a further 27.8% were Investment Managers. Only 4.7% were ESG/RI specialists. 40.6% worked in Asset Management organizations. Before participants began the survey, they were asked to provide their informed consent in keeping with CUREC guidelines. This research aims to contribute to the availability of knowledge on climate issues in the investment arena, so participants were offered the opportunity to receive a summary of survey findings on the understanding that all contact information would be kept securely and confidentially, and all answers would remain unattributed.

3.5 Data Analysis

Survey and interview data were analyzed using a number of different techniques, including statistical analysis on quantitative data, and textual analysis on qualitative data. The survey was distributed using the online survey tool 'SurveyMonkey', and following the end of the survey, all data was exported into Microsoft Excel where the statistical analysis was conducted. Before analysis, all interviews were transcribed from audio recordings and written notes. Data from both interviews and the survey were then uploaded into coding software 'NVivo' to facilitate collective analysis. This software provides a platform to organize and analyze data through coding, search, query and visualization tools. A code is a label under which data can be grouped, and these codes can then be cross-examined and combined to highlight data pertaining to different themes and concepts (Saldana, 2009). Thematic coding was used to help categorize and analyze the data and better 'understand the patterns, the recurrences' of responses by framing the ways in which they illuminated, questioned and clarified key themes and answer research questions (Miles and Huberman, 1994; Guest, 2012). During the project, more than 80 codes were used and analyzed through six themes (Appendix 5 presents this coding structure).

This research followed the coding and analysis framework outlined in Braun and Clarke (2006): familiarization with data; generating initial codes; searching for themes among codes; reviewing themes; defining and naming themes; and producing the final report. However, this process was non-linear, with themes and codes identified in initial stages of the project, defined and redefined as new data, themes and concepts emerged during the research process. As such, these codes were developed through a mixture of deductive and inductive study of the research questions and transcripts (Richards, 2009; Miles and Huberman, 1994). This study has focused on creating a 'textual polyphony' (Crang, 1992) whereby the analysis reflects the complexity and contradictions between the multiple participant narratives to answer research questions.

3.6 Reflections on the Research Process

This research has been shaped by creative and academic choices, based on key editorial and research decisions, such as which geographies to study, which quotes to include and how to triangulate and present the data (Crang, 1992; Parry, 1998). As such, this research is 'based upon partiality' and is presented as 'situated knowledge', whereby a study using different participants, or focusing on different locations would produce different results (Haraway, 1991; Hughes, 1999). The results are thus specific to the time and place of the research, and my own interpretation and understanding of participants' responses (Schoenberger, 1991). However, every effort has been made to accurately represent the views and data generated, and address biases where possible. The methodologies are clearly outlined, and repeatable in different settings. Such efforts could usefully extend this research across other investor geographies. In particular, interviews of American investors could help corroborate initial comparisons visible in the survey data.

Positionality and power relations between researcher and participants should also be acknowledged (Gomez and Jones, 2010). As a researcher I had control over whom to interview and, to some extent, the subject of each interview. However, interviews were undertaken in the participants' choice of location (mostly office buildings; their own 'territory' (Rice, 2010)), and they also had greater prior knowledge and experience of investor behaviours and insights into their climate change beliefs and understandings. Interviewees could also rescind or change the terms of their involvement. The research process was flexible to adapt to new knowledge and experience gained throughout the project. Subjectivities were reduced as far as possible to facilitate an accurate and fair representation of participants' observations and experiences to examine existing investment learning and practices.

Chapter 4. Communicating Climate Change To Investors: Results and Analysis

Information about the risks and opportunities arising from climate change are vital to engaging an audience on the importance of this issue and catalysing behavioural change (Painter, 2013). However, just providing more information may not change people's decisions (Owen et al. 2012), so understanding what information investors find useful in translating the science into actionable knowledge is key to supporting their learning and decision-making processes. Survey results will provide broad conclusions, with the in-depth interview responses adding colour to the analysis and understanding of which sources of information investors most often use in Australia and the UK.

This chapter examines the following questions:

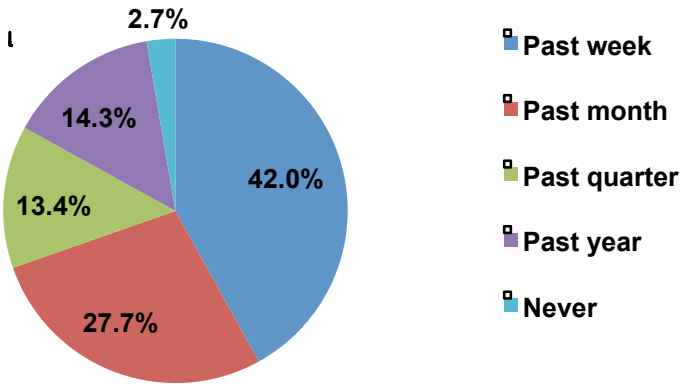
1. Who is communicating climate issues to investors? And which sources of information are investors using?
2. Do investors perceive there to be too much or too little information available on climate issues?
3. What scale of information about climate risks and opportunities is useful for investors?
4. Are formal or informal learning strategies having a stronger impact on investment decision-making around climate change?
5. Is there sufficient translation of climate science into material investment information?

4.1 Communicating to the Investor Audience

This section explores the communication of climate risks and opportunities to investment audiences, building on responses to interview and survey questions exploring which sources of information are most widely used and which are regarded as reliable and rigorous. Only 3 of the respondents to the survey (out of 112 responses to this question, 2.67%) said that they had 'never' read an article that had focused on climate change risks or opportunities, with 42% saying that they had read an article in

the last week (Figure 8). This suggests a market for this information does exist internationally, with information actively being accessed by investors.

Figure 8. When was the last time you read a report / article / research note which focused on climate change risks or opportunities? (Source: Thesis Survey)

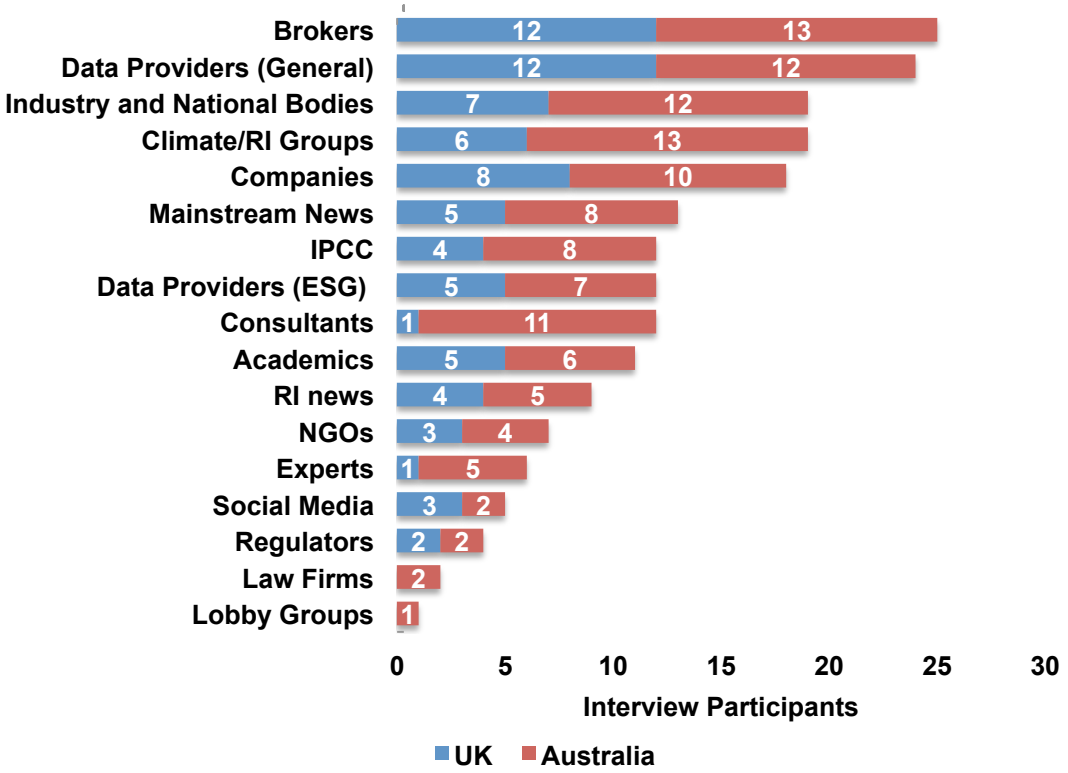


We live in the 'Information Age' (Hara, 2009): an era defined by the Internet and online/mobile communication. This has made dissemination of ideas and content much easier, and made data more accessible, with the vast majority of interviewees saying that they use "Internet searching" (Aus07) to source information about climate change. However, "anyone can write anything at any time, its unfiltered, and its not peer reviewed" (Aus11), so additional discernment is often required to determine which sources are reliable. Investors rely on a wide range of sources to triangulate ideas and ensure that they are getting the best information. During interviews, participants pointed to 17 information sources used to learn about climate change (Figure 9). Due to the open nature of the questions and the different roles of people interviewed, not everyone listed the sources of information they use, others proffered several sources, and some were less specific (e.g. "I get as much information as I possibly can" (Aus04)). Consequently, this list is not representative of all investors but a useful overview, with the single mention of consultants in the UK not suggesting that others never employ them, just that they were not discussed by interviewees.

Figure 9 shows brokers and mainstream data providers were the most frequently mentioned information sources. The results suggest that investors in both the UK and

Australia rely heavily on the traditional providers of financial information to source their climate-related information, with the top three sources all providing both financial and climate data. However, more dedicated climate research from climate groups (19 mentions), the IPCC reports and ESG data providers (12 mentions each) have also gained prominence, particularly in Australia, where these sources gained 28 mentions compared to 15 in the UK.

Figure 9. Information Sources Used by Participants (Source: Thesis Interviews)



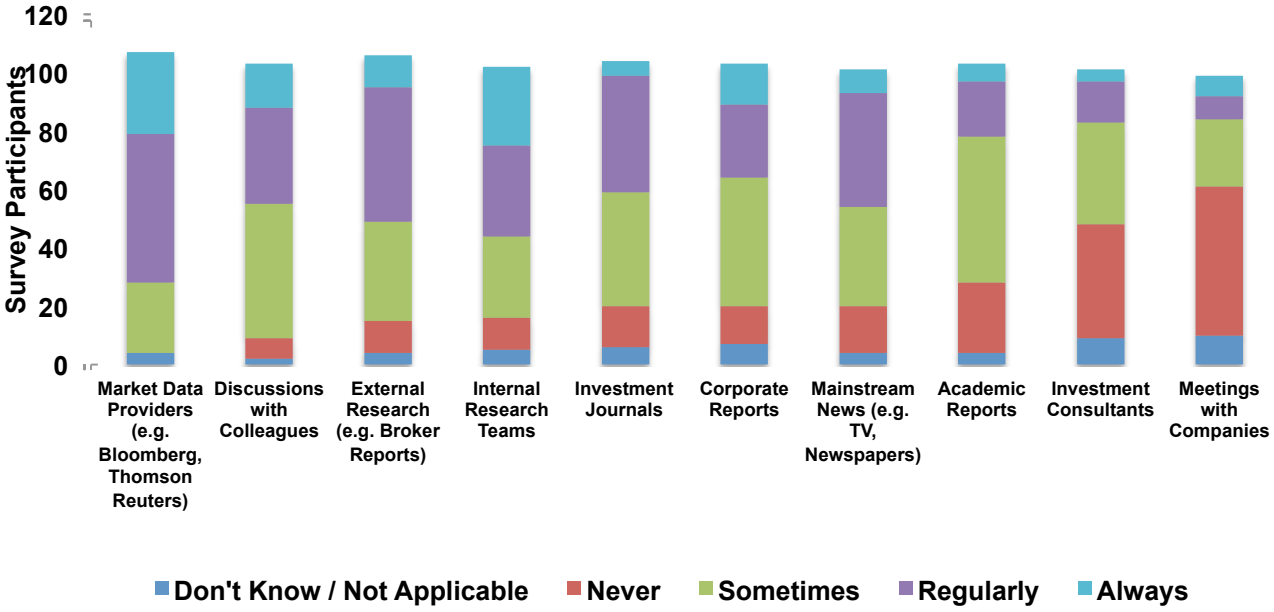
4.1.1 Broker Research

Internationally, external research providers such as brokers ranked highly amongst survey participants: 59.5% reported having used external research for information on climate change (Figure 10) and 53% said they always or regularly use those sources in investment decisions (Figure 11). Broker research is a key information source in both the UK and Australia (Figure 9), with one SF RI manager saying "I find that the work done by the brokers is really useful in distilling information into an investment context" (Aus05). Importantly, this research was seen as useful in linking climate change "back to the financial value" (Aus06). A number of leading brokerage houses were recognized as offering insightful ESG and climate research, with Australian

participants commending Citi, Deutsche Bank and Credit Suisse, and the UK interviewees pointing to the work of HSBC, Morgan Stanley and Citi. However, the level of coverage appears to vary dramatically between brokerage houses.

Figure 10. How do you gather information on climate change issues? (Source: Thesis Survey)

Figure 11. When making investment decisions, what forms of communication do you utilise? (Source: Thesis Survey)



Brokers were also praised for drawing attention to other research reports and facilitating informal networking during round table events. One AM explained the importance of staying on top of broker research, saying "The broker community is unique because if there is a hot topic, then the brokers will arrange the broader meetings on those things… There will be one broker who organizes a lunch that everyone goes to to get up to date with that issue … no one wants to be behind on something that is well understood" (Aus07). However, an Executive in a sustainability-focused AM firm commented, "We have found that traditional 'broking' research is not as long-term oriented or covering these issues as well as we would like" (UK28), suggesting that broking research can be useful in getting those in the mainstream aware of the issues, but that when it comes to informing an already integrated process, primary in-depth information is more important.

Many broker houses now employ RI/ESG teams. Although praised for increasing the amount of information available, interviewees also commented that this segmentation meant that climate change was often an add-on rather than fully integrated into mainstream services, and that although "quite a few of them do climate change reports, they tend to be quite ad hoc, so you have to take them as they come" (UK09). One area where this could be changing is around energy sectors, where fossil-fuel and utilities analysts are having to consider physical and regulatory climate impacts as they are already affecting prices and demand. A PF RI analyst thus commented "We don't just get SRI research; we will also look at mainstream reports like broker research from the oil and gas analyst" (UK20). While this suggests that people are looking at both mainstream and SRI reports, it highlights the continuing gulf between the two. Such mainstream reports could be instrumental in facilitating greater awareness among a wider investor-base who are unlikely to read climate-specific reports, but could also broaden the range of information available for those already considering climate change. However, one broker said "Where I think that the information isn't getting across as well as it could is the work done by the fundamental mainstream analysts that do consider this but isn't recognized by some of the sustainability people. I see that as the biggest information gap" (Aus20). Despite these continuing concerns, broker research was the most frequently mentioned source of information for both Australian and UK interviewees.

4.1.2 Data Providers

Figures 9 and 10 demonstrate the importance of market data providers, with 24 interviewees (12 in each of the UK and Australia) and 54.1% of global survey participants listing this as an important data source on climate change. In particular, many participants in both the UK and Australia discussed the importance of Bloomberg and other global financial data sources for accessing information about corporate and sector exposure to climate change. Of interview participants, 16 mentioned Bloomberg (4 in Australia, 12 in UK) and 12 mentioned using the MSCI database (5 in Australia, 7 in UK). For example, one Superannuation RI manager said "We also subscribe to the MSCI database, which gives a whole overview on ESG, but they also have lots of stuff on carbon" (Aus06). Ensuring that climate information is readily available on these data platforms is vital to its integration in investment decisions in both the UK and Australia. Market data providers are the most relied-upon information by survey participants when making investment decisions, with 28 of 108 respondents (25.9%) using this source 'always', and another 51 (47.2%) using it 'regularly' (Figure 11).

Bloomberg is a leading data provider, and since 2008 has been publishing 'non-financial' data alongside financial data. In partnership with CDP, Bloomberg now provides ESG data for more than 11,000 companies. Importantly, this means that investors do not have to switch between different sources when analyzing company financial and non-financial data. Bloomberg also publishes short insight analysis of key concepts and data sets. In addition, news feeds also pick up and highlight important reports that come out, such as the IPCC report, and Bloomberg New Energy Finance publishes commentaries online. ESG experts are also available to help answer queries, with one RI Analyst commenting that "Bloomberg has a great product, it has loads of data all collected in one place, so you can find out pretty much anything, and they are also very helpful at filling in the blanks where they don't have the data" (UK10). More than 17,100 Bloomberg customers used this ESG information in 2014, a 76% increase from 2013, demonstrating the wider uptake of this information by investors and the diversity of climate information that can be accessed through mainstream investment data providers globally (Bloomberg, 2015). This was also evident in the survey results, which showed that only 11 respondents (9.9%) said

that they ‘did not gather information on climate change’ compared to 60 (54.1%) who use data providers (Figure 10).

Additionally, ESG-specific data providers are publishing reports online and being employed to provide bespoke information both in the UK and Australia. A proliferation of products and global service providers trying to synthesize, analyze and disseminate ESG data has followed the growth in corporate disclosure (Sadowski et al. 2010; WBCSD-UNEP FI, 2010). 12 interview participants mentioned this source of information; Sustainalytics (6 mentions overall – 5 in UK) and TruCost (4 mentions overall – 3 in Australia) were the most commonly cited providers. They play a multi-faceted and important role in standardizing corporate sustainability reports, facilitating sector and portfolio benchmarking, and engaging with corporations to encourage sustainable practices (Sadowski et al. 2010; Slager, 2012). While concerns exist that many are too similar, risk being repetitive and contribute to survey-fatigue and information-overload (Sadowski et al. 2011), one UK interviewee defended the diversity of groups saying “Even if we are all in some ways talking about the same thing- making sustainability a critical aspect of the investment process- there are many different ways to say it and many different things to highlight. I don't think we run the risk of over-communicating on that front because there is so much work still to do” (UK27).

4.1.3 Media

The media also featured heavily, but was more contentious than other channels. While 90 survey participants (81.1%) use ‘mainstream news’ to gather information on climate change (Figure 10) only 13 out of 60 interviewees (21%) said that they use it. However, this discrepancy could be caused by the type and wording of the question: in the survey, ‘mainstream media’ was referred to as ‘newspapers, online content, television etc.’, whereas this definition was not clarified in the open-ended interviews. Another explanation could be the level of expertise in climate change issues within each sample; 30 out of 60 interviewees had a job in which climate change was a regular consideration (RI manager/analyst/consultant or working for a sustainability NGO) compared to only 5 (4.7%) survey participants listing their job as ‘ESG / SRI specialist’. Thus the lower proportion of media usage by interview participants could

be due to their greater access to, and confidence in using, specific climate-related data.

Despite high numbers of users within the survey, and the increasing frequency with which climate change issues appear in the media (Painter, 2013; Boykoff, 2008), interviewees questioned whether media is a suitable source of information. In Australia, one Superannuation CIO said "We don't think that media is a reliable source for having an investment thesis" (Aus02), an AM Executive said of climate change "there is a lot talked about it in the media, but a lot of it is fairly alarmist and maybe not very insightful" (Aus14), and another lamented the "dearth of rigour" in the press (Aus21). While several UK interviewees sought information from mainstream sources, particularly mainstream investment news such as the Financial Times or the Economist, interviewees also noted the political skew of newspapers, and bemoaned the fact that "there has been a debate kept alive (on whether climate change is man-made) even though the academic debate has ended" (UK10). Painter (2013) found that skepticism remained a common frame through which the media reported climate change, with Australian media displaying the highest presence of skepticism within a sample of six countries (Australia, France, India, Norway, UK and USA). Despite its presence within the media, skepticism was not widely evident in my interview sample, with only low-level skepticism around the materiality (rather than the existence) of climate change evident in both the UK and Australia, and the greatest skepticism noted in American survey participants.

Regardless, 81 survey participants (75%) said that mainstream news helped inform their investment decisions (Figure 11), suggesting that the way that climate change information is portrayed in the media can have a direct effect on investors' decisions. A senior RI manager for an AM firm noted the importance of ensuring that rigorous climate change insights, concepts and report summaries were included in mainstream media, saying "People like Carbon Tracker are trying to make the academic stuff more digestible… It puts it into the more colloquial language and is more impactful… I think using mainstream media and social media is much more effective. I think there is progress being made by the academics and I would support them doing more" (UK25). Another method of learning about climate change mentioned by two survey respondents was that of popular science books, demonstrating that the permeation of

science into accessible forms is important. Books such as 'This Changes Everything' (Klein, 2014) can help bring the arguments of climate scientists to everyday publics, including investment professionals, and highlight the need for action in accessible format and language.

An unexpected finding from my interviews was the use of social media platforms by investors, and particularly RI analysts and managers, to keep up-to-date with the release of key reports and announcements, and share their own updates. One Australian SF RI manager uses Twitter to inform beneficiaries and peers of their ESG activities. By "filtering" ESG information, social media can arguably provide a useful "news round up from different sources" (UK24). An AM RI manager in the UK also discussed the use of LinkedIn by different climate groups: "I have joined all these groups that then help me keep up with these things that have come out" (UK24). Social media can thus be used to highlight key reports without causing information overload: "We will tweet out support for other papers but we don't want to inundate so we don't just send around other reports" (UK27). Although only a few interviewees discussed the role of social media, it was noted in both the UK and Australia, and could be an area of expansion and future growth for those trying to communicate climate change to investors, especially for climate groups, scientists and investors trying to publicize their own work to mainstream investment clients without adding to overloaded inboxes. As yet, its role in informing climate change debate, particularly in the investment system, has received little attention in the academic literatures.

4.1.4 Other External Sources

Investors also rely on multiple other external sources of information, including consultants, investment journals, academics, industry and national bodies and regulators. Investment journals were used to gather climate change information by 48.6% of survey respondents (Figure 10), and in informing investment decisions by 80.7% (Figure 11). Furthermore, 75 survey respondents (69.4%) use academic reports to help inform their investment decisions at least sometimes (Figure 11). In addition, 19 interview participants noted the importance of supranational and industry body reports in highlighting important climate-related issues (Figure 9), citing the IEA, the OECD and the World Bank as useful sources. These appeared to be more commonly

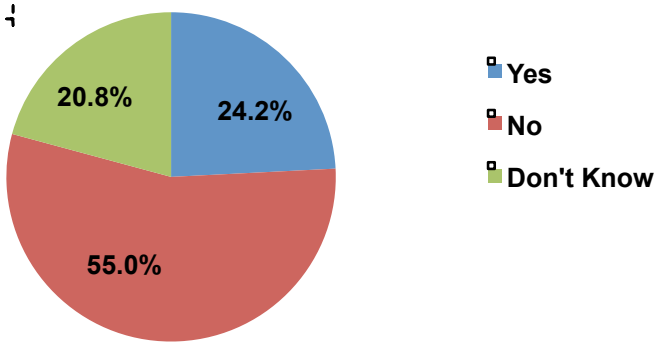
used in Australia (12 mentions) compared to the UK (7 mentions), perhaps due to their focus on broader global and regional scale issues, which are considered more frequently by Australian interviewees (see Section 4.3). While providing insight into both past and future trends, some participants commented that the conclusions of these reports are difficult to convert into actionable information: speaking about an IEA report one AM said "I thought it was a good piece of work, but … one has to get to their conclusions, draw on some other things to get numbers that matter, and even then its quite hard to translate that into something that will make a difference to an investors actual decision" (Aus17).

Investment consultants are seen as vital to integrating sustainability into SAA and AM hiring practices (Knight and Dixon, 2009). They are particularly important for those firms with external managers and smaller internal teams that may lack the internal investment and research capacity, including several SFs in Australia. However, interview participants appeared skeptical about their contribution regarding climate change to date. A sustainability NGO director commented: "I have heard of one investment consultant who explicitly didn't cover ESG unless you paid for it, even if it was material, they wouldn't consider it in their recommendations or in their advice to an AO unless they paid extra" (UK05). Although 12 interview participants mentioned the role of consultants in sourcing climate information (Figure 9), Australian SFs dominated this response and Mercer was the only mainstream consultant praised by name for their climate work. Only 53 survey participants (49.1%) said that they use consultants in their investment decisions and only 4 said that they 'always' use consultants – the least of any option given (Figure 11), suggesting that mainstream consultants could be doing more on climate issues, but perhaps at a strategic rather than individual investment level. Interestingly, no participants mentioned management consultants such as McKinsey, who have large environmental research capabilities and products. Further research could explore the failure of such management and investment consultants to impact investors' climate awareness through their communication strategies, expanding on existing literatures regarding RI in investment consultant service provision (c.f. EUROSIF, 2009; Caldecott and Rook, 2015).

4.1.5 Internal Research Capacity

Another source of information is internal research teams, with 33 survey respondents (29.7%) saying that they use internal research to learn about climate change (Figure 10), and 79% saying that they use internal research teams to help inform their investment decisions (Figure 11). While most investment institutions will have research teams, there is a growing trend towards establishing in-house RI or ESG research capacity that can provide an overlay of different ESG issues relating to stocks and sectors (Bourghelle et al. 2009). While this trend was slowed by the global financial crisis causing a cutback in 'extra-financial' research (Herzig and Moon, 2012), ESG teams can still be found in PFs and SFs, with 30 (51.7%) of the organizations interviewed have internal climate-related research analysts. Where they do exist, internal RI teams appear to be larger in the UK than in Australia: the average size in Europe is 5.4 (Extel, 2014), compared to Australia where the biggest SF team is 3 people (Aus06), suggesting that there is greater resource capacity in the UK than Australia linked to greater AUM (OECD, 2014). However, only 24.2% of survey respondents knew of an internal team looking at climate risks, and 55% knew that they did not, perhaps due to the different nature of the institutions and individuals targeted in each method (Figure 12).

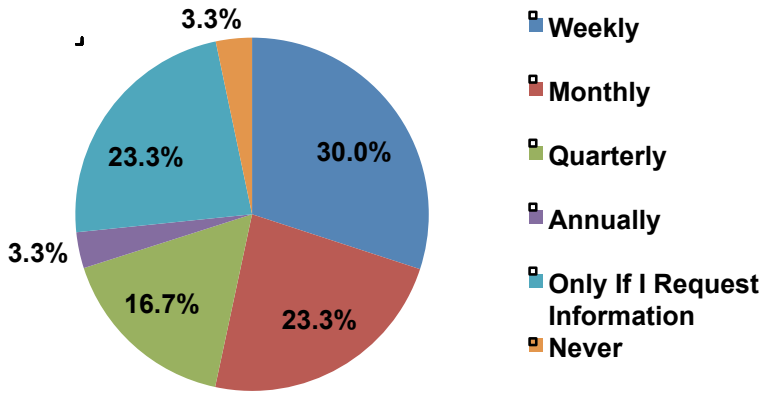
Figure 12. Does your firm or organization have an internal team looking at climate risk or environmental considerations? (Source: Thesis Survey)



Bos (2014), however, cautions that 'to accomplish true ESG integration, one should make ESG an integral part of the investment analysis performed by the mainstream analysts and an integral part of the overall investment process'. While there will always be a need for 'experts' in a particular area within an organization, it could be argued that the success of an ESG team could be seen in its own demise if it were able

to facilitate successful integration of ESG considerations by mainstream analysts (Arjalies, 2010). However, interviewees argued that until this integration is further developed, the presence of ESG teams in-house can enable bespoke and practical guidance, in the form of written research, participation in internal and client meetings and through engendering personal relationships with colleagues which could spark further interest and understanding around climate change issues and impact. This was also seen in the results of the survey, which showed that of those who were aware of internal ESG teams (30 individuals), only 1 person said that they had never interacted with them, with the largest proportion (30%) saying that they interacted on a weekly basis (Figure 13).

Figure 13. If your firm does have an internal team, how often would you interact with them or read a research note that they publish? (Source: Thesis Survey)



4.1.6 Climate/RI Groups

19 interviewees noted Climate/RI groups as important sources of information. 13 of these were Australian interviewees, compared to just 6 in the UK (Figure 9). This difference could perhaps be due to the apparent cohesion within Australia's RI networks centering around the IGCC, which was seen by interviewees as having a positive impact on both the climate policy and investment spheres. While there are several groups vying for attention and readership in the UK, and several interviewees are members of multiple groups, the PRI was mentioned as being important in both the UK and Australia. Interviewees in both the UK and Australia noted that they use these groups both for the provision of information in the form of formal reports and

updates, and for networking and peer-learning, which will be discussed further in Section 4.4.

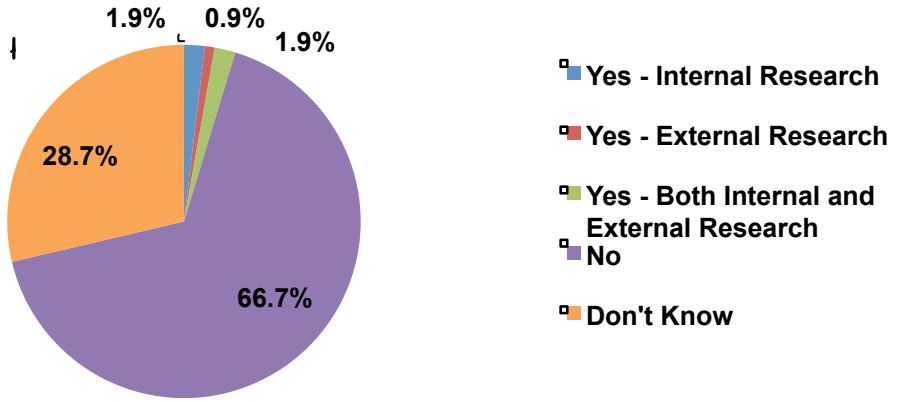
There was a divergence in the survey and interview participants in regards to climate group membership – with half of interviewed institutions (29 out of 58) signatories of the PRI, 22 members of CDP (38%) and 18 members of the GIC (31%), compared to just 10.9% of survey participants members of the PRI, and only 4.5% members of CDP. There are several potential explanations for this result: 1) the sampling techniques used meaning that those interviewed were more likely to have RI specialists and therefore more likely to engage with the climate groups, or at least know whether or not their organizations were members, compared to survey participants who were mostly mainstream actors, perhaps explaining the greater concentration of 'don't know' (33.6%) and 'no' (53.6%) answers to the survey question; 2) the density of investors in the UK and USA mean that a smaller percentage are part of these groups; 3) that the smaller concentration and size of internal teams in Australia make external networking and collaboration more attractive - only two interviewed investment organizations in Australia were not part of any group, compared to four in the UK. However, membership wasn't applicable (i.e. they were not investment organizations) for more UK interviewees (11 in UK vs. 6 in Australia).

4.1.7 Research Budgets

An important point to consider when discussing information use is the availability of financial capital for purchasing and writing research. One potential barrier to providing climate change information could be that few investors appear willing to pay for this 'non-financial' information, under the assumption that it is an optional extra and not directly material to market prices and returns. Figure 14 shows that only five of 108 survey respondents knew of climate research budgets within their organizations (4.7%). Interviewees appeared to circumvent this issue by using existing sources of information such as consultants, data platforms or brokers, and particularly being able to reward them through non-monetary means: one AM Executive said "There are also a couple of stock brokers that do very good ESG research so we utilize them and reward them for their efforts by giving them extra bits

of brokerage" (Aus14). Additionally, publicly available information from climate and industry organizations are welcome, but this could leave them open to the biases and perspectives of individual organizations and is not equivalent to having a dedicated budget to fund objective research. One interviewee commented that the lack of funding for research was representative of the endemic lack of resources in the climate investment space, and that impartial climate research was coming up against privately-funded advertising and biased research by lobby groups with an anti-climate stance: "there's nowhere near enough resources (in climate RI groups). There was a single advertising campaign by the Minerals Council ran against the carbon tax or some other tax that would have been imposed on the extractives industry, but the single ad campaign was $24 million" (Aus19).

Figure 14. Does your firm or organization have a separate research budget for climate change research? (Source: Thesis Survey)



The publicly available IPCC report should therefore be important for investors interested in learning more about global and regional climate risk. However, while 12 interviewees mentioned reading the IPCC reports, many agreed with the sentiment that they provide general knowledge rather than investment-relevant information: IPCC reports are "not necessarily helpful… it provides some evidence but it doesn't necessarily translate that into something that is helpful in terms of making investment decisions" (Aus17).

Section 4.1 has identified a wide range of information sources available, but greater accessibility throughout mainstream and public platforms is needed. Climate groups

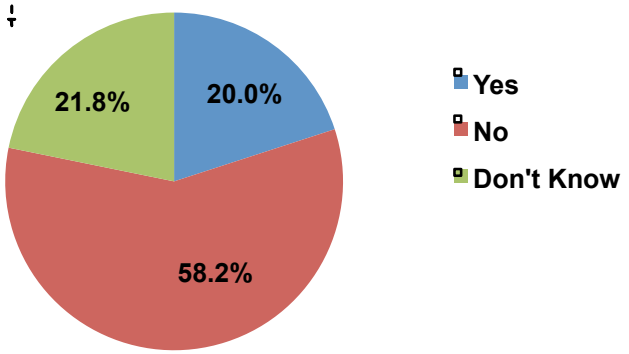
are important in disseminating information and networking, especially for those lacking internal capacity, but their scope and outreach still remains limited by the lack of funding. Objective research costs time and money, and independent investment research providers are unlikely to engage on climate issues until investors are willing to pay for such information, so greater emphasis on the materiality of such information is needed.

4.2 Information Availability: Too Much or Too Little?

A growing literature explores the idea of 'information overload' and the fallacy of information deficit models, whereby increasing the amount of information available will not necessarily lead to a more efficient system, and could even act as a hindrance (Gleick, 2011; Agnew and Szykman, 2010). Marteau et al. (2002) argue that 'while information may be necessary for behaviour change, it is rarely sufficient'. There is a real concern about the impact of 'information overload' on individuals' and organizations' cognitive and operational performance as time has to be spent filtering out useless information, and focusing on a single task is more difficult due to the distraction of updates and inboxes (Dean and Webb, 2011; Hudson, 2012). While there is clearly information overload in our day-to-day lives, this section seeks to explore the dynamics of climate-related information in the markets.

Figure 15 suggests that actors in the financial market still feel that there is insufficient information available about the risks and opportunities from climate change, with only 20% of 110 survey respondents saying that there is adequate information to properly analyze corporate exposure to climate change. This is likely to be a major barrier to the integration of climate change into decision-making, and corresponds with the existing literature on this topic which suggests that investors are challenged by the incomplete, heterogeneous corporate ESG information available when they are used to homogenous financial information (Curran and Moran, 2007). Investors are likely to be put off by high research costs (financial and time costs) in trying to locate and evaluate incomparable ESG data, especially if they do not fully appreciate the materiality of such information (Aerts et al. 2007).

Figure 15. Do you feel that there is sufficient information available about corporate exposure to climate risks and opportunities? (Source: Thesis Survey)

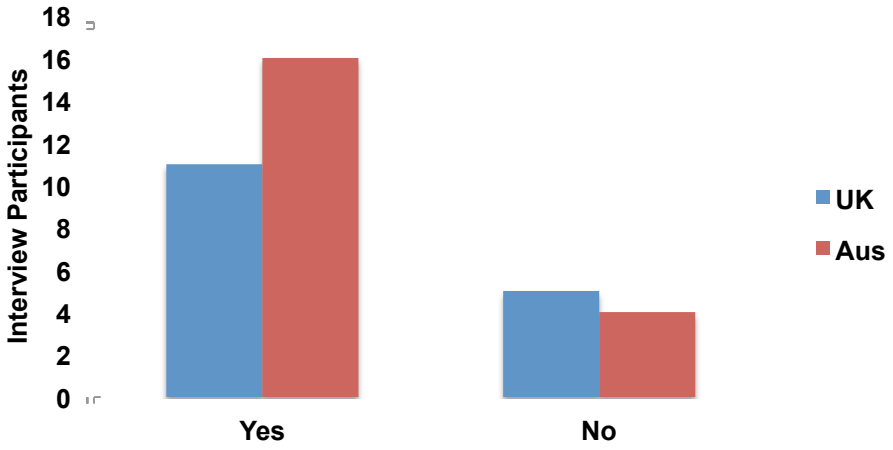


Standardized corporate disclosures, and more rigorous coverage within mainstream news and investment journalism could further improve information provision. Although sustainability reporting has increased markedly in past decades, only 34.7% of buy-side respondents to an Extel survey thought that corporate CSR disclosures were valuable, although this is up from 31.1% in 2014 (Extel, 2015). While only 27.9% of survey respondents said that they use corporate annual or sustainability reports to learn about climate risks and opportunities (Figure 10), 76% said they use corporate reports to guide their investment decisions (Figure 11). Integrating climate exposure into annual reports and highlighting the materiality of climate change to corporate financial performance could be key to greater climate awareness in investment decisions. While Integrated Reporting has been growing in popularity with companies and investors alike (Eccles and Krzus, 2010), this is not yet a legally binding concept. The Initiative for Responsible Investment (2014) provides a useful outline of country-by-country regulations guiding sustainability disclosures. Governments and stock exchanges have increased pressure on companies to disclose, but no formal standards have been implemented despite mandatory reporting. Consequently, benchmarks of performance remain scarce (Cerin, 2002). Although there has been a proliferation of indices and ratings created to help investors attempt such comparisons, these remain problematic and under-utilized (Sadowski et al. 2010; Tripoli 2011).

In contrast to the survey figures outlined in Figure 15 where 58.2% of respondents said that there was insufficient information, Figure 16 shows that 25 interviewees said

that there was sufficient information available on climate change, compared to only nine that said there was not enough information: comments included “This is not an information problem” (UK19) and “I don't think getting hold of information is a problem” (UK04). Furthermore, five Australian and six UK participants said that there was “too much information”, with seven interviewees mentioning that they suffered from “information overload” (3 in Australia, 4 in the UK).

Figure 16. Is there sufficient information available on climate change? (Source: Thesis Interviews)



One RI analyst within an AM firm said that “With every company we are interested in there is quite a lot of information available, especially now that reporting of sustainability is becoming more mainstream and is mandatory now in several countries” (UK10). However, this was not a universal view, with an RI manager from a SF saying that “I think part of the challenge that we face as an industry is that we have all of these elaborate systems that have been set up like Bloomberg and Factset and all of these great tools that investors have … but we don't have a good quality of that (climate information) coming through those channels and we don't have other platforms that we can use to share climate information” (Aus15). This suggests that even though many of these platforms do contain ESG information, it is still not being integrated and used to its maximum potential. Especially among those engaging with investors on climate issues, there was an expressed frustration that “there is a lot of good research done but it is not taken up” (UK17). This is perhaps where the RI teams, consultants and brokers have the potential to become an important conduit for research and the education of investors around the availability and use of existing climate information such as within mainstream data platforms.

One key determinant of uptake was the credibility of information, with one AM saying "I suppose, as with any topic, it is about trying to get the right balanced view. It's sometimes a fight to work out the sources and credibility of the information" (UK13). Variation in quantity and quality of information between asset classes and sectors was also acknowledged as being particularly significant, with disclosure seen as best amongst the worst polluting sectors such as fossil fuel and extractives industries due to the huge pressure being put on those companies to disclose their carbon and stranded asset risk. Royal Dutch Shell, for example, led the investor relations rankings around ESG and sustainability strategies in the Extel survey (2015). This could be a response to the active engagement with these high-emitting companies, although causal links are difficult to establish: "maybe the information that has come out may have been better than it might otherwise have been, but its really difficult as you don't have a counterfactual to show what it would have been if you hadn't engaged, but I think if nothing else it reminds the companies that people are aware of the issues and want them to be dealt with, and it encourages them to either disclose more or disclose something differently or change practices, and any of those things are positive" (AU14). Several interviewees also said that "Data availability on equity is easier" (UK21) than in other asset classes such as fixed income.

Filtering of key information was seen as important. One Pension Industry Body Executive said there was "probably an over-supply of information, but what might need to happen is more filtering" (Aus08). However, within Australia there was some disagreement among interviewees, with others suggesting that such filtering already does occur informally through the sharing of information through social media and between peers, and more formally in the provision of newsletters and updates from various organizations: "I think at the moment we have the filter- you have the UNPRI and the IGCC and the brokers producing reports which are based on the academic information … but it's still not getting through" (Aus11). Questions thus remain as to whether this is an information or a dissemination issue.

Interviewees suggested that information is available, but not in the necessary formats or platforms for mainstream investors. There was a concern that much of the climate information was "preaching to the converted" (UK08), whereby those 'in the know'

have plenty of information whilst those outside the RI circles are lacking information. This can most clearly be seen in the comparison between the survey and interview data, whereby the membership of climate change groups (which are doing a large share of the formal filtering and sharing of information) was higher in the interviews than the survey and correlated to the concept of whether or not there was sufficient information (Figure 17). 60 participants who were not part of climate groups said that there was not enough information, compared to just 22 who were. Of those within climate groups more were happy with the amount of information than unhappy, although this correlation was smaller, suggesting that improvements can still be made.

Figure 17. Climate Group Membership and Information Sufficiency (Source: Thesis Interviews)

		Is there enough information?	
		Yes	**No**
Are you a member of a climate group?	**Yes**	**24** 22 interview 2 survey	**22** 12 interview 10 survey
	No	**12** 2 interview 10 survey	**60** 4 interview 56 survey

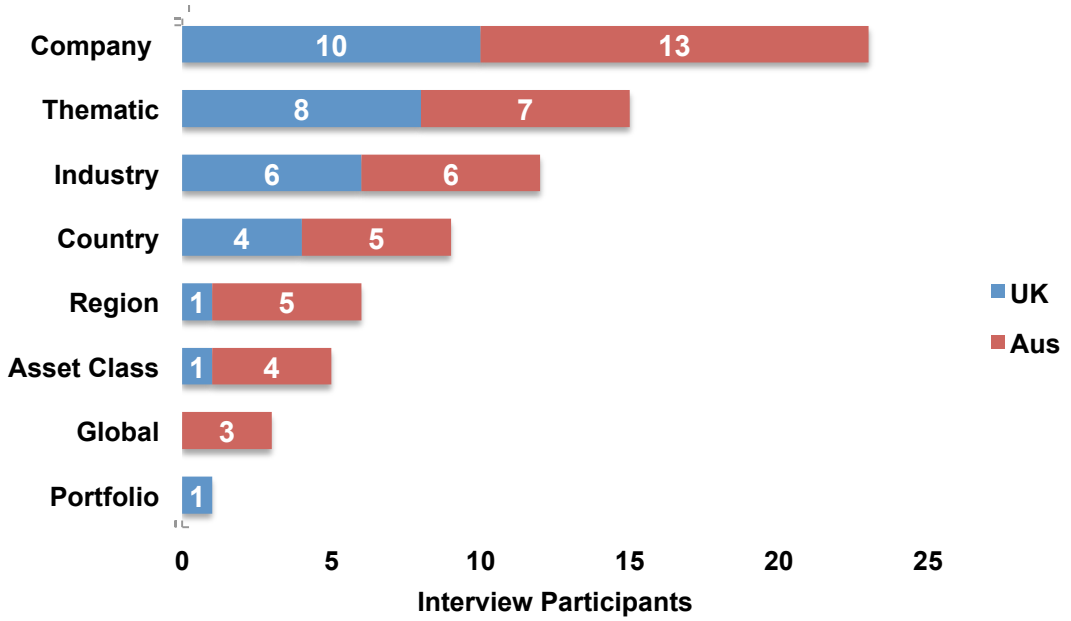
This would suggest that climate change groups are providing a useful service and should aim to reach a wider audience than just their own membership in the provision of updates (perhaps through social media and existing investor networks), but also that information providers could better highlight the materiality of their own research directly through the provision of Executive summaries and updates in mainstream investment news channels such as Bloomberg, MSCI, the Financial Times and the Australian Financial Review.

4.3 What Scale of Information are Investors Looking For?

Determining the type of information that investors need is also important, with this section exploring the scale of information that investors require. Uptake of information depends upon its utility, regardless of its accuracy or availability. Figure

18 demonstrates demand for different scales of information, with company-specific information most frequently mentioned by both UK and Australian interviewees.

Figure 18. Scale of Climate Change Information
(Source: Thesis Interviews)



The type of information required depends on the asset class, job description and type of investor. One RI analyst from a brokerage firm said "Different people in the investment community have different roles and different types of portfolios, and what is relevant varies for each investment asset class or investment geography" (Aus20). In particular, national and international scales are perhaps more important for investors exposed to sovereign risks such as in bonds and macro longer-term risks within fixed income markets compared to equity investors more at risk from short-term corporate valuation changes. Those focusing on high-level asset allocation for AOs are less likely to require company-specific information than analysts and investors exposed to those companies. This was evident in the survey results: the average rank for company-specific information was 3.037 by Executives and Trustees compared to 2.573 from Non-Executives (whereby lower mean is a higher ranking) (Figure 19). However, Executives are more likely to be looking at global information, with an average score of 2.24 compared to 3.06 for all Non-Executive participants (Figure 20). Different investment firms are also structured differently and have different investment foci, with some having a bias towards infrastructure and

property, for example, and therefore "There are different needs for different schemes" (UK26). Information providers must work hard to communicate the right information to the right audience, whilst ensuring that everyone has at least a basic understanding of key facts. A leading Australian NGO Executive thus commented that "we have assessed our member interest on topic areas, and international agreements always ranks number one, and Australian emissions trading scheme always ranks number two" (Aus25), perhaps showing that a broader knowledge is needed before a more focused one. The capacity and existence of internal research teams and dedicated analysts will also determine the scope and depth of the research undertaken.

Figure 19. Rank of Importance of Stock-Level Information: Executives vs. Non-Executives (Source: Thesis Survey)

STOCK-LEVEL INFO	Rank					Total	Mean
	1	2	3	4	5		
Exec	8	2	5	5	7	27	3.037
Non-Exec	29	20	7	9	17	82	2.573

Figure 20. Rank of Importance of Global-Level Information: Executives vs. Non-Executives (Source: Thesis Survey)

GLOBAL-LEVEL INFO	Rank					Total	Mean
	1	2	3	4	5		
Exec	12	2	5	2	7	33	2.24
Non-Exec	18	11	24	8	22	83	3.06

4.3.1 Company, Sector and Thematic Scales

Company-scale information was mentioned most by interviewees (Figure 18) and ranked most important by 37 of 118 (31.4%) survey participants (Figure 21). However, Figure 21 also shows that company information was ranked as least important (5^{th}) by 24 individuals (20.3%) and as not applicable by 9 participants. This variation, with company-specific information seen to have the largest variance and standard deviation of all scales (Figure 22), meant that sector-specific information

was on average ranked more important by survey respondents (Figure 23), despite only 12 interview participants saying they used this information (Figure 18) and only 22.9% of survey participants ranking it 1st (Figure 21). However, it was the only scale with a median ranking of 2, showing that sector-specific information had fewer low ranking scores than other scales (Figure 22). In relation to company- and sector-scales, an interesting point was made in the differences between the UK and Australian markets: in Australia "We haven't got a big market, we will only have three companies in every sector … so we only have two or three to choose from, so sector and company research is basically the same thing" (Aus07). This meant that those investment organizations that had Australian-only investment mandates were able to research every company in the sector, whereas in the larger UK market investors tended to use best-in-class approaches and benchmarking. While not included in the original survey questions, an answer emerging during the interview process was the importance of the thematic scale, whereby investors in both the UK and Australia were keen to learn about themes which might affect investments at a range of scales, such as stranded assets, technological advances and water scarcity. Thematic information was the second most-frequently mentioned scale of information mentioned by both Australian and UK interviewees (Figure 18).

Figure 21. At what scale do you most consider climate change as it relates to your investments? Please rank in order of importance. (Source: Thesis Survey)

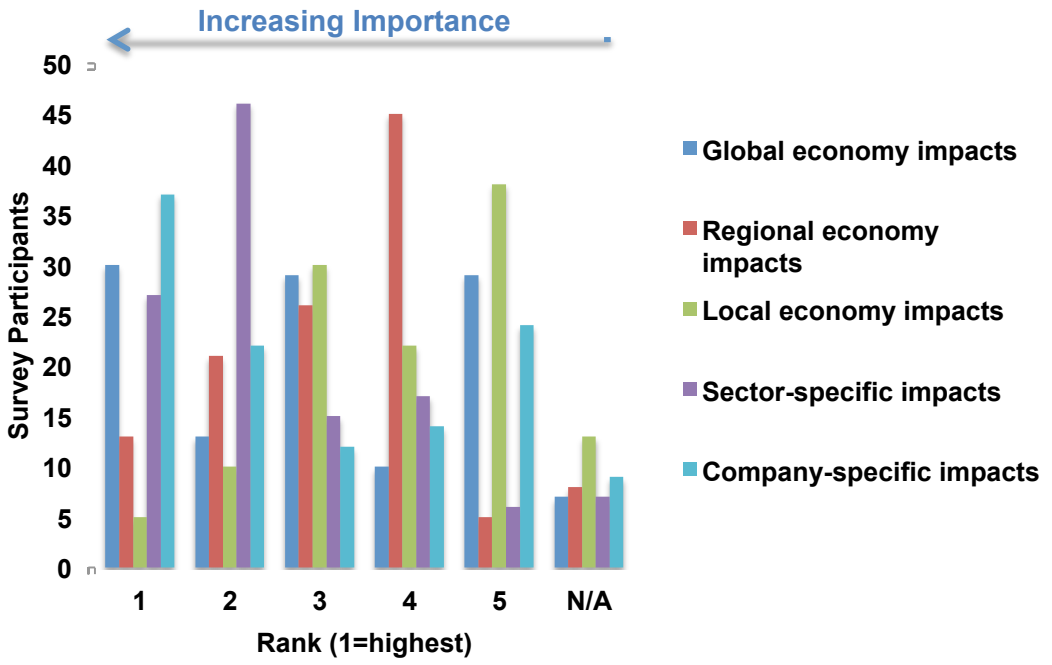
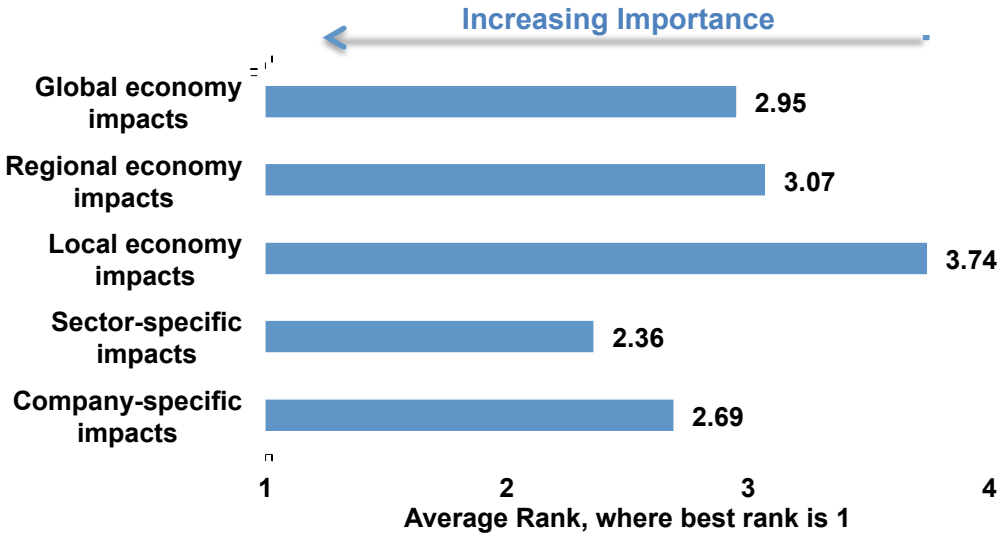


Figure 22. Statistical Analysis of Scalar Results (Source: Thesis Survey)											
Answer Options	**Rank**					**Response Count**	**Median**	**Mode**	**Mean**	**Variance**	**Standard deviation**
	1	**2**	**3**	**4**	**5**						
Global economy impacts	30	13	29	10	29	111	3	1	2.95	2.0025	1.4151
Regional economy impacts	13	21	26	45	5	110	3	4	3.07	2.0049	1.4159
Local economy impacts	5	10	30	22	38	105	4	5	3.74	2.5476	1.5961
Sector-specific impacts	27	46	15	17	6	111	2	2	2.36	2.4096	1.5523
Company-specific impacts	37	22	12	14	24	109	2.5	1	2.69	3.4481	1.8569

Figure 23. At what scale do you most consider climate change as it relates to your investments? (Source: Thesis Survey)



4.3.2 Regional and Global Scales

Asset and sector levels appear more important than local, regional and global scales for both interviewees and survey participants (Figure 18 and Figure 23). However, global impacts were still seen as important by survey participants, with a modal rank of 1 as a quarter of survey participants ranked it most important. One interview participant described climate change as the "6th Industrial Cycle" (UK02) arguing for its global impact on economic and political stability. Several interviewees suggested

that research into climate change began at the global scale before delving into greater company and sector detail. While survey participants ranked global scales above local and regional scales on average, interviewees mentioned country and regional impacts more than global issues (Figure 18 and Figure 23). In particular, country and regional scales are used to understand regulatory impacts that climate change will have on investments, with one SF CIO saying "We have looked at country-specific information where we are looking at things like carbon markets and policy risk" (Aus02). Regional climate impacts were also seen to be in the media more often, with concerns growing around the frequency of drought affecting water scarcity, with interviewees mentioning the on-going 2015 droughts in Brazil and California, as well as the Millennium Drought that affected Australian investments between 1997 and 2009, as presenting both investment risks and opportunities (c.f. Hawes, 2015; Heberger, 2011). Australian participants mentioned global and regional scales more frequently than UK interviewees; perhaps due to the physical isolation of the Australian economy and the importance of regional and global influences (particularly China and the US) on the relatively small Australian asset markets.

Both UK and Australian interviewees however, recognized that investors should know about the importance and materiality of climate change at all of these scales, with the majority of those interviewed looking at climate issues across several different scales: "If I think about infrastructure managers, they are looking at the region and then the sector and then the stock. So it is all the way down" (Aus03). Just as climate change adaptation is required at multiple scales (Adger et al. 2005; Bulkely, 2010), financial actors need to start adjusting their learning processes and decisions to incorporate climate knowledge across multiple scales, as regional and global impacts will affect company valuations, for example.

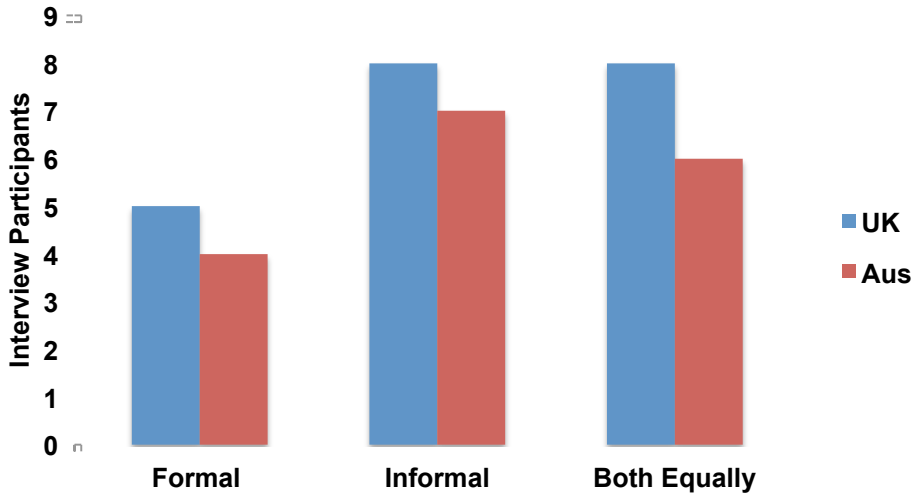
4.4 Formal vs. Informal Learning

Colley et al. (2002) suggest that the boundaries between informal and formal learning are vague and ill-defined, in that 'there are few, if any, learning situations where either informal or formal elements are completely absent'. For the purposes of this research, formal learning will refer to asocial reading of reports, data sources and material, as well as formal social learning through attending organized conferences,

whereas informal learning refers to peer-to-peer and ad hoc discussions. This section explores the prevalence of both formal and informal practices in the UK and Australia, and discusses the opportunities for 'formalizing informal learning' (Colley et al. 2002), potentially optimizing the different learning process.

Figure 24 shows that 14 interviewees use both formal and informal processes equally in learning about climate change: "I think they are both equally important in different ways. I think the informal are really helpful in reinforcing conclusions I am making through the other research that I do, and also to test ideas and those kind of things that you can't do from I report" (Aus15). Those communicating climate change also noted the need for both formal and informal information and learning, saying that investors appreciated informal sessions to discuss and share thoughts on recent reports, and networking opportunities to explore how the conclusions might be implemented in practice.

Figure 24. Dominance of Formal vs. Informal Learning Strategies (Source: Thesis Interviews)



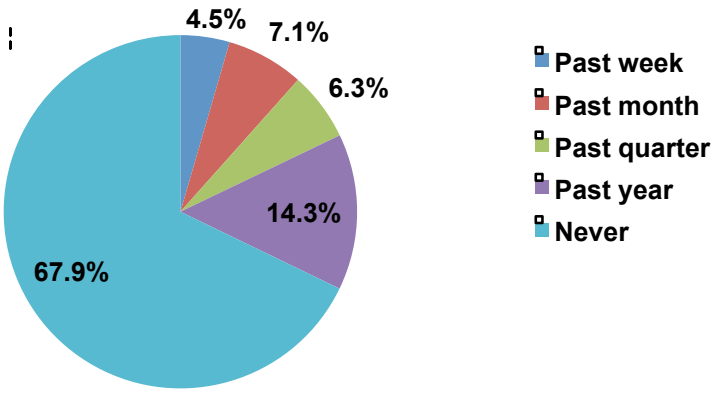
4.4.1 Social and Asocial Formal Learning

Formal learning processes are still very valuable to investors, with their need for accurate and timely data meaning that frequent reports, updates and data are required for decision-making. Section 4.1 outlined the dominance of data providers and external research as key information sources, valued above informal discussions with

colleagues in the survey sample, with 69.7% of survey respondents having read a climate report in the past month (Figure 8). Research interviews corroborated these results, with an AM Executive saying that he learnt about climate change best "Probably through the reports, the informal stuff is important but most of the really solid stuff is from the reports" (Aus14). Several participants also mentioned the importance of data, charts and info-graphics as a way to better identify, visualize and analyze the key themes of a paper when carrying out formal learning. Reports and formal learning were noted as particularly important for investors who are not already plugged into climate networks, and therefore not likely to attend conferences or networking events. An article in the FT or on Bloomberg is much more likely to have an impact, with investors needing "evidential data" to change beliefs (UK02).

Concerns that "the vast majority of investors" would not be aware of or attend the climate-related conferences (UK01) were substantiated by the 67.9% of survey respondents who said they had 'never' been to a conference or presentation that focused on climate risks or opportunities (Figure 25). However, those survey participants who had attended a conference in the past month were from different countries and represented a range of job titles, including three ESG specialists, five Executives, three AMs and two financial advisors - suggesting that attendance is not limited to ESG specialists. Interviewees saw conferences as an important learning process, providing a "good sense of what different companies are doing and what problems they are facing" (UK23). Conferences and meetings can thus be seen as important formal learning opportunities. Globally, conferences are organized by a range of organizations, cover an array of topics including climate-specific and more general RI conferences, and cater for a variety of audiences. However, issues around this as a technique of learning were raised by interviewees: both Australian and regional-based UK participants lamented the geographic concentration of conferences such as the annual Responsible Investor conferences held in London and New York, saying that attendance was impractical and expensive, limiting the type and frequency of in-person events they could attend (Aus28 and UK25). While it was recognized that there had been an increase in web-based conferences and meetings, geographic distance was still seen as a disadvantage in both the formal and informal learning processes occurring in this space.

Figure 25. When was the last time you attended a conference or presentation which focused on climate risks or opportunities? (Source: Thesis Survey)



4.4.2 Informal Networking and Peer-Learning

Interestingly, interviewees suggested that the informal social learning opportunities at these conferences often outweighed the asocial formal learning. An AM RI analyst said "chats in-between the presentations are often more helpful / interesting", finding that while the presentation themselves rarely provided new investment ideas the informal networking opportunities were useful for "bouncing ideas off each other" (UK22). Beyond such formal networking opportunities, the RI industry exhibited strong informal networks. "There is quite a nice informal element around people in the ESG industry in the City. We go for coffee or lunch; there are no industry secrets behind what people are doing … we felt like we were fighting the same battle so we almost ended up sharing approaches: what worked and what didn't work so that has built a nice platform" (UK17). This was evident in both the UK and Australia, with a researcher provider saying "Australia is a small place. There are only two cities where anything happens (around RI) and we all know each other" (Aus28). The strong networks were evidenced by the willingness of participants to recommend others for the snowball sampling and the over-lapping nature of those referrals. One RI manager thus commented "there are a lot of formal mechanisms out there but most of the progress we have made on climate change has been through informal mechanisms. In terms of different stakeholders collaborating together and setting up more formal mechanisms to feed that through" (UK24). While informal social learning within these networks is perhaps dominant, they also facilitate the formal knowledge-sharing through the distribution of reports and research. There was also a degree of informal

sharing through different investment chain intermediaries, with one AM Executive saying "the stock brokers are quite a good conduit for sharing stuff out there" (Aus14). This suggests that more opportunities for informal networking within the investment industry should be encouraged.

Perhaps the most useful social learning techniques described by different interviewees was the concept of 'peer-learning'. Learning from those of similar experiences, backgrounds and profession is a key knowledge-sharing process (Hara, 2009), with early-adopters of RI helping to "socialize that message and let it be heard amongst the broader investment and business communities" (Aus16). Groups of peers thus appear to help normalize discourses and beliefs around the materiality of climate change. "The vast benefit of it is how quickly you can get things done because the existing trust is already there" (Aus28). This builds on a growing academic literature around 'communities of practice' and peer-learning (c.f. Lave and Wenger, 1991; Smith and McKeen, 2003). An RI manager thus described one such informal network:

"I talk to my peers about how they are looking at certain issues; you don't necessarily tell them everything but over time you develop a group that you trust and an informal, smaller group with whom you might talk a bit more candidly. I think it is hugely important in our field and that information is very useful for us to take internally to use as leverage. It helps you push things through." (UK24).

Although apparent in both the UK and Australia, greater emphasis on the learning opportunities of such informal groups was noted among Australian interviewees, perhaps due to the geographical remoteness, the smaller nature of the industry and the greater reliance on external interaction and cooperation.

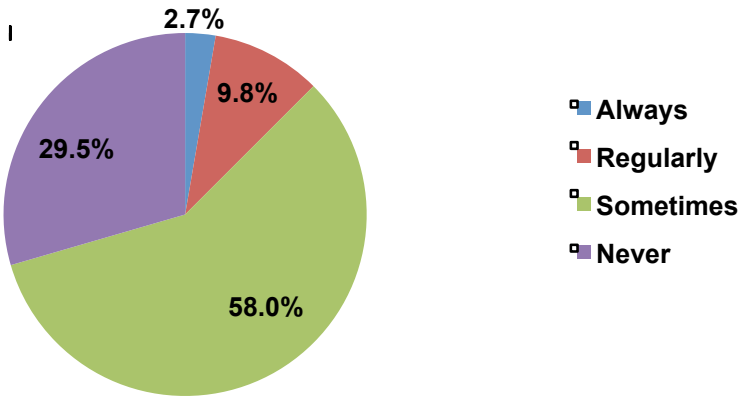
4.4.3 Learning Within Investment Institutions

Knowledge sharing within investment institutions is also prevalent. Interviewees discussed internal research platforms that are used to store, organize and share interesting reports and articles. Particularly useful in the era of online content, this facilitates the filing and filtering of information for later use and sharing with others. Furthermore, one RI Analyst mentioned that they can upload meeting notes, podcasts

explaining important reports and engagement information alongside their research on a particular theme or company, "so all the information is collected together" (UK20). Informal knowledge sharing also occurs within investment institutions, with many participants discussing the informal sharing of ideas and research reports within their teams. This was visible particularly within the SFs in Australia and those investment houses with small internal teams, as the size of the team and lack of research capacity necessitated on-going discussions and a reliance on each other to share interesting articles.

However, while the RI professionals interviewed held regular meetings with investors and updated them on the latest thinking, Figure 26 showed that 29.5% of survey respondents 'never' talk about climate risks in meetings with other investors and clients, and 58% only do 'sometimes'. Of the 14 who 'always or regularly' discussed climate matters, the majority (8 individuals) were Executives, and only one was an AM. This suggests that while there is a reasonable amount of formal and informal learning about climate change, the extent that this feeds into investment discussions remains questionable, and that there remains a core group of investors who do not consider climate change at all in investment decisions.

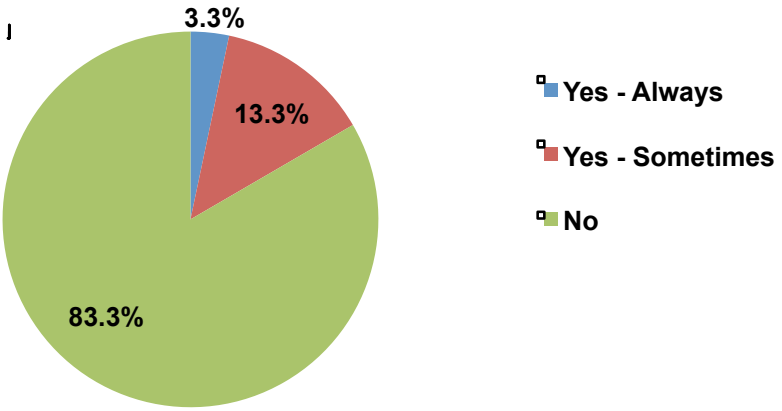
Figure 26. How often do you talk about climate risk in a meeting with other investors or clients? (Source: Thesis Survey)



This lack of formal discussion of climate change within investment institutions was further demonstrated by the fact that of 120 respondents, only four (3.3%) said that climate change is 'always' a standing agenda point in Investment Committee meetings, while the large majority (100 individuals, 83.3%) said that it was not (Figure 27). Interestingly, the four respondents that answered 'yes-always' came from

different types of company (SF, Investment Bank, and two AMs), demonstrating that climate change is considered relevant to all three institutional types. Investment Committee meetings are a particularly important part of many investment institutions governance, with Collie (2014) saying that 'More often than not, it is an Investment Committee that establishes strategy, oversees critical asset allocation decisions and selects the people who take day-to-day responsibility for running the money'. As such, if climate change is to be taken seriously within organization and incorporated into investment decisions and discussions, it needs to be established as a key concern at this strategic level. As one data provider put it: "The problem is a) quantifiable and b) on a bigger scale than they realized. The problem is also an opportunity" (UK02), and Investment Committees should thus examine the implications for their business strategy, as well as risk and return considerations. While "ad hoc" and "reactionary" discussions about climate change are occurring in investment organizations, evidenced by the 70.5% of survey participants who discuss it at least sometimes (Figure 26), the lack of formality and frequency will limit the integration of climate change into daily decisions and reduce the urgency with which investors talk and learn about the issues.

Figure 27. Is climate change a standing agenda point in regular Investment Committee meetings? (Source: Thesis Survey)



4.4.4 Formalizing the Informal Learning

Examples of good practice regarding internal knowledge sharing and integration of climate change issues do exist and were highlighted throughout the interview process. One SF described their RI governance approach, including a senior management

"Global Responsible Investment Committee" chaired by the CEO to discuss the importance of RI at a strategic and firm-wide level, and an "ESG Committee which is more practitioners so is more portfolio managers from across the business; each investment team is represented and that's more of an ideas sharing forum" (Aus15). Different portfolios and investment houses will necessarily face different exposure to climate issues, and therefore several interviewees suggested that a 'comply or explain' structure within investment reports sent to the Investment Committees could be used to ensure that investors considered the appropriate risks and opportunities and highlighted them where deemed relevant. These discussions could start to formalize the dialogues that are already happening on an informal basis, and encourage them to take place where they are absent.

Top-down leadership is arguably necessary for firm-wide integration of climate considerations (Juravle and Lewis, 2009; Mercer, 2011; Garratt, 2011), and consequently peer-learning among senior managers could stimulate widespread change within institutions and throughout the investment market. This kind of informal network is perhaps less common due to concerns around Chinese Walls, confidentiality and conflicts of interest. However, several groups do exist to encourage greater knowledge sharing, and promote high-level collaboration and learning, with a sustainability NGO Executive saying that these groups are beneficial because "everyone struggles to bring case studies to life when it isn't through face-to-face interaction" (UK18). Examples of such high-level 'communities of practice' include the 'Cambridge Leaders Academy' and 'The A4S CFO Leadership Network', which are invitation-only Executive peer-learning groups designed to facilitate knowledge sharing and the development of collaborative projects (Cambridge Network, 2015; A4S, 2015a). The important part of such peer-learning groups is "finding that core group of insiders who can be your advocates. They are respected and seen as credible and are 'one of the club.' Therefore they can say what everyone else may have been saying, but it will be heard" (UK18). This demonstrates the importance of getting business leaders involved in this task of integrating climate change. Furthermore, two UK NGOs interviewed are each organizing a series of dinners for senior members to meet, share ideas and discuss strategies for moving climate and ESG agendas forward – such opportunities could perhaps be adopted in Australia. While a group of Executives does exist, (the Australian Institute for

Superannuation Trustees), this group discusses a range of issues rather than just climate change, and that although "they are happy to share their views, climate is still like religion - it will split a room" (Aus11). This suggests that forming smaller groups of Executives supportive of action on climate change (communities of practice), similar to those in the UK, could be more effective and avoid divisive debates.

Social learning needs to be moderated by formal learning to avoid the pitfalls of social 'copying' (Rendell et al. 2011) and stay abreast of scientific and policy developments (Pidgeon and Fischhoff, 2011). While highly educated investors are perhaps less likely to fall into this trap, 'group-think' and 'herding' are common market traits (Kahneman and Tversky, 2011). One interviewee commented of the informal RI networks that "there is insufficient cross-pollination of ideas. It's no different to the boys club of directors in a way. Its probably more porous and progressive minded, but you do wonder if there is enough different thinking coming through" (Aus28). While networks are good for sharing experiences and knowledge, those on the outside of these groups could be left behind, and the idea of trying to find 'best practice' can "imply that there is actually simple solution … whereas at the end of the day people have to take their own views because the world is uncertain" (Aus20). This is perhaps most likely in a smaller industry such as in Australia, where the opportunities for groupthink bias and fewer diverse inputs is potentially higher. Peer-learning can be a very useful tool for education and implementation of change, but needs to be part of a suite of learning processes which also includes discussion with a wider range of peers, experts and organizations as well as formal learning through reading reports and articles.

The interview process highlighted that the rise of network learning has perhaps been most effective when facilitated and formalized by NGO groups working to advance responsible investment, such as the network developed through the IGCC in Australia. These NGO groups have facilitated both formal and informal networks within the investment industry (Guyatt, 2013). Peer-learning can occur organically, but these formalized networking opportunities mean that discussions can involve experts as well as industry practitioners to ensure that knowledge sharing remains focused on the latest science and business foresights. Formal sharing of latest reports and experience via webinars, conferences and meetings also occur simultaneously

with the informal learning strategies within these groups. Interviewees in both the UK and Australia who were part of groups said that the networking opportunities provided were valuable.

These climate groups are also working together to share reports and organize projects that avoid overlap through an "informal network behind the scene of all the groups collaborating and informing each other on projects". Key to this collaboration is trying to ensure that "our members time is not wasted, and that they understand how initiatives relate to each other" (Aus25). This appears to be particularly important in the UK where a number of different groups are working in similar areas and with similar goals, compared to Australia which is a more concentrated market. A diversity of groups can lead to a multitude of opportunities to catalyze progress throughout the investment system, but further collaboration between and within the organizations could increase the efficiency and efficacy of their operations through strong formal and informal relationships (Guyatt, 2007), as has been shown in the formation of formal partnerships between regional climate and sustainability groups (GIC, 2014; GSIA, 2014).

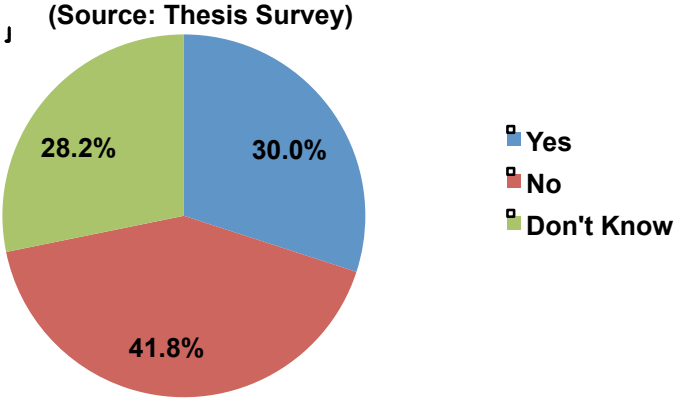
4.5 Translating the Science

"First and foremost, we want to deliver superior performance for our clients. Anything that we have access to that will help us do that, we will look at. The challenge is then to prove that is material. A lot of progress has been done in terms of the ESG quality of the analysis but we still have quite a way to go" - UK24

Translating academic knowledge into a material investment thesis is key to its integration into investment decision-making (UNEP FI, 2009b). Although scientific research can be critiqued for its technical language and the politicization of research funding (Hulme and Maloney, 2010), the overwhelming implication is that climate change is happening, and will affect our ability to continue business-as-usual (IPCC, 2014). However, 41.8% of survey participants said that the language used in climate change communications was not appropriate for the investment community (Figure 28). Survey participants commented that climate change communications were too "nebulous and nuanced", "politicized", "full of jargon or difficult to follow" and

"alarmist arguments". One survey participant said "High excitability does little toward progress and often has the opposite effect/affect. Transparent, matter-of-fact, solution based communication is greatly needed". Even RI professionals recognized the language barrier: "there is a degree of bottleneck in investment firms whereby you have a very enthusiastic ESG team but it doesn't mean that the information is necessarily filtered down to (AMs) and ultimately taken on board. It is about strategy and how to articulate it so that people will care" (UK17). However, the lack of funding and research budgets for such work could be a key reason for the deficit of investor-appropriate language and research. Alongside technical and non-relevant language, interviewees in both countries also commented that the length of most climate reports was too long: "when a big report comes through on climate that is relatively technical that might be 50 or 100 pages, I find it very hard to read that kind of stuff" (Aus13). Another said: "Time is a major factor for me and for investment teams. So generally good, concise exec summaries I think for me are the things I like to look at" (Aus15).

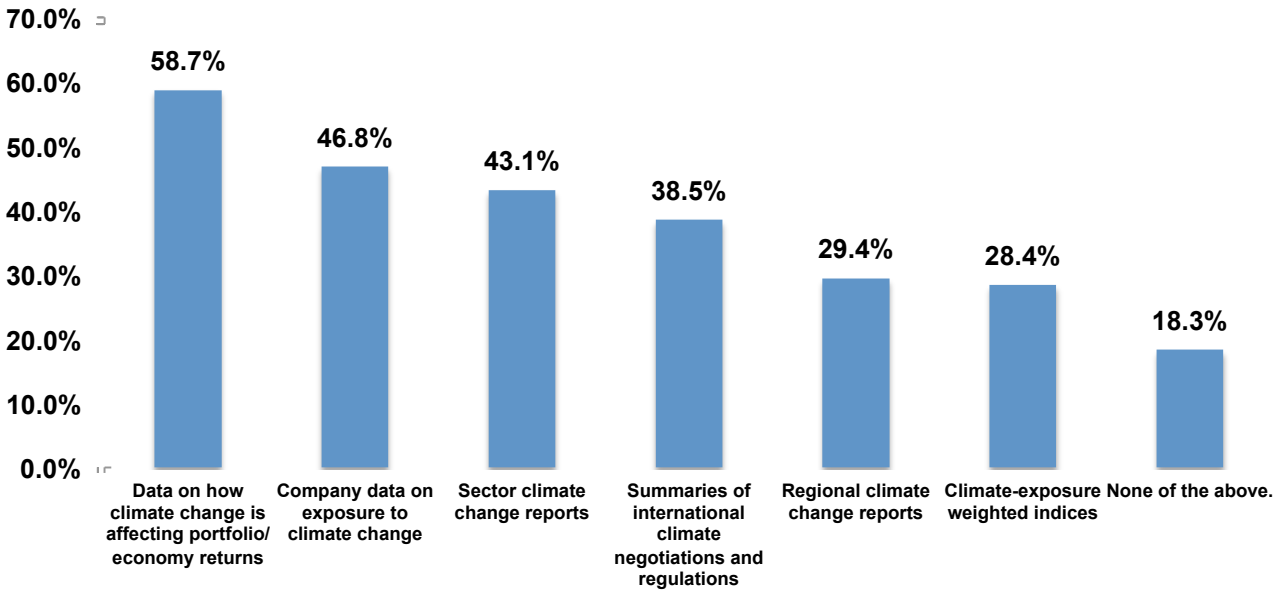
Figure 28. Do you think that language used in climate change communications is appropriate for the investment community? (Source: Thesis Survey)



Although the material financial impact of climate change has been evident for more than a decade now (Stern, 2006), investors have traditionally seen ESG issues as 'non-financial' considerations (Hawley et al. 2011), and "there is still a very strong perception that climate change and other types of impacts are 'nice to haves' that aren't about the future performance of the fund" (UK18). Interviewees in both the UK and Australia suggested that more high-profile "case studies" and mainstream coverage of the materiality of climate change could highlight the benefits of taking climate change

into account: 58.7% of 109 survey respondents wanted better data on how climate change was affecting portfolio/economy returns (Figure 29). One SF RI manager commented, "It is just so difficult to get that direct nexus between the information, climate change and what's happening through to our investing. We are a mainstream investor investing across the full investment universe so it is difficult to see how that plays out from the investment perspective" (Aus04). Communicating climate change in risk and return language used by investors could catalyze change, as this allows for timely decisions based on cost-benefit and risk analysis, rather than delaying action until certainty is improved (Painter, 2013). Interviewees in both countries praised work that shifted discourses from moral campaigns towards material financial risks. "I think that the recent work … by groups like Carbon Tracker around stranded assets, backed up by the IPCC findings around the carbon budget, has helped to present to investors a much simpler thesis a lot of them are finding it easier to get their heads around than climate risk more broadly" (Aus16).

Figure 29. What addition information would be helpful to better account for climate change in investment decisions? (Source: Thesis Survey)



Interestingly Figure 29 corroborates Section 4.3 findings that there is greater interest in company and sector-specific data compared to regional and international information. It also identifies a gap between wanting the information on how climate might affect portfolios to then actually seeking a mechanism for changing investment practices, with only 28.4% saying they would be interested in climate-tilted indices.

Uptake of existing information appears a step removed from the investment process: "Lots of information is available but it is difficult to find good investment ideas among all the information" (UK22).

Time-frame considerations hinder the translation of climate change into investment theses, with this barrier mentioned more frequently by Australian investors (13 mentions vs. 7 in the UK). Short-term investment horizons are often seen as incompatible with the climate science being provided (Kay, 2012; Paulson Jr. 2015). An Australian survey participant commented "Most managers are focused on short term returns as this is the biggest risk to their business… Communications about what might happen decades away does not attract their attention". Greater emphasis on existing and immediate climate impacts, such as the increasing frequency of extreme weather events and pollution impacts, could help negate arguments for delaying action (Nahal and Lucas-Leclin, 2013). Another interviewee said "given the nature of climate change it is very difficult to pin down when certain things are going to occur, so that has made it quite challenging" (Aus15). Greater understanding of policy pipelines and scenario modeling could thus enhance understanding of likely impacts and the time-frames for investment exposure, with 38.5% of survey respondents saying that summaries of policies and regulation would be useful (Figure 29). Time-frames around stranded assets was highlighted as being potentially useful, with one AM saying "if you had some models where you could point to stranding potential then that would be more helpful" (UK09).

While divestment campaigns have undoubtedly raised the profile of climate change in the investment market, interviewees - especially in Australia - argued that they hindered climate integration by focusing on fossil fuels rather than holistic environmental changes and arguing from a moral and political standpoint rather than a financial one. "A lot of the research in this area is kind of propaganda on either side, and that's what makes it hard… what we are exploring, and what we have had success in doing, is that you have to be un-emotive about this and just treat it as a risk management exercise" (Aus06). It should not be a question of who is right or wrong: focus should be on providing long-term sustainable value for fiduciaries, "we do need to deliver high quality returns, and if (climate change) is a key component to the risk-return envelope then we should be building it into what we do" (Aus23). Participants

agreed that a shift away from rhetoric of climate change as a 'campaign' and towards a discourse of risk and reward is needed. UK participants in particular were keen to emphasize the difficulty in divesting due to "benchmark risk" (UK04), but also recognizing "divestment has a role for some investors, but not for most - at the end of the day it is a very small proportion of investors who are divesting from fossil fuels… so yes I think that divestment is something that has increased attention, but not necessarily deliver the results that its proponents are advocating for" (UK05).

It should also be recognized that for many investors who already analyze and attempt to measure and reduce risk, they are likely already accounting for and thinking about some of the issues around climate change: "I kind of suspect that it (climate change) is just part of the normal analysis that they do" (Aus13). Education and dialogue is thus needed to ensure that investors are comfortable discussing these issues, but this is seen as an "uphill struggle to convince that kind of demographic that the issues are relevant from an investment perspective and also to invest the time to do that" (UK18). Climate science needs to be simplified without falling into the trap of over-simplification; investors need to be aware of feed-back loops and the interdependencies within the system, such as the stress-nexus between food-water-energy (Bazilian et al. 2011) to better identify risks and opportunities that do exist. Several survey participants commented that the breakdown of different climate components was needed, with one AM saying "climate change is a bucket which any topic is thrown into. I would like to see someone have the courage to specifically address each concern and not lump the topics together under climate change". Senior managers and a well-integrated ESG team of experts that can explain key concepts face-to-face are perhaps key in helping normalize these ideas into the business psyche of the firm and making this science "more digestible for investors" (UK23), with one interviewee saying "I think more informative, logical argument is needed" (Aus22).

4.6 Communication and Learning Conclusions

This Chapter has highlighted the communication and learning strategies currently employed throughout the investment system around climate change. In particular, it has demonstrated similarities between the UK and Australia in the reliance on

mainstream information, notably data providers and brokers. Australian interviewees, who tended to use a wider range of information, mentioned information provided by consultants and climate groups more frequently suggesting that there is greater knowledge sharing through the investment chain in Australia. However, UK interviewees relied more heavily on internal research teams, perhaps due to the greater scale and capacity of these teams due to the differing nature of the investment industry. While there is a clear market for information on climate change (30% of interviewees and 58.2% of survey participants said there was not enough information), this research also highlighted the need for greater filtering, application and translation of existing information into concise summaries: "what there is a huge lack of is translating this into a language that a main trustee could get their head round. It is a very complicated area and it needs to be translated into slightly less complicated language to understand why this matters to me now" (UK25). Interviewees noted the importance of accessing information about climate change at a range of scales. Although Australian interviewees exhibited a greater interest in the global and regional scales, company and sector-specific information was more prominent in both countries and across both interviewees and survey participants, suggesting an ongoing need for improved corporate disclosure of climate-related information. In addition, the survey data showed that company and sector information was valued highly by investment managers, where as Executives required higher-level narratives around the global and regional impacts of climate change.

The process and style of learning appears to be dependent on the type of investor, the institutional structures and beliefs, as well as access to formal and informal climate networks. Both formal and informal learning was evident in the UK and Australia. Due to the cultural and institutional differences between the two countries, informal learning appeared more common in Australia based on a reliance on collaboration and external engagement resulting from the geographic remoteness and smaller size of the industry compared to the UK. However, some NGOs in the UK have established strong communities of practice around climate issues for Executives which could usefully be scaled-up and expanded in different settings, as "the CFO leadership group and that peer-to-peer space is a very effective way of changing the beliefs" (UK18). The existence of informal peer-learning opportunities among Asset Managers could also be used to spread knowledge and practices around climate

integration, perhaps through the formalizing of existing social networks and the greater use of social media to disseminate and filter key research and initiatives. However, the multiple climate groups in both countries need to be more aware of reaching out beyond their own networks to ensure that the benefits of peer-learning extend beyond RI professionals to mainstream investors.

Chapter 5. A Systems Theory Approach To Integrating Climate Change: Results and Analysis

This section analyzes participant's responses from a Systems perspective to identify the key actors and leverage points that will be vital to altering existing investment beliefs and practices to better incorporate climate change risks and opportunities.

This chapter explores the following key questions:

1. How do investors perceive climate change issues, and how does it affect investment beliefs and practices?
2. Who are the main actors within the investment chain, and what is their role in integrating climate change considerations into investment decisions?
3. What are the leverage points available to aid the integration of climate change in the investment systems?

5.1 Perceptions of Climate Change

In order to better educate investors, and analyze how Systems theory could help alter practices, it is important to appreciate what investors already know and the language they understand.

5.1.1 Defining Climate Change

Understandings of climate change and how it relates to the investment system varied hugely among participants. This research sought to identify which climate risks and opportunities investors identified as most important for their investment decisions. Survey participants were asked to rank four climate-related issues:

- Physical risks (e.g. changing water scarcity, agricultural productivity or extreme weather events)
- Regulatory risks (e.g. carbon prices, air pollution regulation, emissions targets)
- New technology developments (e.g. solar PV, smart grids)
- Evolving social norms (e.g. divestment campaigns and changing consumer preferences)

Figure 30 demonstrates that regulatory risk is seen as the most important issue for survey participants, with 55 of 127 (43.3%) ranking this as most important. Evolving social norms was ranked as least important by 68 participants (53.5%), with only 6 respondents saying that it was their most important consideration. This is interesting considering that interviewees mentioned divestment campaigns as a key reason behind their increased focus on climate change. Risks appear to be slightly more important than opportunities, which is in keeping with predictions from behavioural finance literatures (Kahneman and Tversky, 2011), with regulatory and physical risks both receiving more 1st rankings. However, new technology developments had a better average score than physical risks and lower variance than regulatory risk (Figure 31). Appetite for different risks and opportunities necessarily varies based on individual and institutional beliefs. This variety of approaches was evident throughout the interviews in both the UK and Australia, with one AM in Australia spending time speaking with experts and universities to invest in new technology, whereas another spent longer trying to understand regulatory risk because it was seen as "one that analysts can get their head round" (UK24).

Figure 30. Please rank the following four climate-related issues in terms of importance as they relate to your investment process and consideration of the financial impact of climate change on portfolios. (Source: Thesis Survey)

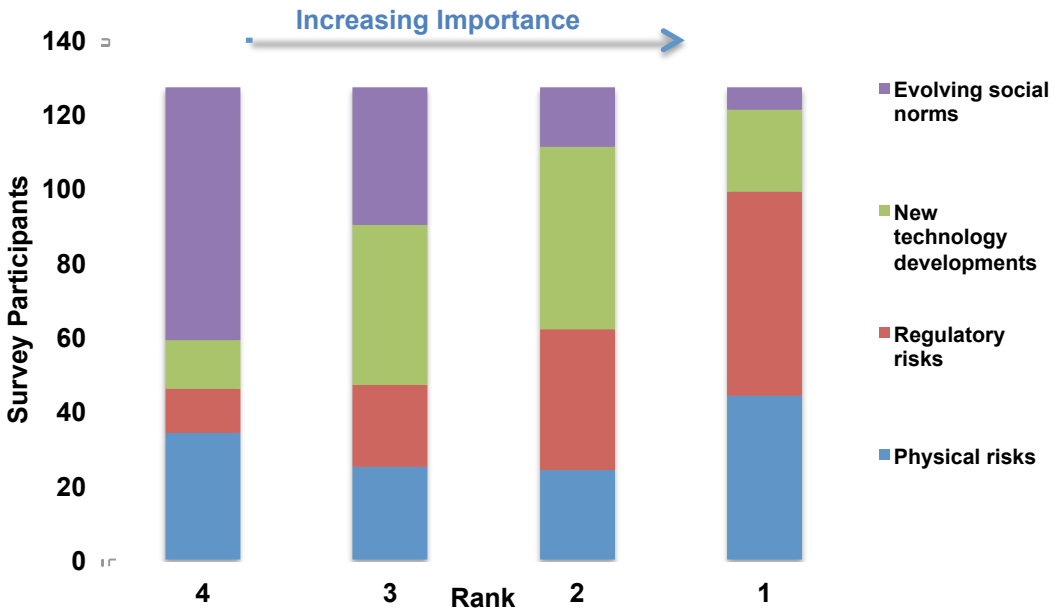


Figure 31. Statistical Analysis of Climate Definition Results (Source: Thesis Survey)										
	Rank				Response Count	Mean	Median	Mode	Variance	Standard Deviation
	1	2	3	4						
Physical risks	44	24	25	34	127	2.39	2	1	1.26	1.1234
Regulatory risks	55	38	22	12	127	1.93	2	1	1.84	1.36
New technology developments	22	49	43	13	127	2.37	2	2	1.27	1.13
Evolving social norms	6	16	37	68	127	3.31	4	4	1.50	1.23

5.1.2 Risk vs. Opportunity

Both research methods demonstrated the consideration of both risks and opportunities relating to climate change: 27 interviewees consider risk and opportunities relating to climate change equally (Figure 32) and 40.2% of survey participants said they read about risks and opportunities equally (Figure 33). Only 8.7% of those surveyed said that they do not read reports about either.

Figure 32. Do you consider risk or opportunities relating to climate change? (Source: Thesis Interviews)

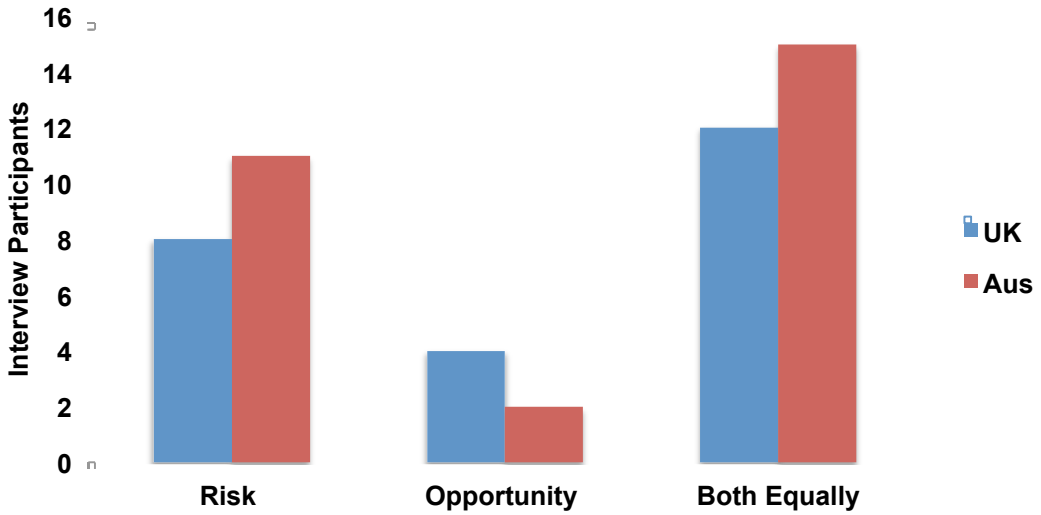
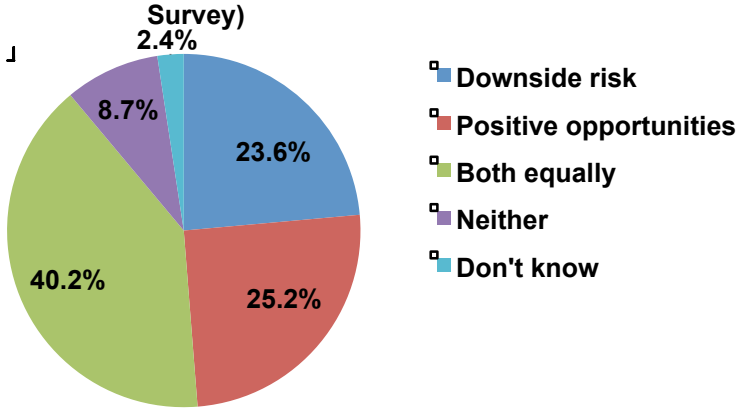


Figure 33. Do you read more information about the climate investment downside risk (e.g. flood risk) or the positive market opportunities (e.g. clean tech developments)? (Source: Thesis Survey)



However, there was still a concern among interviewees that "we are still wrestling with a perception that the environment and adjusting to the pressures which are taking place either are a source of losing competitive advantage, or they are a costs, there is not a widespread understandings that there are opportunities" (Aus09). 19 interviewees focused more on the risks relating to climate change, and this response was greater in Australia than in the UK. Regulatory risk was a particular concern for Australian investors, with carbon pricing mentioned by 11 Australian interviewees (compared to 5 UK participants). Only 6 interviewees focus more on the opportunity side and 4 of these were UK investors. However, this risk bias did not extend to survey participants, with 32 survey participants looking at positive opportunities more than downside risks, compared to 30 who focus on the downside risks more (Figure 33). This perhaps suggests that the USA has more climate-friendly investment opportunities due to the larger size of the market, especially compared to Australia.

Definitions of climate risk and opportunity also varied. Some searched for opportunities in a negative sense by exploiting cheap fossil fuel assets that others were divesting from, or opportunities to 'play' or 'hedge' regulatory changes in search of profit. However, others explored positive investments including green property/infrastructure, renewable energy, battery storage technology and climate/green bonds. Furthermore, the binary between risk and opportunity was problematized, with investments in renewables traditionally seen as a climate-related opportunity but actually a liability in the wake of regulatory uncertainty. Perception of

policy risk also varied. Although a majority acknowledged growing uncertainty ("there was a time when the only risk around coal mines was whether they would get built and around price, whereas now … there is massive risk that they are never going to see the light of day", Aus07), one RI manager said "there is very little regulatory risk in Australia" because the government is not willing to tax mining (Aus04). Similar discussions were evident in the UK, with some arguing that the failure of the European Emissions Trading Scheme demonstrated weak regulatory risk whilst others thought the carbon price would soon strengthen. Regulatory uncertainty also affects a range of asset classes, with one AM saying "I think it has an impact both on equities and the way we look at bonds for countries. How well you manage environment security results in how stable your country is, with regards to the social-political spectra and that spectra is what will impact your bond so that is when you will get crashes in currency. It is all interlinked" (UK17).

Many investors focused on "risk and reward", and were willing to take investment risk if they deemed the reward to be suitable, regardless of whether these investments were in coalmines or wind farms. The nuance between risk and opportunity was further explored: "The two are so closely related, because if you are going to respond to the risks with money, you've got to invest somewhere else, so the two are moving a bit more in sync than they were" (Aus25). Recent divestment announcements have demonstrated this, with leading institutional investment organizations, such as Rockefeller Foundation and AXA insurance, divesting from some fossil fuels and actively reallocating this capital to clean tech or other 'green' investments (Rockefeller, 2014; Clark, 2015a). While Painter (2013) argues for using risk language in climate communications, and Boykoff (2008) notes the lack of risk framing in UK media, this thesis recommends a focus on the materiality of both climate risks and opportunities.

5.1.3 Focus on Holistic vs. Carbon Issues

Interviewees discussed the difficulty of considering climate change due to its multi-faceted and intangible nature: "Climate change is a very wide concept, which is not very actionable" (UK03). A global problem with localized impacts across multiple timeframes, climate change requires familiarity with a range of information and

concepts. One RI manager thus said it "is not just emissions, it is about rising sea levels, it is about changes in weather patterns and how that affects food and transport, and all of that global stuff" (Aus03). Interview comments highlighted a gap between RI professionals and mainstream investors in their breadth of focus when defining and discussing climate change. More interview participants discussed climate as a holistic issue rather than focusing on carbon emissions (28 vs. 13). However, RI professions showed a greater tendency for this holistic thinking than mainstream investors (18 vs. 10 individuals; 81% vs. 53%) (Figure 34). This could reflect their RI/ESG expertise and ability to spend more time researching these issues. There was also greater consideration of holistic issues in Australia compared to the UK, perhaps due to the greater frequency of extreme weather events, flooding and forest fires.

Figure 34. Investor Consideration of Climate Change: Holistic vs. Carbon Focus (Source: Thesis Interviews)

	Carbon Focus		Holistic Climate Change	
	RI	**Mainstream**	**RI**	**Mainstream**
UK	4	4	10	1
Australia	0	5	8	9
Total	**4**	**9**	**18**	**10**

While holistic understandings of climate change are needed for its full integration into decision-making (Mercer, 2015), interviewees were sceptical of the extent that this occurred: "I don't think this industry is very good at taking that broader view" (UK06). This was seen as symptomatic of the wider financial system, where individual analysts and investors often focus on a specific sector, isolated from integrated macro thinking. Interviewees argued that integrating holistic climate information was challenging, as different facets are "quite difficult to price" (Aus24). Interviewees and academic literatures alike therefore suggest that companies must do more to demonstrate the materiality of climate change in all its guises (c.f. A4S, 2015b; UNEP FI, 2009b; Eccles et al. 2012), with investors saying that they do look at these issues if they affect bottom lines.

Water was one environmental issue identified as both a risk and an opportunity in the UK and Australia: "I guess water risk … is the key because people can get their head

around it: either there isn't enough water or there is too much water. It is something that translates it to the here and now; it is already having direct financial impact on communities and business operations…I don't think there is that understanding in other areas" (UK25). Water has gained increasing attention from the RI community; PRI and CDP have established water-related research and engagement projects, and Bloomberg publishes corporate water-use data linked to a World Resources Institute tool illuminating exposure to future water scarcity (WRI, 2015). This focus on water was particularly emotive in Australia, where the Millennium Drought (and subsequent flooding) led to a "sophisticated water market" and a greater awareness of weather-related climate changes: "We know that there will be more evaporation, there will be more extreme weather events, basically the price of water is likely to continue to rise, and so that is one area that we could invest" (Aus01). However, others were more sceptical of the opportunities around water: "the challenge of water is that there aren't many ways of investing in water companies from an innovation perspective" (UK04), with another saying that "either they are not listed or they are very small or they are a small part of a very large company so you are not going to see the market impact of what they are doing" (UK14). Interdependencies between water and energy were also discussed by investors, both in noting the holistic nature of climate change and in questioning the environmental benefits of large-scale solar projects, due to their dependence on water. Regardless, water issues are becoming more material for investors, particularly in emerging economies such as China and India, with water scarcity limiting growth across different time-frames: "Water risk can be immediate or a bit more long-term, conceptual. Even within the same issue, it varies according to the geography and sectors" (UK24).

While some investors are considering the broad materiality of climate changes, concern remains that this is not implemented in a strategic or systematic way. "Natural resource usage intensity is a huge part of the conversation that is often overlooked. Unfortunately it is not really connected so people understand curbing carbon but don't understand what it has to do with water intensity. I think there is a lot of work to do on that front" (UK27). While it is perhaps easier for investors to consider the risk of rising sea-levels when they own a coastal airport, or water scarcity when they invest in agricultural land in California, a consideration of climate change at a strategic level requires an appreciation of climate interdependencies. The recent

media focus on fossil fuel divestment and unburnable carbon have concentrated RI discourse around carbon and energy debates, perhaps to the detriment of wider discussions: "Too many pension funds at the moment are thinking about it in terms of corporate engagement and individual fossil fuel companies" (UK25). Sustainability organizations, corporations and investment analysts could better highlight the materiality and interdependencies linking different aspects of climate change to investment decisions.

5.1.4 Familiarity with Climate Language and Concepts

Regardless of definitions, 113 (88.3%) of survey respondents said that they were 'somewhat' or 'very' familiar with sustainability investment topics, with only 4 (3.1%) saying that they were 'somewhat' or 'very' unfamiliar with them (Figure 35). This was despite only 4.7% of survey respondents being RI specialists. However, respondents were less familiar with specific climate-related concepts. Almost a quarter (24.8%) said they were unfamiliar with all five listed terms (Figure 36). Only the general term 'ESG' was familiar to more than half of respondents, suggesting a tendency to focus on sustainability rather than climate change specifically. Only 34.4% said they could explain the 2^{o}C target, which is perhaps concerning, as this target is key to understanding policy urgency and carbon budgets. Only 32% of respondents were comfortable with the holistic concept 'stress-nexus' of water-energy-food. Although divestment and stranded assets debates have been recent but growing phenomena, while only 29.6% understood 'stranded asset risk', 41.6% were familiar with 'carbon bubble'. These are all key terms within climate dialogues, and without clarity on this language, understanding and integration into investment decisions will likely be limited.

Figure 35. How would you rate your own familiarity with sustainable investment topics? (Source: Thesis Survey)

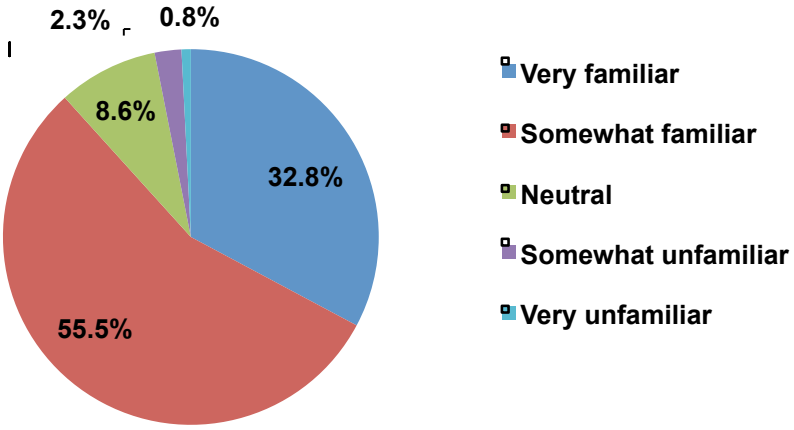
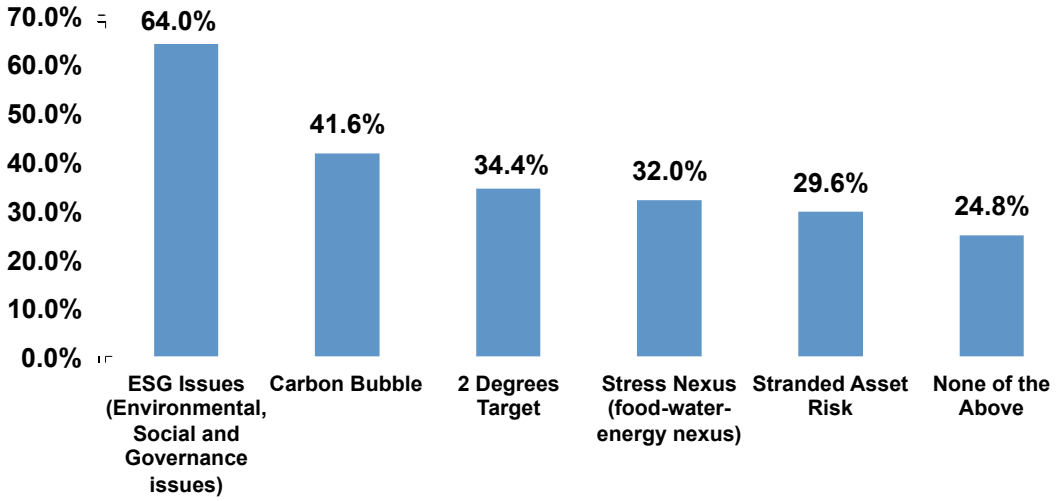


Figure 36. Have you heard about the following climate-related concepts? Please tick all that you would feel confident in explaining to a friend or colleague. (Source: Thesis Survey:)



5.2 Actors in the Investment Chain

Juravle and Lewis (2008) identify investment chain constraints as a barrier to the spread and integration of RI, most notably accountability deficits, conflicts of interest, asymmetrical information and low demand for SRI. However, the capacity for change does exist: “I think that what is annoying is that the investment industry has the talent, it has the resources, it has the ability to develop the products, it has the ability to communicate with its beneficiaries - it has the ability to make the difference”(Aus12). This section explores the role of Asset Owners, Asset Managers, Governments, Beneficiaries and Intermediaries within the investment industry in catalyzing a shift towards financing climate mitigation and adaptation.

5.2.1 Asset Owners

Many AOs already integrate sustainability into investment decisions and mandates (UNEP FI, 2014; GSIA, 2014). As long-term investors with large amounts of pooled capital, they are exposed to climate risks and opportunities and uniquely placed to create momentum throughout the investment chain.

While the majority of the 17 AOs interviewed use external managers, both internally and externally managed funds can integrate climate change: either during internal stock-picking decisions or by mandating and monitoring integration by external managers. Interviewees in both countries identified pressure from AOs as a key motivator driving AMs to identify climate-related risks and opportunities: "AOs are driving our business, because at the end of the day, our job is to meet their needs and do business with them and for them" (UK08). Investment mandates can facilitate: better alignment of time horizons between Managers and Owners; establishment of appropriate risk frameworks; outline the expectations surrounding corporate engagement; and align interests through the setting of suitable long-term oriented remuneration structures. The International Corporate Governance Network thus published a 'model mandate' to guide AOs in developing mandates that account for ESG considerations (ICGN, 2012). Furthermore, activism on climate issues among AOs appeared to be on the rise, particularly as a result of calls from the NGO community to disclosure and decarbonize portfolios. However, a recent report by the Asset Owner Disclosure Project (2015) found that of the top 500 global asset owners, roughly half did absolutely nothing to protect investments from the threat of climate change, and no fund had yet calculated their portfolio wide fossil fuel reserves exposure.

Interviewees also noted AOs role in public policy discussions. Investor policy engagement on climate change has increased in recent years (PRI, 2013), but is time and resource intensive, so many investors (particularly in Australia) outsource and delegate engagement to collaborative initiatives or industry associations. Groups such as the NAPF and the IIGCC in the UK, and ACSI and the IGCC in Australia facilitate stronger engagement with policy-makers through a "coordinated institutional investor voice" (Aus06).

5.2.2 Asset Managers

As the actors most associated with investment selection, AMs are key to allocating capital towards a lower carbon economy (Dlugocki and Mansley, 2005; UNEP FI, 2014), both in active investment strategies where individual asset classes and stocks can be chosen, and in passive index-based investments by selecting tilted indices. A number of mechanism exist to help AMs account for their climate change exposure, and uptake of these has been growing in past years, especially with the development of green bonds and low-carbon indices (EUROSIF, 2014). For example, the number of climate-related investment vehicles grew from 280 with US$134bn in assets in 2012, to 325 vehicles with US$276bn in assets in 2014 (GSIA, 2014). One Consultant commented that investors were beginning to realize that you can "get the same index return with 30-40% less carbon" (Aus12), with more and more clients expecting AMs to be considering these options. This was supported by Kidney et al. (2015): 'Demand for climate-friendly is there, if the investment also complies with financial requirements'.

Some AMs (particularly in Australia but also in the UK) were wary of acting before policies around carbon pricing and renewable energy subsidies improved: "Until policy makers address that, I don't think you can expect fiduciary investors to essentially stomach short-term detrimental return in the expectation that policy makers will get their act together" (UK26). However, others recognized their potential role in changing the investment system: "AMs have an opportunity to help move the agenda forward" (UK21) through greater corporate engagement, the threat of divestment and the opportunities for active investment in greener companies. Many of the 21 AM firms interviewed were integrating climate change into investment decisions to some extent. Fourteen had ESG or RI teams that helped Managers analyze climate risks and opportunities both at a strategic and stock-specific level. Other Managers without specific RI mandates suggested that they looked at climate issues if and when "it relates to profits and returns" (UK22).

Corporate engagement by investors can put pressure on companies. For example, 2015 saw groundbreaking shareholder resolutions filed against oil and gas giants Shell and BP, with investors demanding greater disclosure and monitoring of

exposure to climate change and stranded asset risks (Clark, 2015b). The larger the investment institution, the greater influence engagement and divestment could have, so those taking individual action tended to be larger UK and/or global institutions, with others undertaking collaborative engagements. However, widespread pressure from AMs is perhaps still lacking, as climate change rarely appears the focus of investor relations teams and quarterly updates (Eccles and Serafeim, 2013). Interviewees thus argued that without altered incentive structures and reduced policy uncertainty, the contribution of AMs to the integration of climate change into the investment chain is diminished.

5.2.3 Governments

A recurring theme during interviews was the centrality of Government in the framework for assessing and incentivizing climate-related investment opportunities. "I think that government leadership is absolutely crucial in this process. I don't think that industry can do this as a bottom-up process" (UK11). Interviewees mentioned a range of government interventions needed to combat climate change, including better urban planning, carbon pricing, international funding of adaptation in developing nations, and incentives for renewable energy. One interviewee said "It is very difficult to get capital markets to perform the role of governments" (Aus04).

"The regulatory environment has been a disincentive for listed equity managers to consider it (climate change) as a high priority in their thinking" (Aus05). Policy uncertainty and the short-term nature of democracy were mentioned as hindering climate-aware investing in both countries. Interviewees (3 in the UK, 4 in Australia) had lost money as a result of renewable energy policy changes: "Climate policy has impacted returns but not in the right way. Policies on renewables have been particularly uncertain and the repeal of subsidies has been a material loss to investors globally" (UK16). Australia's large-scale renewable investments fell to $40 million in the first half of 2014 from $2.7 billion in 2013 (Hannam, 2014): "There is not a lot of investment in renewables at the moment due to the political landscape" (Aus11). Four interviewees (3 UK, 1 Australia) also feared that continued uncertainty and unchecked climate change could affect national sovereign ratings, with undue insecurity affecting international confidence in national markets. Conversations with

colleagues and clients were also noted to be imbued with political friction, supporting the idea of belief overkill and that climate change has become polarized along political lines (McCright and Dunlap, 2011; Baron, 2009).

Pressure for clear government action has thus been growing (World Bank, 2014b): 370 investors with US$24tr AUM signed the Global Investor Statement on Climate Change calling for national and international climate policies (GIC, 2014), and even major oil and gas companies have called for governments to 'introduce carbon pricing systems and create clear, stable, ambitious policy frameworks that could eventually connect national systems' (UNFCCC, 2015). While UK and Australian governments once led international action on climate change, investors noted their recent backwards momentum. Investors interviewed recognized that there are conflicts of interest for governments, but were adamant that if renewable and clean tech investments are to be attractive, government action and policy certainty is required.

5.2.4 Beneficiaries

The public can also encourage more responsible investing. As beneficiaries of institutional investors (e.g. PFs, insurance companies and superannuation funds), it is in their long-term self-interest to encourage their AOs (and by extension AMs and companies) to operate sustainably: to protect the world they live in for themselves but also to generate better long-term returns on their savings and pensions (Clark et al. 2014).

Interviewees noted a recent rise in queries around climate issues, and particularly divestment and carbon exposure, due to NGO campaigns in the UK and Australia. However, the level of engagement was still very small: "We have 770,000 members and I would say that we have had 30 members write in" (Aus03), with average large corporate PFs only getting ten queries a year (Blandin, 2015). The level of engagement is likely to vary between funds and the demographics of members, especially when the fund is linked strongly to a particular industry. For example, interviewees noted disengagement on climate issues was higher in aviation industry funds compared to the University sector, for example. Generational differences were also highlighted: several interviewees commented on higher demand for ESG options

among young people, but also that as older generations approach retirement they take more interest in their pension investments. However, disengagement is still far higher than engagement, and this reduces the pressure being exerted on AOs and AMs.

While many institutional investors offer ESG or low-carbon options, investors in both countries used poor uptake of these funds as evidence of beneficiary apathy towards climate issues, saying "if our members really were concerned, you'd see a lot more money going into those options" (Aus04). This suggests that until beneficiaries demand climate-aware investing, or move their money to ESG options, investors will continue to see climate as a peripheral issue, particularly as when asked about what issues they want investors to be considering, a Pension Fund Industry Body found that "climate change comes below paying conditions of employees, human rights and many other less talked about ESG issues" (UK26). One problem with separate ESG funds is also "what do you do if the sustainable option under performs the non-sustainable one" (Aus08) – this could spark further questions about fiduciary duty and the materiality of climate change. However, some interviewees, and particularly the RI managers, thought that ESG should be integrated into mainstream funds, or even that ESG option funds should be the default. One interviewee suggested that "Rather than putting the onus onto the individual, particularly when you are moving to DC schemes where so much is on the individual … you have to make sure the default is integrated. Even if people deliberately choose something else, they are more likely to have done some research" (UK18). Although the shift from DB to DC reduces institutions' liability and risk, it does not mean they can ignore long-term risks such as climate change. Publics should put more pressure on their AOs and AMs, but funds must also educate their beneficiaries of the options available and the financial materiality of climate changes.

5.2.5 Intermediaries

Intermediaries engage with and advise AMs and AOs, influencing the information flows and feedback loops within the investment system. These intermediaries include investment consultants, research and data providers, actuaries and accountants, NGOs and interest groups. Intermediaries are noted as being important actors within network

and multi-scalar governance literatures (Backhaus, 2010; Ostrom, 2010; Newig et al. 2010).

Interviewees in both countries pointed to the importance of climate groups and ESG research providers in providing information updates and data, the lobbying of governments and corporations, and the facilitation of networking and peer-to-peer learning. For example, the IGCC was noted as a "really good organization to be involved in to understand what is happening around the policy and regulation areas" (Aus03) and "they have a 'learn over lunch' meeting which is very useful" (Aus06). However, it became clear that climate groups were underfunded and lacked capacity to have a wider impact. Alongside calls for better funding of these groups, interviewees argued that mainstream investment research providers and in particular the investment consultants and accountants should be playing a large role in providing climate information for clients.

Some consultants, and Mercer was highlighted in particular in both the UK and Australia, are already helping institutional investors in the integration of ESG considerations, especially those exploring divestment or decarbonization. They have also produced seminal reports on integrating climate considerations (e.g. Mercer, 2015; Towers Watson, 2012). However, several interviewees criticized the consultant industry in general: "they have collectively failed to pick this up. They have all studied it, and they are all capable, but no one will stick their necks out and run with it and give advice to their clients" (AUS12). Without the input and focus of such intermediaries, the momentum behind RI is unlikely to have a material and lasting impact. Accountants and management consultants, for example, are vital in valuing companies and the calculation of materiality, and without proper consideration of climate change markets will continue to misprice risks and opportunities – while leading companies such as PWC and KPMG have published on sustainability and climate change (PWC, 2010; KPMG, 2011), they were not mentioned by interviewees, suggesting that this information and focus is not translating into investment decisions.

5.3 Integrating Climate Change

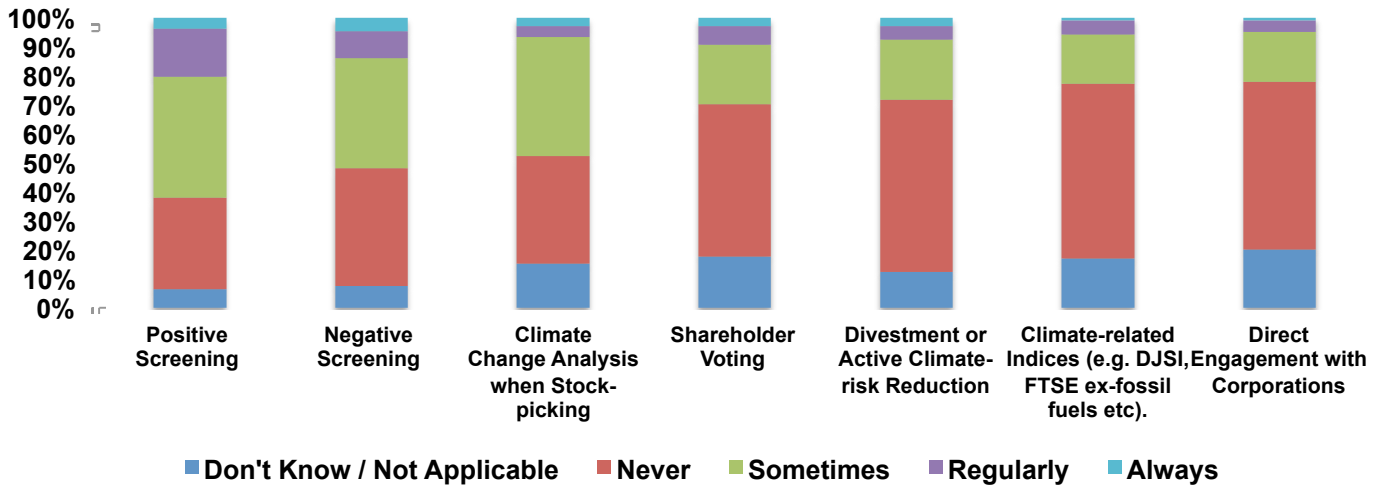
This section explores the different ways in which ESG, and specifically climate change, is being integrated into investment decisions. Integration is a difficult but necessary step to influence asset allocation and shift towards a lower carbon economy (Bourghelle et al. 2009; De Graaf and Slager, 2009). Integrating climate change into institutional frameworks facilitates management of risks and opportunities in a 'prudent and consistent way' (IIGCC, 2015). Many interviewees agreed that investors "are becoming more aware of climate change… But there is a bit of a way to go" (Aus11). GSIA (2014) suggest that the global sustainable investment market has risen from US$13.3tr in 2012 to US$21.4tr in 2014. However, funds integrating climate risks and opportunities will likely be much lower (in a study of 550 institutional investors who had made climate commitments, only 5 had invested in low-carbon indices, and of the 194 who had divested from some fossil fuels, only 18 were AMs and 6 were PFs; Novethic, 2015). As such, further mainstream integration is required to scale-up responsible capital allocation (Arjalies, 2010). Buy-side integration rankings demonstrate its rising prominence in the investment industry (Extel, 2015), but no standard for 'integration' exists although a number of guidelines have established various pathways to integration (c.f. PRI, 2014; VicSuper, 2014).

This research highlighted the diverse integration strategies available: 14 different methods were mentioned by interviewees (Figure 37), and 7 strategies were ranked by survey participants (Figure 38). Figure 37 shows that climate change can be integrated at various levels, from an operating principle, to an engagement strategy or stock selection screen. Consequently, at least one method should suit any institution, from simply adding a risk overlay to altering the entire management and operational structure of the firm.

Figure 37. List of Integration Methods (Source: Thesis Interviews)
• Active Investment in Green Bonds/ Clean Tech/ Renewables etc. • Capital Investment Appraisal • Carbon Foot-Printing and Target Setting • Climate Change Integrated into Fundamental Analysis Reports • Direct Engagement with Corporations • Divestment / Decarbonization • Education of Managers and/or Members • ESG as Central Operating Principle • ESG-tilted Management Incentive Structures • Negative and Positive Screening • RI Policy (Investment policy; risk management policy; ESG-focused hiring policy) • Shareholder Voting • Strategic Asset Allocation • Tilting of Indices

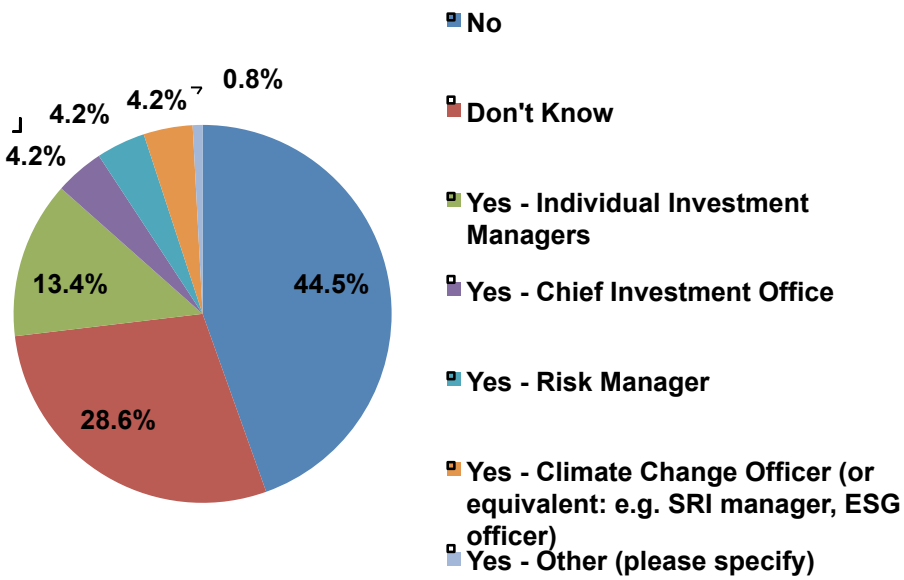
The traditional method of screening (both positive and negative) remains the most common strategy among survey respondents (Figure 38), in line with industry reports (EUROSIF, 2014; GSIA, 2014). However, the dominance of 'sometimes' or 'never' in this chart demonstrates continued inaction within the investment industry. Low corporate engagement is particularly surprising given the high profile campaigns to encourage such action (Flood, 2015) and comments by interviews suggesting that this practice had increased, particularly in the UK, with one Australian SF Executive saying "I think that Europe is just a million miles ahead of anywhere else on issues of engagement" (Aus23). Integration appeared more common within interviewee institutions, although this did vary from institution to institution.

Figure 38. How do you incorporate climate change in your investment process? Please answer for each practice. (Source: Thesis Survey)



The use of RI teams in the integration process also varied. One interviewee outlined two different approaches: "Some take a holistic approach and don't have a separate RI team, so they try to integrate ESG principles directly for the portfolio managers to handle. Some have a separate RI team but they sit closely with the fund managers and provide research and information" (UK02). Each approach was visible in both countries. ESG teams can provide useful research insight, but can be one step removed from the investment process so can be overlooked and overruled by some Managers. However, delegation and expertise is seen as an important part of investment organizations' structure: "we shouldn't expect our general managers to be experts in everything … our ESG people have excellent access to their Investment Committees … and the appropriate decision-making forum has the necessary input from the ESG person or the RI person with due consideration from the CIO, so I think it is actually integrated very well" (Aus25). Regardless of strategy, employees must know what is expected of them, and who is responsible for sustainability and climate change consideration. This was notably lacking within the survey sample: 44.5% of respondents said no-one within their firm was responsible for climate consideration, and 28.6% did not know who was responsible (Figure 39).

Figure 39. Is somebody in your organization responsible for ensuring that climate change considerations have been properly analyzed? (Source: Thesis Survey)



Many RI managers discussed strategies for integrating climate change from the "bottom-up" (Aus24), including helping AMs consider climate change issues on a "case-by-case" (Aus02) basis. Bottom-up approaches can be an effective approach in the short-term, particularly as investors learn and adapt through social interactions as discussed in chapter 4. However, interviewees in both the UK and Australia acknowledged that "Top down emphasis is really important. Support from the Executive Board mean that all analysts need to be thinking about these things" (UK22). Unless the vision and motivations behind climate change integration are clearly communicated, and the tools for change identified, institutional cultural and practices are likely to remain largely unchanged (Kotter, 1995): "Because we took sustainability to our central operating principle it affected everything we did as a company and as a fund" (Aus12). Implementing both top-down and bottom-up integration simultaneously can help 'translate their beliefs and policies into priorities and asset allocation decisions' (IIGCC, 2015; Mercer, 2015).

Some investors struggle to understand "how you make this into an investment case that our Investment Committee will respond to" (Aus08). Others have recognized its importance, saying "We don't find it difficult. It goes into risk and reward" (Aus07). The possibility of integrating climate and ESG considerations into the fabric of the investment process and culture of the firm, whereby the goals and corporate structure are affected, has been evidenced by a number of ethical and RI funds, as well as integration into mainstream institutions (GSIA, 2014). However, just having a policy may not lead to integration: "Just because they don't have a climate change policy doesn't mean they are not doing it, but there are people who have policies who may not implement them very well either" (Aus13). Integration of ESG is a key step towards climate-aware investing but requires top-down structural change, with bottom-up efforts able to contribute but ultimately limited.

5.4 Belief Formation and Crystallization

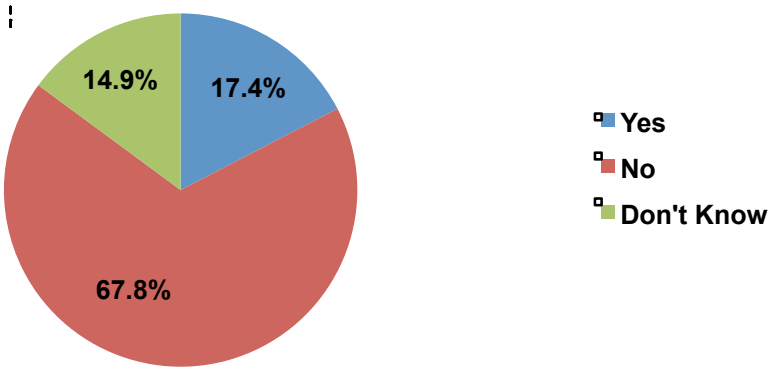
Changing beliefs can be an important leverage point within a system (Meadows, 2008), with investment beliefs shown to affect market outcomes and investment returns (Kurz, 1998; Koedijk and Slager, 2007). Understanding how these beliefs are

formed and crystallized into norms could help further climate change integration into investment decisions (IIGCC, 2015).

Investors manage and direct their actions by following dominant conventions (Kahneman, 2011). Collective norms are shared and disseminated across the market, and consequently 'the integration of ESG information will become a mainstream practice if, and only if, there is a shared belief among investors that ESG information is relevant' (Bourghelle et al. 2009). One SF Executive commented "If its not philosophically driven, you leave yourself very open for criticism. I think we are better off doing nothing than going off down a path half-heartedly" (Aus23). Beliefs drive operational practices, with one interviewee stating that "Our beliefs are how we should be managing money; they are the foundation of everything we do" (Aus23). For climate change to be given sufficient focus in investment organizations, it needs to be explicitly acknowledged in investment beliefs and policies (Mercer, 2015).

However, "AOs get to this (introducing climate-related investment beliefs) in a variety of ways" (UK08), with institutional leadership structures dictating the formation of investment beliefs. Several of the AO institutions (and AMs to a lesser extent) had developed and published RI beliefs, with participants highlighting good examples from CBUS, Hesta and Local Government Super in Australia, and the Environment Agency PF and USS in the UK. However Figure 40 shows that just 21of 121 survey respondents (17.4%) knew that climate considerations were in their organizations' investment beliefs, supporting the IIGCC's (2015) finding that 'the majority of funds still do not explicitly do this either as part of the responsible investment policy or core investment beliefs'. Interviewees in both the UK and Australia also acknowledged a lack of climate-related investment beliefs, with ten interviewees (8 in Australia, 2 in UK) saying that their firms had RI policies but not climate-related investment beliefs.

Figure 40. Is climate change a specified consideration in your organizations' official investment beliefs? (Source: Thesis Survey)



Interviewees suggested that experience of climate change and its materiality, as well as the influence of leadership drove belief formation. One AM firm adopted investment policies "Partly because that kind of fund has performed reasonably well" (UK14), whereas an ex-CEO said "In 2000 I started to think about sustainability in a general sense and took it in to the organization as our central operating principle, so it become our ethic" (Aus12). Interviewees also noted that unsupportive senior leadership teams are likely to be a significant barrier to the introduction of climate-related beliefs. This is perhaps worrying given the potential for 'belief overkill' to limit the acceptance of climate change among investment Executives, many of whom might fall into categories that are not pre-disposed to accept climate change (McCright and Dunlap, 2011; Collie, 2015). PWC's 18th annual global CEO survey of business and investment risks did not rank climate change in the top 19 risks due to insufficient interest by CEOs on the issue (Confino, 2015; PWC, 2015). Networking and peer-learning, especially among Executives, could be important to ensure that more Executives understand climate-related risks and opportunities so that climate beliefs can become normalized throughout the investment system.

However, an investment belief on its own will not be sufficient for organizational change: "If you start with a belief, and you want to hard-code that into the way that you invest, you will then need to work out your monitoring mechanisms and the flow of information" (Aus23). Without this implementation the belief will not be

crystallized, and is unlikely to lead to new policies and practices. IIGCC (2015) thus suggest that investment beliefs should explain and reference:

- The fund's assessment of the most likely future climate change scenario.
- The degree of concern and the fund's level of conviction about future investment impacts.
- The way the fund intends to manage this exposure.

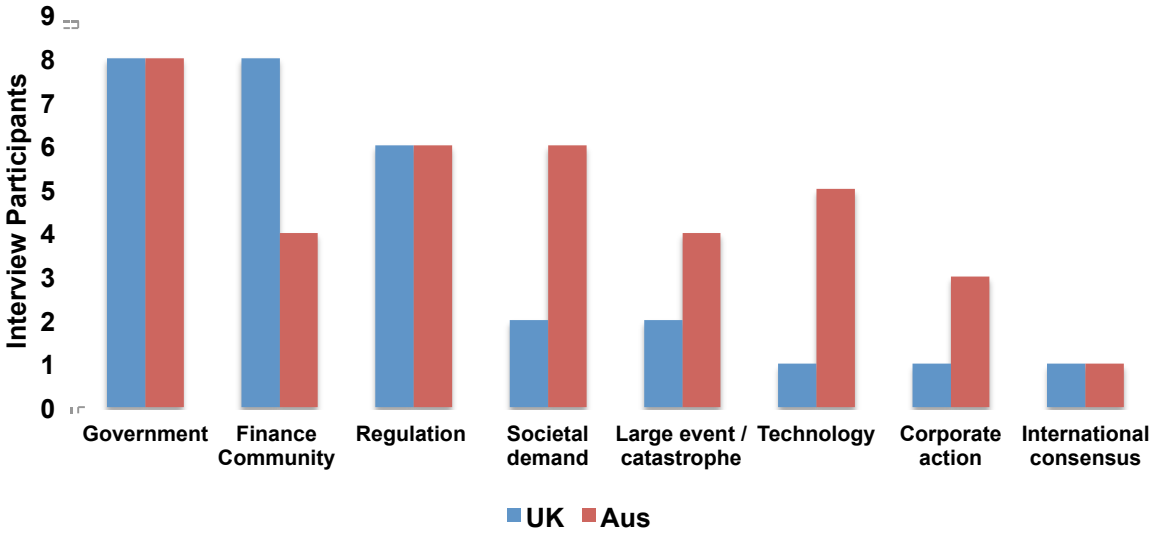
While belief sets should remain relatively stable to allow for consistent and rigourous approaches to be developed, interviewees noted that RI policies based on these beliefs could be updated frequently to incorporate new concepts and investment mechanisms. Evidence of such policies, and their impact on decision-making, is growing in the market, with AM firms introducing policies to attract AO clients with existing climate beliefs and AOs adopting policies to appease beneficiaries and direct asset allocation: "We actually adopted a policy around responsible investment … That is starting to be embedded into our process, so when we are looking at an investment we are looking at the ESG implications" (Aus03). However, other interviewees discussed the difficulty in developing practical and transparent beliefs around climate change, saying "We have a set of investment beliefs, one of them relates to ESG but it wasn't clear, and we didn't agree as to how much of it was branding and how much of it was aimed at investment returns." (Aus02). Therefore, understanding the investment case for considering climate issues, and outlining how it will be implemented in practice, are key to belief crystallization.

5.5 Leverage Points and Sparking Change in the System

This section explores, from a Systems perspective, the ways in which integration of climate change into investment decisions could be further catalyzed.

Figure 41 provides a frequency analysis of the eight drivers mentioned by interviewees when asked 'where do you think systemic change will come from?'. These results demonstrate demand for financial and political systems to work together to tackle climate change. This re-emphasizes the Systems theory acknowledgement that the investment system does not act in a silo (Meadows, 1999).

Figure 41. Drivers of Future Integration of Climate Change Into Investment Decisions. (Source: Thesis Interviews)



Interestingly, 'government' and 'regulation' are equally important to both UK and Australian interviewees. Tighter policies and regulation were seen as necessary to incentivise investment towards a lower carbon economy by 28 interviewees: "At the end of the day I think that governments have to be the ones who put the constraints on, there has to be some sort of constraint on carbon emissions"(Aus08). Carbon pricing was discussed by 16 interview participants; mostly in the context of regulatory risks, but also for its potential to catalyse a large-scale shift in investment if a credible and long-term pricing structure was introduced. This could change the rules of the market, acting as a leverage point for change by altering the stocks and flows of goods and services internationally. Despite recognizing the need for a carbon price, one Consultant said that investors are "nervous about the fact that if we do … there is a potential to be left with a stranded asset and lose money" (Aus12). It was argued that national and sub-national level pricing would be vital to change, with interviewees sceptical about the likelihood of international carbon pricing: only 2 mentioned international consensus as a driver of change (Figure 41).

Twelve interviewees suggested that the finance community would catalyze change, particularly given regressive policies in the UK and Australia: "the finance community will probably lead ahead of the government, as is the case now" (UK27).

This belief was greater in the UK (8 mentions) than Australia (4 mentions), perhaps due to the larger size and national importance of the finance industry in the UK and the smaller role of government, particularly in the utilities and energy sector. One interviewee thus commented "I think regulation on this is difficult … what tends to happen is that the big funds start doing something and gradually the world moves that way" (UK08), suggesting that herding behaviour and peer-learning, if channelled in the right direction, could cause a cascade of responsible investing. Catalysts for such a change could include further information on the materiality of climate change, and momentum behind discussions of climate change integration as a fiduciary duty and legal requirement (as espoused by groups such as ClientEarth). Improving information flows is an important leverage point within a system (Meadows, 2008), perhaps particularly in the UK, where more interviewees believe there is not enough information (Chapter 4.2). Furthermore, if fiduciary responsibilities did require a consideration of climate change in the future, this could alter the rules of the system, and potentially even cause a paradigm shift towards climate change as an overarching focus in investment decisions due to its potential for industrial-scale changes to socio-economic systems.

Although momentum behind the evolution of fiduciary standards to incorporate climate risk is increasing (Barker and Youngdahl, 2015), paradigm shifts are unlikely to occur in the next few years. One SF Manager was keen to delineate meeting fiduciary duty and catalyzing a shift towards a lower carbon economy: "we consider ESG but we do not make investment decisions just to drive an environmental outcome" (Aus04). This suggests that while investors recognize climate change as a material risk and opportunity, they do not see a wider responsibility to drive structural change. Two strategies thus exist: a climate risk strategy and a climate impact objective. Available integration strategies do not always achieve both, so investors need to be clear on their reasons for integrating climate considerations (Dupré et al. 2015). Concern also exists that potential changes could end up pushing investors in the wrong direction, as Forrester (1971) argued with regards to leverage points. For example, some interviewees fear litigation cases if they *do* invest for environmental rather than financial gain thereby breaking fiduciary duty, but also fear losing the best managers to competitors if they introduced more stringent monitoring and mandating towards environmental consideration. However, one leverage point that could have

significant potential in the investment industry is that of 'self-organization'. One interviewee said "Self-organization is more powerful than regulation", arguing that "if you and I agree to do something we are more likely to do it than if we are told to" (UK08). By establishing their own networks, initiatives and investment strategies, investors can alter the system through collaboration and peer pressure driving greater uptake of innovation, information and beliefs, and reducing fears of losing competitive advantage.

Australian interviewees appeared to recognize a wider variety of drivers for change than UK participants. UK interviewees focused almost entirely on the role of government and investment peers (22 mentions vs. 7 of other drivers) compared to Australia's 18 mentions of government and finance vs. 19 mentions of other drivers (Figure 41). Other drivers included technology developments, whereby renewable energy, battery storage and other low-carbon enablers reach price-parity and become sound economic investment decisions, or catastrophic / large-scale event causing businesses, governments and investors to recognize the risks (6 mentions each - Figure 41). However, others (particularly in Australia) lamented the slow nature of change, and the idea of waiting for catastrophe. Societal pressure was also seen as an important change driver, particularly through lobbying governments and AOs to act, with social campaigns against war, apartheid and tobacco successfully affecting investment decisions in the past (Renneboog et al. 2008). However, questions remain as to the impact of the divestment campaign, and whether engagement would have better long-term outcomes (Caldecott et al. 2013). Those putting pressure on investors must consider the potential positive and negative outcomes of their efforts, and recognize the need to seek common goals: "The key thing is that different stakeholders have to play a role. What will make the most maximum impact is if everyone coordinated their impact" (UK24).

Facilitating an 'outside' and systems-focused viewpoint is perhaps particularly useful for the complex issue of climate change. Systems theory identifies the potential for non-linear changes to a system, whereby momentum from one actor or one initiative can be used to catalyze wider change somewhere else in the system. This was emphasized by one interviewee who said "a little bit of fiduciary enlightenment, along with marginally better regulation, along with beneficial member input, all coming in

relative proximity of each other drive significant steps forward and across the way the markets work, and that is the world we are in now. If any one of those elements is a drag or a negative, then you slow the system down, like we did with regulation in Australia, but if they all keep moving and edging forward then you get this acceleration in behavioural change" (Aus25).

5.6 Integration and Systems Theory Conclusion

This research has highlighted the important role that different actors all must play in altering the investment system towards a greater consideration of climate change. In particular, interviewees in the UK and Australia both highlighted the role of government and the finance community (both AMs and AOs) as being important drivers of change. Within the investment system, interviewees and survey participants identified a greater focus on climate risks than on opportunities relating to climate change, especially among Australian interviewees where focus on regulatory risk was high due to recent experience of uncertainty. However, experience of climate changes also appeared to have induced a more holistic understanding of climate change in Australian interviewees relative to UK interviewees, although both countries had a divergence in definitions between RI professionals and mainstream investors. This experience of climate change and government apathy appears to have influenced Australian investors to the extent that they are more aware of alternative drivers of climate integration and action, including the role of technology, social pressure and large-scale climatic events in catalyzing change.

Both UK and Australian interviewees mentioned the disengagement of beneficiaries as a barrier to action on climate issues, as it weakens their feedback loop along the investment chain. This was particularly noticeable in the DC structure of Australia, whereby interviewees believed that the individualization of risk increased demand for financial outperformance. However, participants in both countries commented on the greater availability of investment mechanisms for integration of climate change within the investment system. Interviewees also noted the growth in corporate and policy engagement- largely collaborative in Australia and private engagement in the UK- although this finding was not extended to the survey participants. The development of sustainable investment practices can be seen as an 'unending process

defined neither by fixed goals nor by specific means of achieving them' (Hjorth and Bagheri, 2006), with a diverse range of possible actions available and an array of leverage points identified in this research. Interviewees most frequently mentioned the changing of rules and goals of the system as the most likely leverage points (primarily by governments and investment Executives), although self-organization of investors around climate issues and efforts to increase information flows also appeared to be occurring through the growth of networks, collaboration and knowledge sharing within and between institutions. However, the continued lack of investment beliefs, understanding of key concepts or discussion at the Investment Committee level identified in the survey show that there is still progress to be made on a firm-by-firm and industry basis in integrating climate change into investment systems.

Chapter 6. Conclusions

This thesis has explored the knowledge and beliefs surrounding climate change risks and opportunities within institutional investment organizations in the UK and Australia. The UK and Australia were chosen because of the high level of climate change exposure in their asset markets, and their differing institutional investment structures. The analysis drew on 58 semi-structured interviews with various actors within the investment industry. Investment institutions interviewed accounted for almost 30% of Australian AUM (A$700bn) and 24% of European/Middle Eastern Assets (£6.5tr). These interviews were supplemented by 154 responses to a structured survey of global investors and financial managers. This helped provide global insight into the institutional investment system learning and climate integration practices.

Existing academic literature on climate change and investment has tended to give only limited attention to the issue of how mainstream investors are most efficiently and effectively informed about climate change developments, and how these ideas inform investment decision-making. This thesis has consequently utilized Communications theory to analyze empirical evidence of current learning processes and perceptions of language and channels used to educate investors in the UK and Australia. Additionally Systems theory was used to enrich insights regarding the integration of climate change into investment decisions. As an extension to this research, US institutional investors and the international insurance industry could be studied using the same methodologies to expand existing comparisons and understandings of the international institutional investment system.

This research has found that investors use brokers, data providers, and mainstream media to inform their investment decisions in both the UK and Australia. Efforts to provide more rigourous and timely climate information through these channels would be welcomed by interviewees. In particular, a need for the better translation of climate science into actionable investment theses was highlighted: only 20% of survey respondents and 32% of interviewees said that there is sufficient information, and only 30% of survey respondents thought that the language used is suitable for investor audiences. This was despite the multitude of climate groups and initiatives that have been established in recent years to help investors consider these issues. The failure of

investment companies to explicitly budget for purchasing third-party climate change related investment research, evident in this survey, could be limiting the amount of information of a suitable length, language and detail of research available to help investors integrate climate into everyday decisions. Further emphasis on the materiality of climate change for financial risk and return could broaden the integration of climate risks and opportunities into everyday investment decisions. A novel finding was the increasing role of social media in providing a filter and sharing platform within the RI profession, providing a channel for reaching wider audiences and reducing information overload. Despite widespread recognition of climate issues, survey results showed limited appreciation of climate change terms, including 'stranded assets' and the 2^{o}C target. Perceptions of climate issues also varied, with Australian interviewees more likely than their UK counterparts to identify with holistic climate topics, focus on climate risks rather than opportunities and use global and regional information. Thematic information and regulatory risks were acknowledged as important by both Australian and UK interviewees, although the scale of information required varied by job type and investment focus.

Investors in both the UK and Australia engage in formal and informal learning about climate change. This research suggests scope for further development of informal communities of practice around climate issues within the investment system, with such groups able to facilitate both social peer-learning and asocial knowledge development through enhanced access to climate research. Such networking opportunities could be particularly important among Executives and Asset Owners: without top-down leadership through Investment Committee meetings, via manager mandates and explicit investment beliefs, the uptake and dissemination of climate information is likely to be limited. Results showed the continued lack of consideration of climate change at this institutional level, with only 3.3% of survey participants always considering climate change during Investment Committee meetings. Executive networking opportunities already exist to a limited extent in the UK, but could be scaled up in both the UK and Australia in line with existing formal and informal networks of RI professionals. Networks of individuals and the role of social learning appeared stronger in Australian than in the UK, possibly a result of the geographic remoteness and small scale of the investment industry, causing a greater reliance on collaboration and knowledge sharing. This self-organization of investors could be a

vital leverage point to encourage greater dissemination and uptake of knowledge and investment action through peer and legitimacy pressures.

While institutional investors, and particularly Executives within investment firms, can influence asset allocations to better account for climate change risks and opportunities, another key conclusion is the importance of lobbying of governments and clearer engagement throughout the investment chain. Participants highlighted regulatory risk, and particularly uncertainty regarding carbon pricing and renewable energy subsidies, as a key barrier to investing towards a low carbon economy. Collaborative pressure on governments for greater regulatory and policy stability could thus help change the rules and goals of the investment system, and potentially create a paradigm shift in the investment markets towards a consideration of climate change as a material risk and fiduciary duty. While both UK and Australian interviewees highlighted the role of government and the financial community itself in driving changing attitudes to climate change in the investment system, Australian participants had a greater awareness of alternative drivers including social pressure, technological advancements and catastrophic climate events.

Changing investment behaviour to take greater account of climate-related issues is possible, and is already occurring, but this research suggests that there remains scope for this to be scaled up and intensified. Increased collaborations, communication and peer-learning between investors, between climate groups, and between governments is still required. Better learning, language and leadership within the institutional investment system could thus help promote solutions which engender greater integration of climate change thinking, sufficient, perhaps, to help push private capital towards funding the $53trn of investment required to deliver a more sustainable, lower carbon global economy.

Appendix 1: Interview Consent Form

UNIVERSITY OF OXFORD RESEARCH: INVESTORS AND CLIMATE CHANGE

CONSENT FORM

	Please initial box
I confirm that I understand the nature of the project, and have had the opportunity to ask questions.	☐
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.	☐
I agree to take part in the above study.	☐
I agree that my interview may be used during the write-up of the thesis, and that I may request, but will not automatically be given, a copy of the transcript before its inclusion in the dissertation to ensure that my views and opinions are put forward as I intended them.	☐
I agree to the interview / meeting / consultation being audio recorded. I understand that all details will be kept securely in a password-protected file.	☐
I agree to my name/position to be included with any reference to my interview in the discussion. (OPTIONAL - to be discussed during the meeting)	☐

Name of Participant	Date	Signature
Name of Researcher	Date	Signature

Appendix 2: Semi-Structured Interview Example Questions

Interview questions would vary for different types of interviewee, with separate question outlines designed for ESG officers, mainstream investors, and those working for climate or sustainability groups. Interviews were semi-structured, so these questions were used as prompts and discussion points.

Mainstream Investor Questions:

Background to you and the firm:

1. What is the role of the firm? Does it directly manage assets?
2. What is your position within the firm? Are you directly involved in investment decisions? How do you interact with the AMs if you are an AO?
3. How would you rate your own familiarity with sustainable investment topics?

Climate change in your firm:

4. The term "climate change" is broadly defined, and incorporates many issues. What climate change issues do you most look at when making investment decisions – regulatory risk, physical risk, clean tech opportunities, changing consumer preferences?
5. Do you have a tendency to focus on risk or opportunity within your research?
6. When looking at climate change do you focus mostly on carbon, water, energy, impacts on agriculture etc.?
7. Is someone in your firm responsible for assessing the climate change risks within the portfolios held by the firm and by individual investors? Are managers asked about climate change issues during investment management or risk management meetings?
8. Does your firm or organization have an internal team/individual looking at climate risk or environmental considerations? If yes, how often do they publish research reports or provide information for managers?

Forming investment beliefs:

9. What information and forms of communication help to shape or inform your over-all investment beliefs and your investment decisions?
10. Is climate change included in the firms' investment beliefs, and are managers asked to take these risks into account? If so, where has this impetus come from?
11. Do you think fiduciary duty does or should incorporate consideration of ESG and climate issues?

Climate change in investment decisions:

12. How frequently would you consider climate change issues in your investment decisions?

13. Do you discuss climate change risks and opportunities with your colleagues or clients?
14. How do you gather general information on climate change issues both outside and inside your investment profession? What sources of information do you use?
15. What types of information (market prices, narratives, charts, regional data, sector information)? Is this granular company information, sector specific issues or thematic trends?
16. If you find an interesting article, do you share that with your team directly, or write a note on the issue etc.
17. Do you have a research budget for information on climate change? Do you pay for external papers and reports etc.
18. Does your company belong to an investor group on climate change, and if yes, do you personally engage with them or read the reports? Do you feel that membership is useful – what type of engagement is most helpful (reports or meetings)
19. Do you network and engage with other companies, competitors etc. on climate risks and opportunities.
20. Do you feel that there is sufficient climate change data available to help inform your investment decisions? Does the uncertainty in climate data affect the ways in which you use the data?
21. What additional information would be helpful to better account for climate change in investment decisions?
22. What are the barriers to incorporating climate change considerations into daily investment decisions?
23. Has the policy regime increased the uncertainty around climate change science, the risks and opportunities?
24. Do you feel that you learn more about climate change in your job through reading reports and attending meetings, or at home via mainstream media, experience of physical changes (e.g. drought or floods) or social discussions?
25. What motivates you to find out and discuss climate change? Is it managers / beneficiaries / material concern for profits / moral / branding?

Appendix 3: List of Interview Participants

My thanks to all those who participated, both listed and unlisted. This is a list of interviewees who consented to being mentioned by name. Included are the organization and position at the time of the interview.

Name	Organization	Position
Hitesh Thakrar	Abu Dhabi Investment Authority	Fund Manager
Saskia Kort-Chick	Alliance Bernstein Global	
Robbie Miles	Allianz Global Investors	ESG Analyst
Nader Naeimi	AMP Capital	Head of Dynamic Asset Allocation and Portfolio Manager
Paul Murphy	Australian Council Superannuation Investors	Executive Manager, Institutional Investments and Policy
David Macri	Australian Ethical Investment Ltd	Chief Investment Officer
Tom Garcia	Australian Institute of Superannuation Trustees	Chief Executive Officer
Kelly Christodoulou	Australian Super	Environmental, Social, Governance Manager
Gregory Elders	Bloomberg Intelligence	Senior ESG Analyst
Garrie Lette	Catholic Super	Chief Investment Officer
Louise Davidson	CBUS	ESG Investment Officer
James Hulse	CDP	Head of Investor Initiatives
Elaine Prior	Citi Research	Managing Director, ESG Analyst

Howard Covington	ClientEarth	Trustee
Pablo Berruti	Colonial First State Global AM	Head of Responsible Investment Asia Pacific
John Purcell	CPA Australia	Policy Adviser ESG
Faith Ward	Environment Agency Pension Fund	Chief Responsible Investment and Risk Officer
Liza McDonald	First State Super	RI manager
Kevin Bourne	FTSE Group	Managing Director
Daniela Saltzman	Generation Foundation	Director
Mark Mills	Generation Investment Management LLP	Partner
Andrew Major	HESTA	General Manager - Investments
Azhar Abidi	IFM Investors	Director, Responsible Investment
Stephanie Pfeifer	Institutional Investor Group on Climate Change	Chief Executive
George Dallas	International Corporate Governance Network	Policy Director
Therese Niklasson	Investec Asset Management	Global Head of ESG
Nathan Fabian	Investor Group on Climate Change	Chief Executive
Alice Prudhoe	Local Government Super	Sustainability Officer

Bill Hartnett	Local Government Super	Head of Sustainability
Richard Higgins	Macquarie Group	Investment Analyst
Sam Churchill	Magellan Financial Group	Head of Macro
Will Pomroy	National Association of Pension Funds	Policy Lead: Stewardship and Corporate Governance
Freeman Le Page	Newton Investment Management Ltd	SRI Client Director
Paul Chandler	Principles of Responsible Investment (UNPRI)	Investor Engagements Manager, Environmental Issues
Andrew Spence	Qantas Superannuation Limited	Chief Investment Officer
Jonathan Mirrlees-Black	RARE Infrastructure Limited	Head of Research
David Bentley	RARE Infrastructure Limited	Senior Investment Analyst and Portfolio Manager
Susheela Peres da Costa	Regnan	Deputy Managing Director
Franziska Jahn-Madell	Ruffer LLP	Responsible Asset Manager
Mike Clark	Russell Investments	Director, Responsible Investment
Richard Stathers	Schroders	Head of Responsible Investment

Camilla Ritchie	Seven Investment Management	Asset Manager
Therese Kieve	ShareAction	Senior Analyst & Engagement Officer
Rebecca Maclean	Standard Life Investments	Responsible Investment Analyst.
Frances Hudson	Standard Life Investments	Investment Director, Global Thematic Strategist, Multi Asset Investment
Bob Welsh	Sustainability Advisors	Executive Director
Jessica Fries	The Prince's Accounting For Sustainability	Executive Chairman
Greg Fernance	The University of Sydney	Head of Investment and Capital Management
Julie Hudson	UBS Investment Bank	Managing Director, ESG and Sustainability, Equity Research
Christophe McGlade	UCL	
Talieh Williams	UniSuper	Manager, Governance and Sustainable Investment
Elizabeth Ottewell	Zenkyoren Europe Limited	

Appendix 4: Survey Questions

Consent:

1. Please indicate your willingness to participate in this study.
    a. I confirm that I have read, and understood, the nature of the project.
    b. I agree that my survey answers may be used in aggregate, and that if I participate I will be sent a summary report of the survey findings.
    c. I agree to take part in the above study.

Defining Climate Change:

2. The term "climate change" is broadly defined, and incorporates many issues. Please rank the following four climate-related issues in terms of importance as they relate to your investment process and consideration of the financial impact of climate change on portfolios.
    a. Physical risks (e.g. changing water scarcity, agricultural productivity or extreme weather events)
    b. Regulatory risks (e.g. carbon prices, air pollution regulation, emissions targets)
    c. Regulatory risks (e.g. carbon prices, air pollution regulation, emissions targets)
    d. Evolving social norms (e.g. divestment campaigns and changing consumer preferences)

Climate Change Knowledge:

3. How would you rate your own familiarity with sustainable investment topics?
    a. Very familiar
    b. Somewhat familiar
    c. Neutral
    d. Somewhat unfamiliar
    e. Very unfamiliar
4. Do you read more information about the climate investment downside risk (e.g. flood risk) or the positive market opportunities (e.g. clean tech developments)?
    a. Downside risk
    b. Positive opportunities
    c. Both equally
    d. Neither
    e. Don't know
5. Have you heard about the following climate-related concepts? Please tick all that you would feel confident in explaining to a friend or colleague.
    a. 2 Degrees Target
    b. Stranded Asset Risk
    c. Carbon Bubble
    d. ESG Issues (Environmental, Social and Governance issues)
    e. Stress Nexus (food-water-energy nexus)
    f. None of the Above
6. At what scale do you most consider climate change as it relates to your investments? Please rank in order of importance. (Note that the choices will move order as you rank them.)

a. Global economy impacts
b. Regional economy impacts
c. Local economy impacts
d. Sector-specific impacts
e. Company-specific impacts

Investment Behaviours and Climate Change:

7. Is climate change a specified consideration in your organizations' official investment beliefs?
    a. Yes
    b. No
    c. Don't Know
8. Does your firm or organization have an internal team looking at climate risk or environmental considerations?
    a. Yes
    b. No
    c. Don't Know
9. If yes, how often would you interact with them or read a research note that they publish?
    a. Weekly
    b. Monthly
    c. Quarterly
    d. Annually
    e. Only if I Request Information
10. Is climate change a standing agenda point in regular Investment Committee meetings?
    f. Yes- Always
    g. Yes- Sometimes
    h. No
11. Is somebody in your organization responsible for ensuring that climate change considerations have been properly analyzed?
    a. No
    b. Don't Know
    c. Yes– Individual AM
    d. Yes– Chief Investment Officer
    e. Yes- Risk Manager
    f. Yes – Climate Change Officer (or equivalent, e.g. SRI or ESG Manager)
    g. Yes- Other (please specify)
12. How do you incorporate climate change in your investment process? Please answer for each practice.

Answer Options	Always	Regularly	Sometimes	Never	Don't Know / Not Applicable
Negative Screening (e.g. exclusions)					
Positive Screening (e.g. best-in class)					
Climate Change Analysis when Stock-					

picking					
Divestment or Active Climate-risk Reduction					
Shareholder Voting					
Direct Engagement with Corporations					
Climate-related Indices (e.g. DJSI, FTSE ex-fossil fuels etc).					

13. How often do you talk about climate risk in a meeting with other investors or clients?
    a. Always
    b. Regularly
    c. Sometimes
    d. Never
    e. Don't Know
14. When was the last time you read a report / article / research note which focused on climate change risks or opportunities?
    a. Past Week
    b. Past Month
    c. Past Quarter
    d. Past Year
    e. Never
15. When was the last time you attended a conference or presentation which focused on climate risks or opportunities?
    a. Past Week
    b. Past Month
    c. Past Quarter
    d. Past Year
    e. Never

Decision Making Practices

16. How do you gather information on climate change issues? Please tick all that apply.
    a. Mainstream news (e.g. newspapers, online content, television)
    b. Corporate annual or sustainability reports
    c. Data providers (e.g. Bloomberg, Thomson Reuters
    d. Investment journals
    e. Internal research
    f. External research (e.g. Investment consultants, industry or broker reports, climate groups, academic articles)
    g. Face to face meetings (with clients, experts and/or colleagues)
    h. Social discussions outside of work
    i. I do not gather information on climate change
    j. Other (please specify)
17. When making investment decisions, what forms of communication do you utilize?
    a. Corporate Reports
    b. Meetings with Companies

c. Mainstream News (e.g. TV, Newspapers)
d. Market Data Providers (e.g. Bloomberg, Thomson Reuters)
e. Internal Research Teams
f. External Research (e.g. Broker Reports)
g. Investment Consultants
h. Academic Reports
i. Investment Journals
j. Discussions with Colleagues

18. Does your firm or organization have a separate research budget for climate change research?
    a. Yes - Internal Research
    b. Yes - External Research
    c. Yes - Both Internal and External Research
    d. No
    e. Don't Know
19. What addition information would be helpful to better account for climate change in investment decisions? Please tick all that apply.
    a. Regional climate change reports
    b. Sector climate change reports
    c. Company data on exposure to climate change
    d. Climate-exposure weighted indices
    e. Data on how climate change is affecting portfolio/economy returns
    f. Summaries of international climate negotiations and regulations
    g. Other (please specify in the comment box below)
    h. None of the above.
20. Do you feel that language used in climate change communications is appropriate for the investment community?
    a. Yes
    b. No
    c. Don’t Know
21. Do you feel that there is sufficient information available about corporate exposure to climate risks and opportunities?
    a. Yes
    b. No
    c. Don’t Know

Climate Change Investor Groups

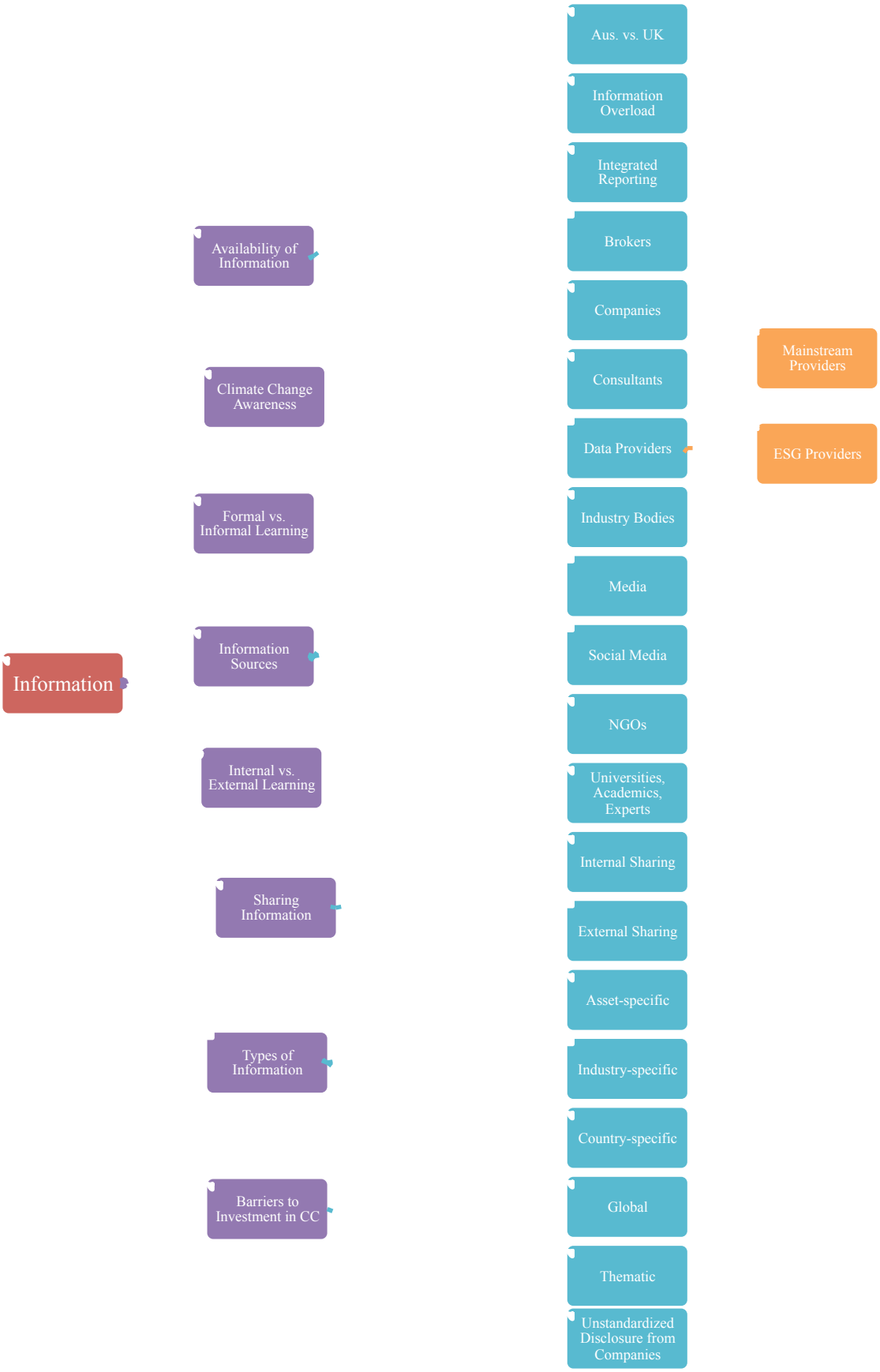
22. Is your organization a member of a group / network on the issue of environment or climate change? Please tick all that apply
    a. PRI (Principles of Responsible Investing) a.k.a UNPRI
    b. CDP (Carbon Disclosure Project)
    c. UK SIF (UK Sustainable Investment and Finance Association)
    d. A4S Investor Network (The Prince’s Accounting for Sustainability Investor Network)
    e. IIGCC (Institutional Investor Group on Climate Change)
    f. IGCC (Investor Group on Climate Change)
    g. RIAA (Responsible Investing Association Australasia)
    h. Don't Know
    i. No
    j. Other (please specify)

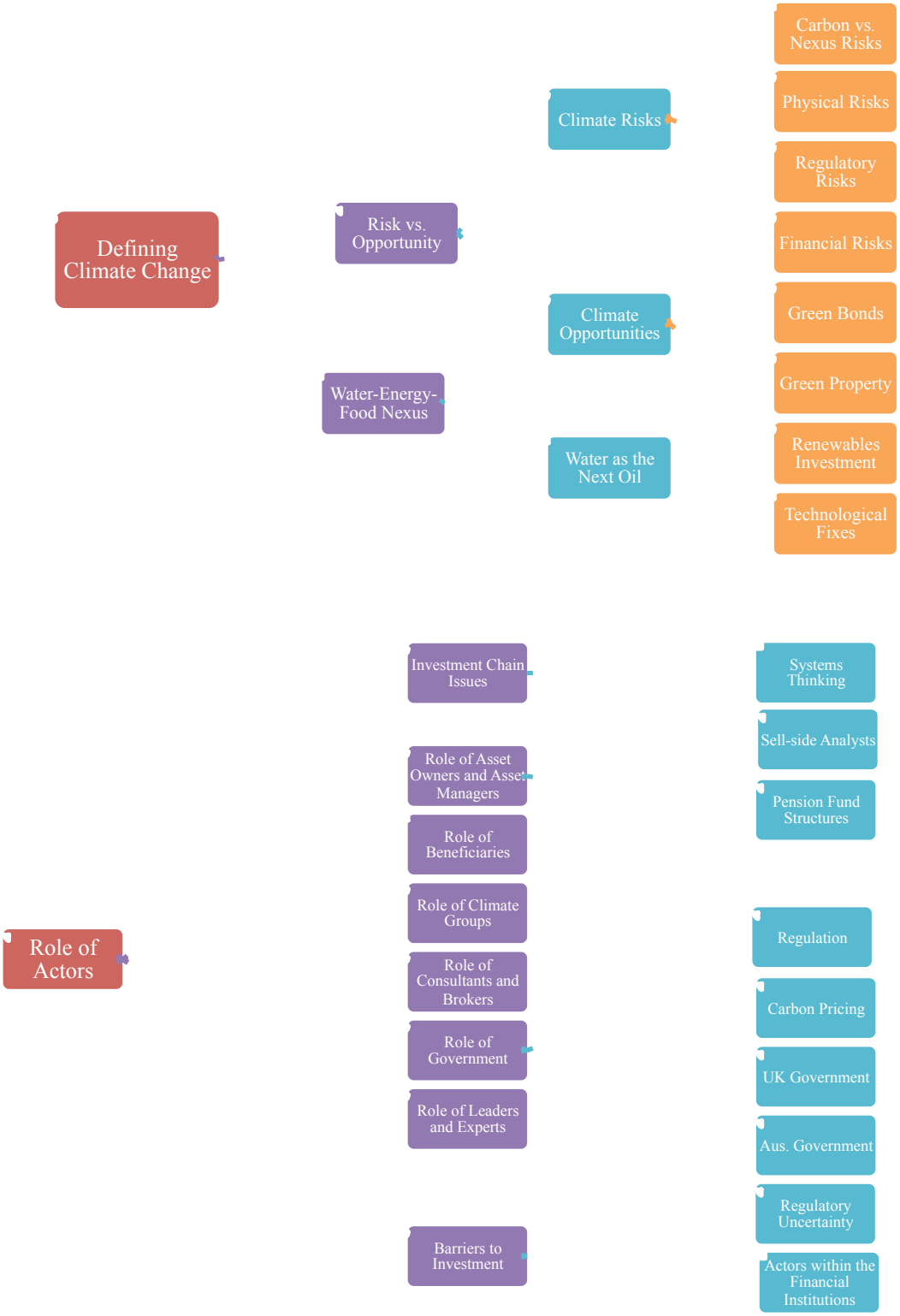
23. How often have you engaged with at least one of these groups / networks:
    a. Often (at least once a month)
    b. Occasionally (at least quarterly)
    c. Infrequently (once or twice a year)
    d. Rarely (less than once a year)
    e. Never
24. In what ways have you engaged with the groups you indicated above? Please tick all that apply
    a. Sit on a board or committee
    b. Attend workshops or conferences
    c. Read reports and newsletters
    d. Request further information
    e. Participate in meetings, webinars etc.
    f. Other (please specify)
25. Do you feel satisfied with the information provided by these groups?
    a. Very satisfied
    b. Somewhat satisfied
    c. Neutral
    d. Somewhat unsatisfied
    e. Very unsatisfied

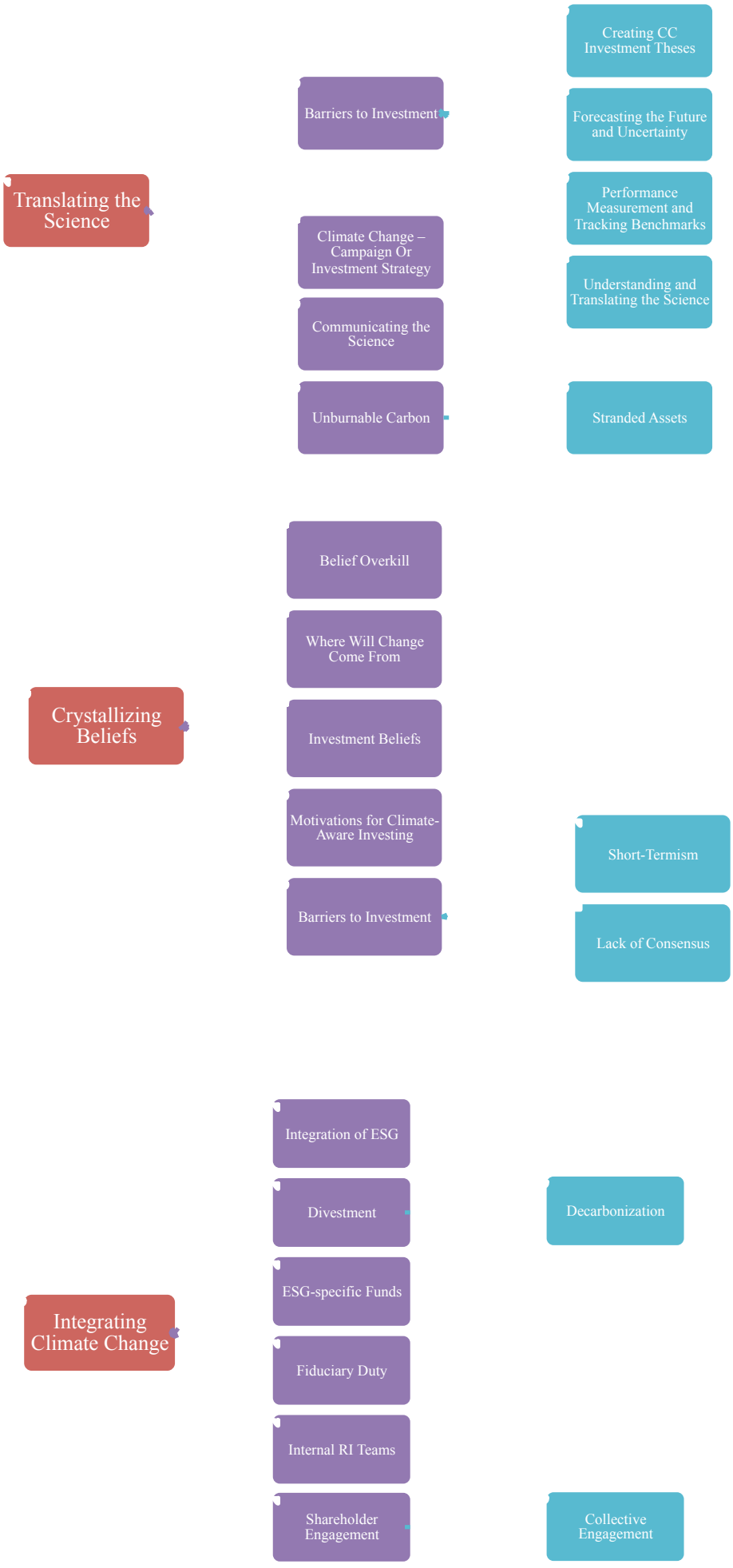
Contextual Information:

26. Please provide some background information
    a. Company
    b. City / Town
    c. Country
    d. Email
27. Which of the following best describes the firm at which you are currently and primarily employed?
    a. AM
    b. Investment Bank
    c. Pension Fund
    d. Sovereign Wealth Fund
    e. Other Financial Institution
    f. Other (please specify)
28. Which of the following best describes your current position at the firm you described above. Please tick all that apply.
    a. Trustee/Board member
    b. Executive
    c. Non-Executive AM
    d. ESG / SRI specialist
    e. Other (please specify)
29. Please feel free to leave any further comments on the issue of learning about climate change and the availability of climate information in the investment community.

Appendix 5: Coding Framework




Defining Climate Change
Risk vs. Opportunity
Climate Risks
Carbon vs. Nexus Risks
Physical Risks
Regulatory Risks
Financial Risks
Climate Opportunities
Green Bonds
Green Property
Renewables Investment
Technological Fixes
Water-Energy-Food Nexus
Water as the Next Oil
Role of Actors
Investment Chain Issues
Systems Thinking
Sell-side Analysts
Role of Asset Owners and Asset Managers
Pension Fund Structures
Role of Beneficiaries
Role of Climate Groups
Regulation
Role of Consultants and Brokers
Carbon Pricing
Role of Government
UK Government
Role of Leaders and Experts
Aus. Government
Regulatory Uncertainty
Barriers to Investment
Actors within the Financial Institutions


Translating the Science
Barriers to Investment
Creating CC Investment Theses
Forecasting the Future and Uncertainty
Performance Measurement and Tracking Benchmarks
Understanding and Translating the Science
Climate Change – Campaign Or Investment Strategy
Communicating the Science
Unburnable Carbon
Stranded Assets
Crystallizing Beliefs
Belief Overkill
Where Will Change Come From
Investment Beliefs
Motivations for Climate-Aware Investing
Barriers to Investment
Short-Termism
Lack of Consensus
Integrating Climate Change
Integration of ESG
Divestment
ESG-specific Funds
Fiduciary Duty
Internal RI Teams
Shareholder Engagement
Decarbonization
Collective Engagement

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