development aid via Official Development Assistance (ODA), which mandates 0.7 per cent of GDP to be given to developing countries (Duetscher, 2009; Horstmann and Abeysinghe, 2011). Are "new and additional" funds simply additional to the status quo or are they in addition to previous pledges? Either way, the current sources of funding are insufficient and unstable to finance global climate adaptation (Duetscher, 2009).

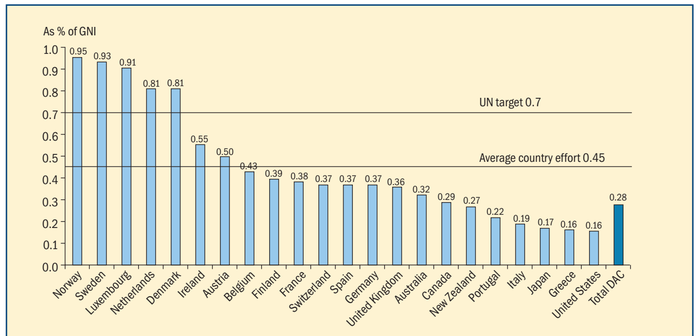
Why Adaptation Finance Requires Diverse Financial Mechanisms

Public finance should not be discredited, as it can play an important role in seed financing adaptation and/or development projects. However, obtaining investment grade and/or private finance for adaptation is critical to its long-term success. This section highlights five important reasons why[1]. First, investment grade finance is the most available form of finance. Second, even if all pledges (as from the UNFCCC mechanism) for adaptation grants are kept, the available funds will still fall short of what is needed (see description and critique of adaptation finance above). Third, investment grade finance lowers transaction costs: high transaction costs have plagued climate finance since inception (Bose, 2011). Fourth, the private finance sector is never restricted to one idea and different entrepreneurs will try out various methods to address adaptation; in the end the best idea will prevail. Fifth, investment grade finance for adaptation creates the potential for robust macroeconomics, especially when large amounts of money to the tune of US$100 billion a year could be available. Grants and pure public finance based activity will be inefficient when the activity is stochastic in nature (Buchner *et al.*, 2011).

Financial Derivatives

Financial derivatives, like responses to climate change, are stochastic. Therefore, adaptation finance can learn from financial derivatives (Kogut and Kulatilaka, 2001).

> 'A financial derivative is a security whose price is dependent upon or derived from one or more underlying assets. The derivative itself is merely a contract between two or more parties. Its value is determined by fluctuations in the underlying asset'. (Sourced from: Investopedia.com)



Net ODA in 2007– as a percentage of GINI

[1] These reasons were discussed at a presentation on ' Adaptation Finance' at CCDA II summit at the UN ECA convention centre and can be found in the theory of Financial Gradients (Bose, 2011)

Financial derivatives function because there are free markets. A free market is a place where individuals come to buy and sell a commodity at their own free will. Public finance, or development pledges, are mandated on donor parties and therefore do not represent a free market. What is required for market methods for adaptation is similar to traditional derivatives. More specifically, there is an underlying local phenomenon that requires international investors, which introduces the local phenomenon into the global market.

	Phenomenon	Market
Traditional Derivatives	Local	Global
Adaptation Derivatives	Local	Global

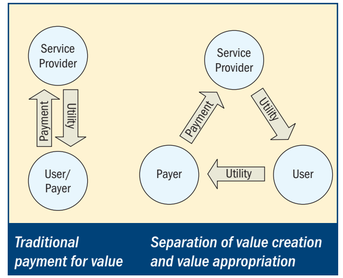
Given the need for adaptation and the varying local characteristics, it is important to further understand adaptation derivatives. Which adaptation actions can be transformed into a derivative and what mechanism(s) should be investigated? Once a market for adaptation derivatives is created, it can potentially lead to substantial investments in regional adaptation and attractive returns for investors.

Financial Gradients Matrix

One might question the viability of adaptation being financed by foreign investors who may not get direct value from a given adaptation project. It is important to note that value creation and value appropriation are separate entities within the business model (Zott

> Adaptation finance must consider the separation between value creation and value appropriation and develop innovative approaches to insure financial returns.

[2] http:// www.google.com/about/company/ history/



Traditional payment for value *Separation of value creation and value appropriation*

et al., 2011). To better understand this differentiation, consider the corporation Google Inc. Google's flagship product is an internet search engine that many people use, but do not pay for; however, Google is a financially viable company. Google made an innovative advertising strategy[2] called AdWords to form a business model that keeps the company financially viable. Therefore, the strategy to create value (the search engine) is separate from value appropriation (AdWords). Google provides value to its users, who in turn provide value to businesses that want people to visit their websites. The businesses then pay "Google" for words that, if searched for, will bring their websites into the view of the user. Similarly, adaptation will create value for many people. However, not all those who benefit may be able to pay for it. Therefore, adaptation finance must consider the separation between value creation and value appropriation and develop innovative approaches to insure financial returns.

Real Options

Given the uncertain nature of adaptation, localities will require real options to adequately reduce the risks of indeterminate change. Risks are associated with not only extreme weather events, but also other future uncertainties within the development

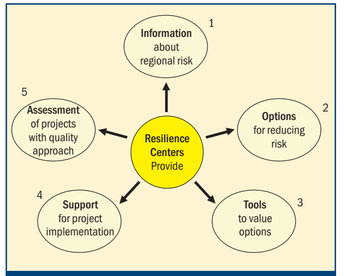
of social ecological systems, which if planned or executed poorly can lead to further risks. Therefore, instead of concentrating on disaster risk management, we coin the term Indeterminate Change Risk Reduction (ICRR). There are various kinds of uncertainties that affect the long-term profitability of proposed projects. Real options can incorporate these uncertainties into cost benefit analyses to provide a greater understanding of available scenarios for decision-makers (Dixit and Pindyck, 1994). 'Real options' enable flexibility for decision-making in areas where traditional economics and financial theory do not offer similar opportunities for decision-making (Gilbert, 2004). This can be useful in answering questions pertaining to future uncertain conditions pertinent to the context of climate change adaptation, such as:

- What is the value of waiting?
- What is the value of changing the path or the technological parameters of a project?
- What scale should the project be?
- Is it worthwhile to abandon a project?

For localities to identify and value real options, they require adequate information about regional risks, technology, and expertise, which are currently lacking in many developing regions (Mitchel *et al.*, 2010).

Resilience Centers

Information and intellectual and technical capacity, although available at the national or international level, are often unavailable at the regional level where disaster risks are most prevalent. Resilience and adaptation will require different approaches depending on the needs of each locality and therefore cannot be outsourced to a central headquarters. Resilience Centers (RCs) serve as a framework to operationalize the approach of financial gradients. RCs will bring together national and international resources with local stakeholders to cater to the needs of the localities they serve, thereby addressing the shortcomings



What Resilience Centers Do

of traditional adaptation finance, and presenting an innovative approach to indeterminate change risk reduction (ICRR).

A Resilience Center is a physical entity that serves a specific locality by bringing together stakeholders to help communities gather information (1), assess site specific risks and uncertainties to analyse available options (2), conduct qualitative and quantitative assessment of those options (3), assist in the implementation of decisions (4), manage and maintain best practices and processes, and provide ex-post analyses of adaptation and sustainable development projects (5). RCs create value by helping communities hedge against the risks of "indeterminate change" via the elucidation of real options available to that locality.

> Resilience Centers create value by helping communities hedge against the risks of "indeterminate change" via the elucidation of real options available to that locality.

How can Resilience Centers Fit into a National Context?

RCs can expand upon existing programs in India. The government of India initiated a scheme called Agriclinics and Agribusiness centers (NABARD, 2011) to support agriculture graduates open centers at the district level to provide agriculture services to local populations, free of cost. Agriclinics and Agribusiness will be financially viable over time. The government will provide the initial and working capital to implement and jump start an Agriclinics, over time the working capital will be appropriated from non-public finance sources (NABARD, 2011). Agriclinics will be managed by agriculture graduates from different universities in India, thereby increasing local capacity for knowledge in agriculture. However, this context or policy framework may not incorporate multi-disciplinary knowledge. Resilience Centers fill this gap and add value by synchronizing various activities from both government and non-government agencies.

Conclusion

Making the planet resilient and adaptable to indeterminate change while working towards sustainability will require hard work from myriad stakeholders. Communities all around the world are facing high unemployment rates. Sustainability is an opportunity for employment if we can bridge financial mechanisms and economic systems. Meaningful employment implies that work done creates value. Creating options is a means of creating value and therefore real options is a mechanism for value creation. Having an option is value in itself. Different entities will have different concerns, face different risks, have different priorities, and come up with different options; therefore, it is important to receive input from diverse sources and stakeholders. RCs elucidate non-biased potential options through data collection and analysis, and incorporate inputs from many sources, local, national, and international. Although the government may address adaptation, their options may be different from that of a developer or local resident of a community. Therefore, a non-biased, non-partisan entity is necessary to work to provide the full spectrum of options available for a given locality.

This paper has highlighted the uncertain risks of indeterminate change that communities face all over the world. It has identified international concern for adaptation and financial mechanisms aimed at addressing best practices for it. Furthermore, it has identified shortcomings in the current structure of adaptation finance and presented a framework approach that addresses those gaps and attempts to fill them with an innovative approach to Indeterminate Change Risk Reduction (ICRR). Resilience Centers is a promising approach to promoting best practices for resilience, adaptation, sustainable development, and disaster risk management. However, it is just a theoretical construct that, at this point, has not yet been implemented in practice. To address the global need for ICRR, Resilience Centers must be put into operation as an option to promote a sustainable future.

References

Bapna M and McGray H. 2008. ***Financing Adaptation: Opportunities for Innovation and Experimentation.*** Washington, DC: World Resources Institute.

Bose A. 2011. **Climate Finance and Financial Gradients: perspectives and methods.** *International Journal of Regulation and Governance* **11**(2).

Buchner B, Falconer A, Hervé-Mignucci M, Trabacchi C, and Brinkman M. 2011. ***The landscape of climate finance*: *CPI report.*** Venice: Climate Policy Initiative.

Burton I, Diringer E, and Smith J. 2006. ***Adaptation to Climate Change: international policy options.*** Arlington, VA: Pew Center on Global Climate Change.

Deutscher E. 2009. **Development Co-operation Report 2009.** *OECD Journal on Development* **10**(1): 151.

Dixit A K and Pindyck R S. 1994. ***Investment under uncertainty.*** Princeton, NJ: Princeton University Press.

Gilbert E. 2004. **Investment Basics XLIX: An introduction to real options**. *Investment Analyst Journal* **60:** 49–52.

Gupta M. 2011. ***The global assessment report on disaster risk reduction.*** United Nations International Strategy for Disaster Reduction.

Hallegatte S. 2009. **Strategies to adapt to an uncertain climate change.** *Global Environmental Change* **19**(2): 240–247.

Horstmann B and Abeysinghe A C. 2011. **The Adaptation Fund of the Kyoto Protocol: A model for financing adaptation to climate change.** *Climate Law* **2**(3): 415–437.

Klien R. 2011. ***Ensuring equity, transparency and accountability, for adaptation finance.*** Stockholm Environmental Institute.

Kogut B and Kulatilaka N. 2001. **Capabilities as real options.** *Organization Science* **12**(6): 744–758.

IPCC. 2007: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon S, Qin D, Manning M, Chen Z, Marquis M, Averyt K B, Tignor M, and Miller H L (eds.)]. Cambridge, United Kingdom, and New York, NY, USA: Cambridge University Press, 996 pp.

IPCC. 2012: *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation.* A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field C B, Barros V, Stocker T F, Qin D, Dokken D J, Ebi K L, Mastrandrea M D, Mach K J, Plattner G -K, Allen S K, Tignor M, and Midgley P M (eds.)]. Cambridge, United Kingdom, and New York, NY, USA: Cambridge University Press, 582 pp.

Mitchel *et al.* 2010. **Assessing progress on integrating disaster risk reduction and climate change adaptation in development processes.** Details available at <http://community.eldis.org/.59e0d267/Convergence.pdf>

NABARD. 2011. Circular No. 145 / ICD - 35 / 2011, 2 August 2011, Agriclinic and Agribusiness Centers Scheme - Final ACABC Compendium.

UNFCCC. 2012. **Funding for adaptation**. Details available at http://unfccc.int/adaptation/implementing_adaptation/adaptation_funding_interface/items/4638.php, last accessed 30 October 2012.

UNFCCC (b). 2012. **Financial, technology and capacity-building support. The Cancun Agreements.** Details available at <cancun.unfccc.int/...and... /new-long-term-funding-arrangements>, last accessed 12 November 2012.

World Bank. 2010. ***The cost to developing countries of adapting to climate change: new methods and estimates.*** Washington, DC: The World Bank. 84 pp.

Zott C, Amit R, and Massa L. 2011. **The Business Model: Recent Developments and Future Research**. *Journal of Management* **37** (4): 1019–1042.

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DISCUSSION PAPER

The Future of Adaptation Finance

Arnab Bose, Jedamiah Wolf, and Seema Sharma

Abstract

Communities all over the world require adaptation strategies and adequate funding to prepare for the uncertain risks of climate change. The current funds available for development —let alone "new and additional" funding for climate change—are volatile and insufficient. This paper proposes that for climate adaptation to be successful it must seek diversity in types and sources of finance (including investment grade finance), rather than being funded solely via public aid, as has historically been the case. This paper suggests that adaptation finance should separate value creation from value appropriation and that localities require real options to hedge against potential risks of indeterminate change.

Introduction

Given the risks and uncertainty of climate change, communities will need options to build resilience to potentially more frequent and more extreme catastrophic weather events (Hallegatte, 2009; IPCC, 2012). Options require adequate financial mechanisms to serve as reliable and sufficient adaptive strategies. "The challenge is not successfully managing a transition from one equilibrium climate to another, but rather, adapting to a far more uncertain climatic future" (Burton *et al.*, 2006). This paper will give a description and critique of the current available financial mechanisms for climate adaptation. It will provide an argument for why adaptation finance requires diverse financial mechanisms and a means to develop real options to be successful. It will introduce an approach to create real options, called Resilience Centers. It will provide an Indian case study and conclusion.

Description and Critique of the Current Financial Mechanisms

The IPCC and multilateral development organizations, such the United Nations and the World Bank, have identified the need for adaptation finance and have developed several initiatives to gather funds (IPCC, 2007; UNFCCC, 2012). It is often argued that because developing nations have contributed the least to—but are likely to be affected the most by—climate change; it is the responsibility of developed countries to finance climate adaptation (Bapna and McGray, 2008; Horstmann and Abeysinghe, 2011). The previously mentioned initiatives from multilaterals (such as the Adaptation Fund and the Green Climate Fund [GCF]) attempt to get developed countries to pledge new and additional funding for climate change. The amount required and the sources of funding are up for debate. The World Bank estimates that between 2010 and 2050, US$75 to US$100 billion will be required annually for adaptation in developing countries (World Bank, 2010). The GCF has pledged to gather US$100 billion per year by 2020 for climate mitigation and adaptation; however, the sources of finance have not been identified (UNFCCC (b), 2012).

There is a debate between developed and developing countries about the meaning of "new and additional" funds (Klein, 2011). Most developed countries fall short of meeting pledges for current

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