

**Re-imagining the risk landscape:
insurance, 'climate risk' and the barriers to change**

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This chapter explores the challenges currently being faced by the global insurance industry, linked to climate change and the changing socio-ecological landscapes within which the industry is now operating. It draws on a case study, undertaken by a team of natural and social scientists and in partnership with a leading South African insurer, already finding itself impacted by a rising rate of insured losses it associates with environmental change. As such, the insurer is becoming increasingly aware that the industry needs to proactively innovate new solutions to address the complex challenges faced.

In this light, the study explores the relationship between ecological and social drivers of environmental catastrophes (referred to as *climate risks*) and the impact these are having on the insurance industry. The study highlights how social influences on the physical landscape (such as land-use management), and referred to as *proximate drivers* of risk, often have equal, if not greater, and certainly more direct, impact on the size and scale of climate risks than ecological drivers (such as rainfall) alone.

In the past, insurers have focused on their ability to assess, and thereby manage risk exposure through actuarial analysis; the use of past claims data to help predict future probabilities for loss. This has proved to be effective in maintaining sustainable levels of risk exposure. But these socio-ecological changes occurring presents a risk landscape that is changing exponentially. This is rendering actuarial analysis increasingly unable to account for these changes.

This suggests actuarial analysis may no longer be as effective a tool for risk management as it once was, raising fundamental questions as to how insurance will continue to manage future risk exposure and what needs to be done to move it away from its traditional approach to risk management (i.e. improving risk management via the client).

In this light, the chapter reflects on what is behind the efforts by The Santam Group (Santam) to try and find ways of responding to the assessment and management of risk and, in so doing, help develop a new strategy for dealing with climate risk. In keeping with Hamann et al. (this volume), to understand the challenges faced by insurance, one must analyse the co-evolution of organisations, and their institutional surroundings, to help identify why companies respond to the need for change often by focusing on improving their existing technologies first before developing new ones.

Here we draw on the international insurance and business literature, referred to in this volume, which suggests that part of the reason is that innovation outside of the traditional ways of doing, is challenging for any industry, no-less-so than in this instance, that requires insurance to develop such a novel paradigm for risk management. Other constraints, including pre-existing business mentalities, the short-term nature of the industry, competition pressures and, unavoidably, the regulatory environment further compound their challenges.

Nonetheless, acknowledging and addressing these obstacles will be crucial if the industry is to remain resilient to the impacts of future climate risk, and is a key motivation behind Santam's efforts in this collaboration.

What follows is an overview of the relationship between the insurance industry and climate risk, including an overview of the 'Eden Study'. This is followed by an analysis of the international literature on what challenges the industry should expect to face as it seeks to change its approach to risk assessment and risk management.

Societies risk manager: in a climate of change

Since antiquity insurance has grown to become 'society's primary financial risk manager' (Hecht, 2008:1959), with early examples dating back to 3000 BC when Chinese merchants would spread their cargo across ships so as to reduce the risk of outright loss. The practice was so popular, and evolved so rapidly, that by the middle of the 17th Century, insurance had formalised and was flourishing across Europe, then the epicentre of global trade.

Today insurance represents 7% of global GDP, with commercial insurers alone turning over US\$4.6 trillion in annual premiums (The Geneva Association, 2011). This makes insurance the largest industry in the world; bigger even than the defense, oil, electricity generation and pharmaceutical industries (Phelan et al., 2011). With financial investments valued at US\$24.6 trillion insurance is also the third largest institutional investor, following pension funds (US\$29.9 trillion) and mutual funds (US\$24.7 trillion) (Maslakovic, 2011).

Insurance is regarded as society's risk manager as its core function is to provide the financial mechanisms that help transfer the risk of loss to others better equipped at managing it (Hecht, 2008). It does this by helping society to pool and diversify its resources (Nel et al., 2011), thereby supporting its clients to avoid having to accumulate onerous levels of savings, to safeguard against loss, in turn allowing them to focus on what they do best (The Geneva Association, 2009).

By helping to transfer and manage unpredictable risk in this way, insurance supports the growth of credit, debt and other equity markets that are key in financing trade (Lester, 2008). The 2005 United Nation's Conference on Trade and Development (UNCTAD) summarised the benefits of an active insurance industry, by helping to promote financial stability, support trade, commerce and entrepreneurial activities, and even relieve pressure on government budgets for other social security and health programmes, free from the shackles of having to set aside enough capital to cover worst-case scenarios (UNCTAD, 2005).

This makes insurance particularly crucial for emerging economies, as its support of supply-led growth underpins development by lowering the cost of identifying and researching

potential investments and mitigating the threat random shocks might have on new business initiatives (Levine, 2005). As such, there is increasingly strong evidence of a direct correlation between insurance, economic development and growth (Ward 2005, Liedtke 2007, Brainard 2008).

But to ensure its own resilience and to protect the broader risk pool against negligence or even malicious intent, insurance limits its exposure only to risks that are both *sudden and unexpected*, regarding more predictable losses as manageable and therefore should form part of any sound risk management strategy. Over time, the evolution of its tools for risk management has improved the capacity of insurers to engage in loss prevention and loss mitigation activities, beyond simply diversifying their risk to others (UNEP-Fi, 2010). These tools reflect its three core activities as a risk carrier (through assessing risk to control exposure), as a risk manager (through excesses and deductibles that incentivise risk management) and through its investment activities (such as catastrophe bonds) that transfer exposure to the financial markets.

Today insurance is faced by a far more complex and interconnected world that presents new, more contemporary hazards that threaten its activities. Climate change, arguably, is most concerning. Driven by sharp increases in anthropogenic carbon emissions, climate change has emerged as one of the primary threats facing the world in the 21st Century. The 2007 Intergovernmental Panel on Climate Change (IPCC) states that warming of the climate system since the start of the industrial revolution (1750) is now 'unequivocal', and that there is a 'very high confidence' that much of this can be attributed to human activities, particularly through the anthropogenic emission of greenhouse gasses (IPCC, 2007: 5).

As the levels of atmospheric carbon fast approach the recommended ceiling of 450–550 ppm CO₂, the natural buffering capacity of the earth's ecosystem has been severely compromised (Millennium Ecosystem Assessment, 2005). With temperatures estimated to rise by a likely 0.2 °C per decade over the coming century (Stern, 2007), the impact this will have on the earth's natural systems, predominantly those driven by the climate, is likely to be profound.

Already, significant increases in the size and scale of storms, and other weather-related disasters have been observed, with average overall losses rising from \$3 billion to well over \$16 billion per annum between 1970 and 2004 alone (Kunreather & Michel-Kerjan, 2007). By 2050, over 200 million people will have been permanently displaced due to flooding, sea-level rise and drought associated with climate change (Stern, 2007:345). The direct and indirect impacts of climate change will cost the global economy anywhere between 5% and 20% of GDP, according to the rate at which emissions rise in the future (Stern, 2007).

The poorest are being most affected due to their preexisting vulnerability to extreme weather conditions. In developing countries, weather-related disasters have risen from approximately 60 per annum in the 1980s to around 130 in 2010 (Jennings, 2011). Of these,

Africa is bearing the brunt, with the impacts of climate change being compounded by large-scale economic and demographic changes, such as rapid urbanisation, linked to shifting economic opportunities across the continent (Hope, 1998).

This deterioration in the environment is further compounded for the insurance industry by the weakness of past governance systems to establish the necessary *rules* to address climate change; a problem particularly evident in areas where state regulation and enforcement was already weak. Attempts to 'command-and-control', imposing penalties when environmental standards were breached (Gunningham et al., 1998), were somewhat successful in regulating larger businesses and more severe forms of environmental degradation (Cole and Grossman, 1999; Durant et al., 2004), yet were regarded as too costly, cumbersome and inefficient to implement effectively (Holley et al., 2011). Similarly 'cap-and-trade', along with a number of subsidy and pollution taxes (Gunningham et al., 1998), also proved largely ineffectual in regulating all but the largest industries and polluters and could only be applied in a limited number of contexts (Farrier and Whelan, 2004) requiring high levels of centralised planning and administration. Even business-led voluntary approaches, unsurprisingly favoured by industry, never truly succeeded, as initiatives tended to collapse the moment the threat of legal intervention, by the state, was lifted (Börzel and Risse, 2010) or opportunities for profit-making curtailed (Freeman and Farber, 2005; Gunningham and Sinclair, 2002; Holley et al., 2011; Porter and Kramer, 2002). These challenges have also been regarded as particularly tough in areas where pre-existing state-centered regulation and enforcement is already weak (Börzel and Risse, 2010).

This ongoing struggle to effectively manage climate change has highlighted the need for the development of alternative institutional mechanisms to help govern its cause and impacts. One approach is to explore the private regulatory institutions that i) are motivated to engage in mitigating the risks associated with climate change as it poses a direct threat to their objectives, and ii) have influence over other stakeholders and institutions that can effect change. The insurance industry has been identified as one such potential regulatory mechanism for helping to manage many aspects of climate change, including its mitigation and adaptation (Leggett, 1993; Paterson, 2001; Phelan et al., 2011).

Over the past few decades insured losses, linked to natural disasters, have risen by an average of 37% per decade (Mills, 2009) with the past ten years recording an exponential rise in the size and scale of catastrophic losses for the industry. The most notable was 2005, when hurricanes Katrina, Wilma and Rita contributed to the \$123 billion of losses, that made that year the costliest on record. More recently, 2011 was ranked second most expensive, at \$108 billion, saved only from the top spot by Japan not being 'fully insured' against the tsunami that devastated its north-eastern coastline (Business Week, 2011). However, predictions indicate that in the future, extreme year payouts, for the global insurance industry, could well range between \$400 - 1000 billion (Mills, 2005).

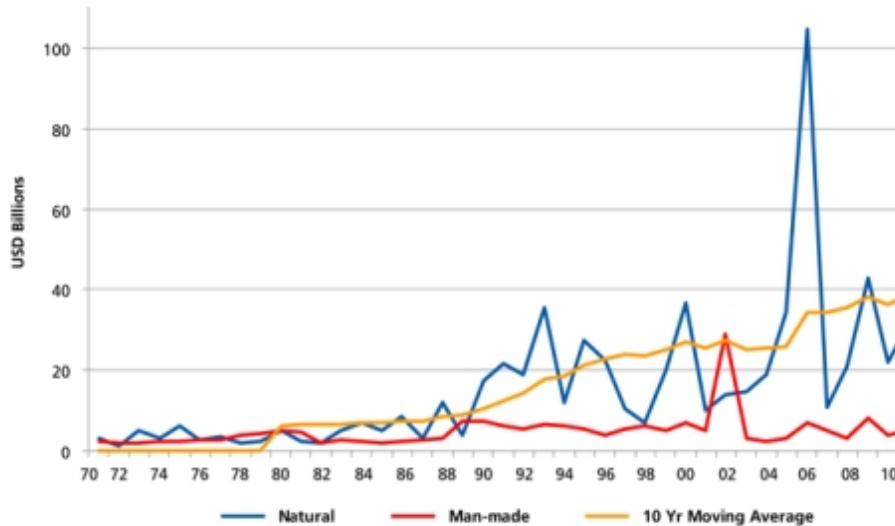


Figure 1: Trends in insured losses due to natural catastrophes and man-made disasters 1970 to 2009 (Guy Carpenter & Company, 2012)

Figure 1 clearly emphasises the rise in losses, for the insurance industry, over the past 40 years. Two features that stand out are the steady growth of the 10-year moving average and the increase in individual annual losses, both in frequency and intensity, which have occurred since the early 1990s. This highlights how vulnerable the insurance industry is to climate change, particularly through the exposure of many of the assets it underwrites to climate related natural hazards such as storms, flooding and sea-level rise. This is compounded by the propensity of people to gravitate towards living in these vulnerable areas (Kunreather & Michel-Kerjan, 2007).

Given the increasing exposure of the assets it insures to climate risk, insurance has been described as the industry with the most to lose due to climate change (Leggett, 1993; Gelbspan, 1998). As such, there is significant incentive for the industry to begin to address these risks and become more proactive in protecting the assets it underwrites in order to reduce its exposure. As the largest industry in the world, with its considerable financial resources and significant direct and indirect influence over its clients and the broader regulatory environment, insurance also has the potential to engage in meaningful climate change governance.

Early attempts to sway the industry in this direction date back to 1992, when Jeremy Leggett, then head of Greenpeace, sought to foster the involvement of insurers in global climate politics (Paterson, 2001). Leggett strongly promoted an attempt to mitigate GHG emissions, ‘through lobbying of industry, government, consumers, and shareholders’ (Leggett, 1993:4) to help focus manage the root cause of the climate risk impacting insured assets. This, in his view, offered the only viable long-term business model for the industry.

However, since the early 1990s the response by insurers has been more focused on adapting their existing business activities, to the impacts of climate change, than trying to mitigate its drivers (Phelan et al., 2011), presumably because this is where they felt they had most control and influence over risk.

Thus, the predominant focus of the industry has, until recently, been on finding ways to strengthen their existing actuarial systems, such as developing climate models to better predict future changes to the local environment (e.g. improving the accuracy of flood lines). This allows insurers to eliminate high-risk assets altogether or impose excesses and deductibles that transfer a portion of risk back to the policyholder. Despite the opportunities Leggett raised, examples of insurers engaging in more mitigative forms of risk governance have remained largely at the fringe of their business activities (Mills, 2009; Paterson, 2001). However, as the rate of losses increase, and insurance continues to respond by developing ways to identify, and then exclude, higher risk assets, so it may be one of the few industries investing in ways that ultimately reduce their potential client pool.

Proximate drivers of 'climate risk'

As the operating environment further deteriorates, and losses continue to mount, so insurers are coming to realize they can't simply continue to operate as they have in the past. But this raises questions as to what conditions are necessary to support the industry become more proactive in responding to climate risk.

In this light, and concerned about simply allowing its response to reflect that of the broader industry, Santam chose to contribute to a study that explored the challenging questions of how to identify and realise new, more innovative and sustainable ways for managing future exposure to climate risk.

Santam is a leading South African short-term insurance company active across Southern Africa and Africa more broadly. As one of the oldest, and largest, short-term insurers in South Africa, it specialises in multiple types of insurance and has successfully diversified its exposure, over time, across multiple lines of underwriting that now include personal and commercial but also far more specialized forms of insurance such as marine, agriculture and heavy industry.

The 'Eden Study' was initiated in response to Santam, like the broader global insurance industry (Mills 2005, UNEP 2007, Mills 2009), beginning to rethink the way it needed to engage in both assessing and managing the risk it underwrites, especially in light of the climate risk related losses they were beginning to accrue. The growing assumption was that the nature of climate risk was beginning to challenge the viability of how insurers have managed their exposure to risk in the past; in particular their dependence on actuarial analysis to help predict the future probabilities of risk occurring. It is this growing struggle of actuarial science, to account for the non-linearity of climate risk that is of most concern. As

such, Santam realised the industry may now need to identify new ways to support the traditional approaches they have relied upon to assess risk in the past.

The study explored the physical changes, linked to climate risk, being observed within the local environment in which insurance operates. It had two aims; firstly to better understand the dynamics of the new risk landscape insurance is operating within and secondly to try and describe the paradigm that shapes the industry's current and future response to climate risk. The intention was to explore how ecological and social drivers of risk, at local levels, have effected, and were likely to affect, the exposure of the insurance industry to future loss. An interdisciplinary partnership of climate, ecological and social scientists (including the authors of this paper) was formed to explore this.

In what follows is an overview of the 'Eden Study' followed by a broader discussion, drawing from the insurance and organisational literatures that anticipate some of the challenges insurance will face as it tries to navigate this new risk landscape.

In so doing, we highlight how the focus of the broader insurance industry has, until now, been on improving and tightening their existing technologies for managing exposure to climate risk; particularly their capacity to assess, and exclude, uninsurable risks. This helps them manage their own exposure to risk and protect the remaining clients in their risk pool. Yet the threat of this strategy is that over the long-term, as the prevalence of climate risk increases, so more assets are likely to become uninsurable, reducing the availability of insurable assets and potentially increasing the vulnerability of both the insurance industry and ultimately the communities within which they operate.

This focus on improving risk assessment, as a risk management strategy, is further called into question by the 'Eden Study', that highlights how climate risk presents both challenges - and opportunities - for the industry. It suggests that insurers should be developing ways to help them move beyond their current strategy of risk analysis and exclusion and, in so doing, promote new more proactive risk management strategies. The major challenge however, is how to achieve such change - a question the Eden Study sought to address.

The Eden Study

The 'Eden Study' was undertaken in the Eden Municipality, a coastal region on the Southern Cape coast of South Africa which, since 2005, has been at the epicentre of a number of volatile weather events. A series of floods and droughts, that occurred between 2003 and 2008, cost the region an estimated R2.5 billion (Holloway et al, 2010). Although 70% of this was borne by the local municipality (when the area was declared a national disaster zone), Eden has accounted for almost 80% of all 'special peril' losses alone, for Santam, over this period (J Nel et al. 2011).

Climate models, developed as part of the study, documented how Eden is undergoing significant shifts in its local climate, driven by a likely temperature rise of at least 1 °c by 2040. This is triggering significant increases in the frequency and intensity of related flooding, wild fire and storm events; with the impact of the latter expected to increase six-fold over the coming decades. In developing these findings it was found that while changes could not be predicted with a high degree of accuracy, due to the complex and interconnectedness of the social and ecological systems being studied, the models did begin to identify the main causes (proximate drivers) and effect (impacts) of climate risk at local levels in Eden (J Nel, 2011). This methodology, it was concluded, could support insurance to identify, and subsequently engage, the root cause of the climate risk impacting insured assets at local levels.

The study, like others (Mills 2005, UNEP), argued that by relying on past events to predict future risk constituted a 'recurring social miscalculation' and that the insurance industry had, and continued to, significantly underestimate the extent at which it could manage its exposure (D Nel et al 2011). Insurance's primary challenge was that it had not given sufficient weight to the relationship that exists between ecological drivers of risk (e.g. increasing rainfall) and more social (proximate) drivers present in the local landscape (e.g. land-surface hardening, deforestation etc.) that actively contribute to the impact of a climate risk (such as a flood event). These proximate drivers, the models found, often contribute more to the impact of a climate risk than the initial ecological drivers themselves (J Nel 2011). But this creates an opportunity for insurance to engage these proximate drivers of climate risk, leading to one of the key findings of the report that insurance in fact has 'more influence than it thinks it has' (Nel et al 2011) but is yet to acknowledge it. Instead insurance has come to see itself as a victim of increasing climate related losses, and associated failures on governing them when, in actual fact, it has considerable capacity to manage many of the drivers of climate risk.

One example of possible engagement is in the case of a regional town in Eden, sandwiched on the coast between the Indian Ocean and a large, environmentally sensitive estuary behind. This area has been especially exposed to floods over the past decade, causing widespread damage and huge losses for the residents, municipality and insurance industry alike. However, although the floods mainly occurred following periods of particularly intense rainfall, that swelled the estuary beyond capacity, a number of proximate drivers were identified to have contributed to the scale of the eventual flood. These included the local parks board that manages the estuary reportedly failing to have breached the blocked estuary mouth in time, thereby preventing the flood waters from flowing out to sea, poor historic planning decisions that allowed properties to be built in areas vulnerable to flooding and even the presence of a now defunct railway causeway, stretching across the estuary mouth, that affects the flow of water within the estuary. In addition, activities by other stakeholders in the broader water catchment area, including extensive felling of trees by the

local forestry company, also contributed to the speed at which water entered the estuary following a rainfall.

The relevance of this illustrative example is that while insurance has little direct or indirect influence over many of the ecological drivers of risk, it does have potential influence over many of these social variables (such as the activities of the municipal planning department or forestry industry) in shaping the flood. While complex, the example provides an indication of the sort of engagement possible for insurance. This could include supporting an update of the scientific data on which the local parks board base their estuary management decisions (acknowledged by them to be out of date), engagement of local government around urban planning and early-warning response strategies or engaging local agriculture to ensure that their land-use management strategies are aligned with the more prevalent threats of the region.

In light of the above, the 'Eden Study' recommended that the insurance industry needs to review its present operations and reshape its risk assessment and risk management policies and practices. As a result, Santam is currently in the process of assessing these recommendations and exploring possible future initiatives, like those introduced above, to help respond to these findings. Although it is too early to know what the results might be, it is nevertheless possible to anticipate, by exploring the existing literature on insurance and climate risk, what challenges insurers are likely to face, and some of the ways in which they might respond as they begin to rethink their approach to risk management.

Limiting the response

The 'Eden Study' helps to highlight the broader challenge that the insurance industry faces, of the crucial link between the physical and proximate drivers of climate risk, and the need to manage them more preemptively, and often beyond the traditional client-insurer relationship. There is now no doubt that the insurance industry is conscious of the threat it, via the assets it underwrites, faces from a deteriorating climate (UNEP, 2007). This explains the growth in the role sustainability is beginning to play (Mills, 2009) as the industry tries to balance its traditional distribution model with the more contemporary challenges its operating environment present.

While this has led to insurance shifting its understanding of, and response to, climate risks, the industry's current response, in managing this exposure, can still broadly be described as coordinated in concept yet fragmented in process. This is far from Porter and Kramer's suggestion that organisations' general response tends to be 'neither strategic nor operational' (2006: 3) but is still mainly limited to managing isolated threats rather than undertaking a more systemic approach to climate risk management, as proposed by the 'Eden Study'.

Here we draw on Kolk and Pinkse' (2005) typology of organisational responses to climate risk, which they describe as split between 'innovation' and 'compensation'. Innovation involves 'process improvement', 'product development' and 'new product and market combinations', that help reduce costs, while compensation includes activities such as greenhouse gas accounting, improvement to supply-chains and political activism. Accordingly, we find that insurers response to climate risk has tended towards a combination of both innovation and compensation, in particular through their search for ways that improve their processes, supply chain efficiencies and in creating new product combinations. However, as we have noted, both innovation and compensation activities are largely aimed at supporting insurance adapt its operations to better manage its exposure to climate risk, rather than developing new ways to manage it.

This response suggests that innovation is continuing to take place within the industry's established paradigms, which encourages a continuation of the same ways of doing, with just improved refinement and sophistication. This explains the resilient emphasis on improving risk assessment while developing ways to better incentivise the client to manage their own risk exposure. This has led to an increased focus on predictive modeling of climate risk (such as refining flood-lines), to strengthen actuarial models and allow insurance to further improve their underwriting efficiency.

Common throughout commercial insurance is the inclination to manage risk almost exclusively via the client-insurer relationship, as documented in Heimer's (1985) seminal study. Focusing on risk assessment in this way has worked well in the past, allowing insurance to work 'at a distance' (Rose and Miller, 1992) and rely upon established ways of thinking and associated systems and technologies. It is in these technologies that they still have a deep sense of faith. One of the benefits of this approach, and there are several, is that radical changes are not required and insurers can remain within their well-established 'rituals of comfort' (Braithwaite, 2008) avoiding having to make risk management decisions directly (Salt, 1998). But a major concern with this strategy is that simply by *tinkering* may not be enough to enable insurers to respond adequately to the growing challenges climate risks present, none less so than the loss of accuracy of actuarial analysis in predicting probabilities of loss.

Linked to Moser and Ekstrom's narrative, and as outlined in the introductory chapter, the insurance industry has, to date, focused its adaptation strategies for climate risk more around 'short-term coping' than longer-term, and thus deeper, 'transformations' of its business activities (2010: 1). This links to James March's (1991) analysis of the tendency of institutions, when addressing new challenges, to attempt 'exploitation' of their existing technologies before turning to 'exploration' of new ones. In his definition exploitation involves refinement and efficiency while exploration requires innovation and a degree of institutional risk taking. As such, the tendency is to view exploration as less certain, more remote in time, and organisationally more challenging. It is therefore seen as a higher-risk

strategy than exploitation as it requires organisations to move outside their operational comfort zones. However, as March emphasises, a learning process that focuses only on exploitation, over exploration, tends to promote responses that are potentially self-destructive (March, 1991: 73).

This is particularly true in the relationship between insurance and climate risk, as defined by the 'Eden Study', which highlights how the insurance industry needs to develop novel tools to manage the proximate drivers of climate risk more systemically and collaboratively. This includes engaging third party institutions that influence risk at the local level and impact, both directly and indirectly, the assets insurance underwrites. This requires insurance to move away from a reliance on simply strengthening its risk assessment to a strategy that mitigates climate risk before it impacts insured assets.

In this context, the 'Eden Study' raises the question as to why the insurance industry continues to make a series of choices that effectively remove them from the target of reducing their overall exposure to risk while increasing the availability of insurable assets? To explore the constraints limiting a more explorative approach to risk management, one needs to examine the historical and institutional environment in which insurance operates.

Historical mentalities

Insurance is guided by implicit choices locked in to many features of its organisational structures, such as the way it gathers information, embeds operational rules and practices, and incentivizes certain activities. These factors compound the challenge of thinking beyond the industry's historical 'blind spots', or implicit 'theories-in-use' (Argyris and Schon 1978), encouraging a search for solutions closer to where they have been found before (March and Simon, 1958; Cyert and March, 1963). This illustrates Bateson's (1973) observation that humans tend to look for responses to new challenges within already established solutions, preventing deeper or 'double-loop' (Argyris and Schon, *ibid*) learning processes from occurring. This explains the continued exploitation of established risk management technologies (i.e. through risk assessment) rather than exploration of new ways to manage risk by insurance (March, 1991: 71).

Risk assessment based on actuarial data is a model that has worked exceptionally well for insurance in the past and has a strong record of being profitable that supports this. Although it is now proving unsuitable for predicting non-linear forms of risk, rather than abandoning it, insurance is inclined to remain loyal and seek ways (such as through risk models) to help strengthen its accuracy. This is further supported by insurance's competitive environment, characterised by new entrants, such as banks and direct-insurers, that are targeting traditional insurers more profitable lines of underwriting. Traditional insurers competitive advantage is still perceived to be their actuarial data sets, providing them with a superior ability to assess more complicated risks due to their longer claims history. As such, traditional insurers are focusing their efforts on protecting their actuarial ability to assess

and price risk by centralising operations, diversifying their distribution channels and developing new product lines.

While this appears to be a sensible and calculated choice based on competitive strategies, the effect is that insurance is essentially further prioritising short-term adaptation of risk assessment over the development of new ways to manage risk. While it is clear that improving risk assessment remains a crucial feature of insurers overall response to climate risk - to help better inform risk management responses and avoid the highest-risk assets - a focus on risk assessment alone could actively shrink the available client base and increase the overall vulnerability of the rest.

The business model

Another challenge is linked to the demutualisation, or public listing, that insurance has undergone globally over the past three decades. While demutualisation is largely acknowledged to have been a necessary process - to help fund expansion in the face of increasing competition - the process brought with it a number of unintended consequences. The most significant was the introduction of shareholders and with them the need to focus on returning consistent profits, rather than on longer-term risk management strategies (Heimer, 1985, 2003). The first obligation for management is now to keep shareholders happy by delivering continual growth and profit that maintains 'value' for investors.

This pressure for short-term profit leads insurance companies to engage in a kind of 'adverse selection', intensifying competition among them to retain the good, and exclude the bad, risks (Baker, 2003). Some researchers argue that this may limit the capacity of insurers to unite individuals and groups around longer-term sustainability goals (Ericson et al., 2000) as insurers are now less flexible in their ability to plan for the future and to develop lasting partnerships with clients and the broader community.

This begins to explain why Leggett's appeal for insurance to become more mitigative in its risk management went largely unheeded. As insurance does not own the assets that emit GHGs and such a large gap exists between the point of emission and the impact of climate risk, many shareholders are likely to be unwilling to agree to investment that has such intangible returns (email correspondence: 24th April 2012). Active in an open and competitive market, if the pricing is too high and the clients are unprepared to invest in longer-term risk management they will simply move to a competitor.

This reality also impacts upon investment decisions which, for insurance, can constitute more than half of its overall profit and is therefore crucial in generating additional shareholder returns. In fact insurance has over time tended to become as dependent, or more dependent, on its investment returns than on underwriting profit (Heimer, 1985), certainly true in the United States and Europe, and increasingly so in other markets. This hints at why insurers seem reluctant to extend their sustainability strategies into their investment portfolios, as proposed by Jeremy Leggett (1993).

Unfortunately, like most industries, insurers are only likely to reduce their focus on short-term profits if they change as a whole, as this would require the adoption of a new set of industry norms. Yet there are examples of the industry achieving this in the past, such as the almost universal adoption, if not yet full implementation, of the environment, social and governance principles during the 1990s. Since 2009, the larger reinsurers have attempted to introduce similar, yet more insurance related, sustainability principles. These include the ClimateWise principles (ClimateWise, 2007) and, more recently, the 'Principles for Sustainable Insurance' of the United Nations Environmental Programme - Finance Initiative (UNEP-Fi) (UNEP-Fi, 2007). Yet the response by insurers has been fairly tepid, marked by broad and vocal interest, yet little real implementation.

The free-rider problem

There is also a general fear that, by engaging third party institutions influencing the proximate drivers of climate risk, will allow an insurer's competitors an opportunity to 'free-ride' off any reduction in risk exposure achieved. This is a significant deterrent as insurers would have to account for this eventuality to both their boards and shareholders, especially in instances where competitors gain a greater advantage, from any risk reduction efforts, than them. This particularly includes engagement with the broader (proximate) drivers of climate risk.

This is a classic 'tragedy of the commons' assumption (Hardin 1968). The problem is that if insurers engage in risk management in the broader risk landscape, by its nature this will benefit other companies, including those choosing to free-ride by not contributing to the collective efforts required by any collaboration. A related argument points to the possibility that if risk is reduced, premiums tend to follow a similar trend. Companies may end up spending more on risk management while failing to realise higher profits. Yet this argument is flawed given the potential for an escalation in claims costs or loss of clients altogether, should insurance fail to address climate risk more systemically.

To address this, insurers will need to highlight that engagement in the broader risk landscape not only improves underwriting but has a series of knock-on benefits as well. This includes positive marketing within the target community, improved relationships with local regulators or simply maximising the benefits associated with being market leader.

Perhaps the strongest support might come from industry associations representing insurers as a whole, thereby helping to eliminate the free-riding issues. There is little doubt a united industry forms a far stronger lobby group than individual companies acting alone, particularly with regard to negotiating with third party institutions and enforcing a coordinated response with clients. The Association of British Insurers (ABI) for example, successfully lobbied the UK government over improved flood defenses (Mills, 2009; Herweijer et al., 2009), threatening to withdraw flood cover altogether should they not

agree to invest, substantially, in infrastructure. Strong industry associations, such as these, can help to coordinate a more united – and thus more powerful – engagement in managing climate risk. They may also be able to better mobilise other stakeholders within the industry, including the intermediary (broker) networks, despite these often being a highly disparate and independent set of stakeholders.

But often the regulatory environment has weakened the capacity of industry associations to engage in issues beyond those relating to the industry's own internal regulations and this will need to be addressed before widespread progress can be realised.

The regulatory environment

As such, the regulatory challenge remains a crucial factor in governing the potential response by insurance in addressing climate risk. In more developed markets, particularly where climate risks are being hardest felt, insurance is finding itself increasingly restricted in how it provides and distributes its policies, settles claims and manages its risk appetite and investment portfolios. While a significant amount of regulation has emerged due to poor housekeeping by insurers (Klein, 2008), there is an additional threat that as climate-related losses rise, and policy costs correspondingly increase, so the regulation of insurance will become increasingly politicised. Insurance will then become regulated around partisan interests rather than linked to more strategic, future-orientated risk management strategies (Monkiewicz and Liedtke (eds.), 2011).

This occurred recently in several of the United States' Gulf states, where a series of large losses linked to hurricanes led to a shift in what and where insurers were willing to underwrite. This created a wave of negative public reaction that sharply politicised the provision of insurance in the southern United States and led to the regulation of insurance becoming a dominant feature of election campaigns (Herweijer et al., 2009). Insurers are now obliged to offer policies at depreciated premiums and to underwrite assets known to be highly vulnerable if they wish to operate in these usually profitable, yet highly volatile, markets (Grace and Klein, 2009). Thus, insurers seeking exposure in areas where high-premium income is available in the good years, do so at considerable risk and, in the event of major losses, possible insolvency. Conversely, in areas where the regulatory environment is overly weak, and the state unable to fulfill its mandate as *the insurer of last resort*, it is likely that regulation of the insurance industry will be core priorities of governments seeking to transfer responsibility over to the financial sector.

Yet regulation also impacts many other factors influencing the exposure of insurers to climate risk. The 'Eden Study' highlights the crucial role regulation plays in governing the risk landscape. While government regulation, in some form or another, exists universally, it is often unbalanced between its short-term and long-term objectives, opting to usually protect the immediate interests of its electorate rather than create regulatory environments that support risk management objectives over much longer-term time frames. As Paterson

(1999) argues, there are few indications that governments truly understand the crucial role insurance plays in climate risk governance.

Insurance regulation globally appears focused more on protecting the consumer and not necessarily aligned with addressing climate risk. Regulation, in its current form, tends to prevent the insurance industry from inventing collective solutions to climate risk, rather than facilitating it (Hecht, 2008). This is reflected, for example, in the undermining, via the competition laws, of the capacity of the South African Insurance Association's (SAIA) to facilitate collaboration between insurers in mitigating and adapting to climate risk. In the US, regulation is known to support the link between insurance and actuarial science, and thus insurers are limited in their ability to base their pricing on more predictive models that may indicate future risk exposure better. This creates a strong disincentive for the industry to seek other forms of knowledge as an alternative to using historical data (Haufler, 2006).

In many instances governments subsidizing the industry or covering the cost of major losses also effectively insulate insurers from risk and make them less sensitive to the challenges of climate risk (Haufler, 2006; Brieger, Fleck and MacDonald, 2001). While we find little evidence that state regulators of insurance have been captured by the interests of the industry - as the classical economic theory of regulation would anticipate (Stigler, 1971) - there is a strong argument that government regulation itself remains somewhat 'captured' by the same short-term mentality that limits insurance's response (see "The Business Model" above). This prevents, rather than facilitates, the capacity of the industry to move beyond its current mentality and to seek new ways to overcome its focus on short-termism, or free-rider problems.

This suggests there is a fine line between too much regulation and too little. On the one hand excessive regulation of insurance can lead to significant restraints in the industry's ability to explore new technologies and innovations. On the other hand, a weak regulatory environment limits the availability of tools for managing risk more proactively. As such, governments must support the insurance industry to explore more innovative forms of risk management, through their regulatory regimes, and thus avoid supporting further exploitation and refinement of the traditional ways of assessing and managing risk.

Towards 'climate risk' management

Insurance has a long and rich history as societies' primary tool for managing risk exposure. This has established the industry not only as a key driver behind economic growth but has led to it being regarded as a 'lightning rod' (Mills, 2005), that absorbs many of the broader levels of vulnerability society faces. However, while its tools and technologies for managing risk have worked well in the past, the emergence of climate change, and the corresponding increase in the size and scale of catastrophic losses, are throwing this into question.

The response by the global insurance industry to climate risk has, until now, been to find ways to improve their ability to assess, and exclude high-risk assets, thereby protecting both insurance and the remaining clients in its risk pool. But this has required a continued dependence on actuarial models, which are increasingly being acknowledged to be unable to account for the non-linearity climate risk presents. Their response has focused on strengthening their ability to assess risk, and exclude assets that pose too great a risk of loss. This is not only leading to a reduction in the availability of insurable assets but might also increase broader levels of societal vulnerability too. Instead, some insurance companies are beginning to explore ways to engage the broader risk landscape they operate within, particularly the many social (proximate) drivers that influence the impact climate risk has at local levels.

There is little doubt, given the threat climate risk presents, that the industry is, at present, not motivated to address these challenges. The paradox however is that one of the defining strengths of the industry, in the past, has been its ability to adapt to address new forms of risk and new operating environments (Ericson, 2005; Lobo-Guerrero, 2008). Yet its ability to adapt to the challenges of climate risk has not yet been as dynamic as in other examples. A tentative explanation for this is that the non-linear nature of climate risk obliges insurance to move away from one of its most defining assumptions; that nature is fundamentally stable (or linear) and thus predictable, resulting in actuarial analysis becoming increasingly unreliable as a means for accounting for climate risk. Adapting to this will require a far greater shift in how insurers operate than in any other point in the industry's past.

There are examples of insurers beginning to engage this challenge (Herweijer, Ranger, & Ward, 2009; Mills, 2009 and efforts by Santam in this chapter). However change will require many organizational and operational challenges to be overcome that continue to push insurance towards responding in ways it always has. These challenges are particularly acute with regard to the short-term nature of the industry, the threat of competition, and a regulatory environment that often limits a more systemic approach to risk management.

Changing the way insurance engages climate risk requires a substantial paradigm shift, no less so than in areas where weak and ineffective regulatory frameworks further undermine the ability to govern climate risk. As such, any response will require concerted efforts and collaboration both internally within the industry and more broadly with regulators, local risk-influencing stakeholders and indeed the broader population. But the very first step, is for the industry to acknowledge the threat they face from climate risk and the impact this is having on how they have traditionally managed risk.

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