Microloans, Climate Change Adaptation, & Stated Investment Behaviour in Small Island Developing States – A Fiji Case-Study

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A thesis submitted to the Department of Geography and Environment of the London School of Economics and Political Science (LSE) in fulfilment of the requirements for the degree of DOCTOR of PHILOSOPHY, London, November 2014.

DECLARATION

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

I declare that my thesis consists of 99,070 words.

JOINT WORK

Chapter 2 was published as:

Laurent, E., & Sharma-Khushal, S. (2015). *Climate Change and SIDS – A Voice at COP21 for Small Farmers*. Issues Paper. Technical Centre for Agricultural and Rural Cooperation .

Within this thesis, Chapter 2 only includes components exclusively written by myself. However I state that there was a 10% contribution from the lead technical expert through jointly editing those components.

"There is no economic imperative that will condemn us to deplete our vital resource base, but neither is there an invisible hand that will prevent us from doing so."

– Jeffrey D. Sachs, 'Common Wealth: Economics for a Crowded Planet'

"Economic development is something much wider and deeper than economics, let alone econometrics. Its roots lie outside the economic sphere, in education, organisation, discipline and, beyond that, in political independence and a national consciousness of self-reliance."

– E.F. Schumacher, '*Small Is Beautiful: Economics as if People Mattered'*

"The truth is that we have never conquered the world, never understood it; we only think we have control. We do not even know why we respond in a certain way to other organisms, and need them in diverse ways so deeply."

– E.O Wislon, 'Biophilia'

Dedicated to

My Amazing Parents

&

My Most Wonderful Husband,

Nehal

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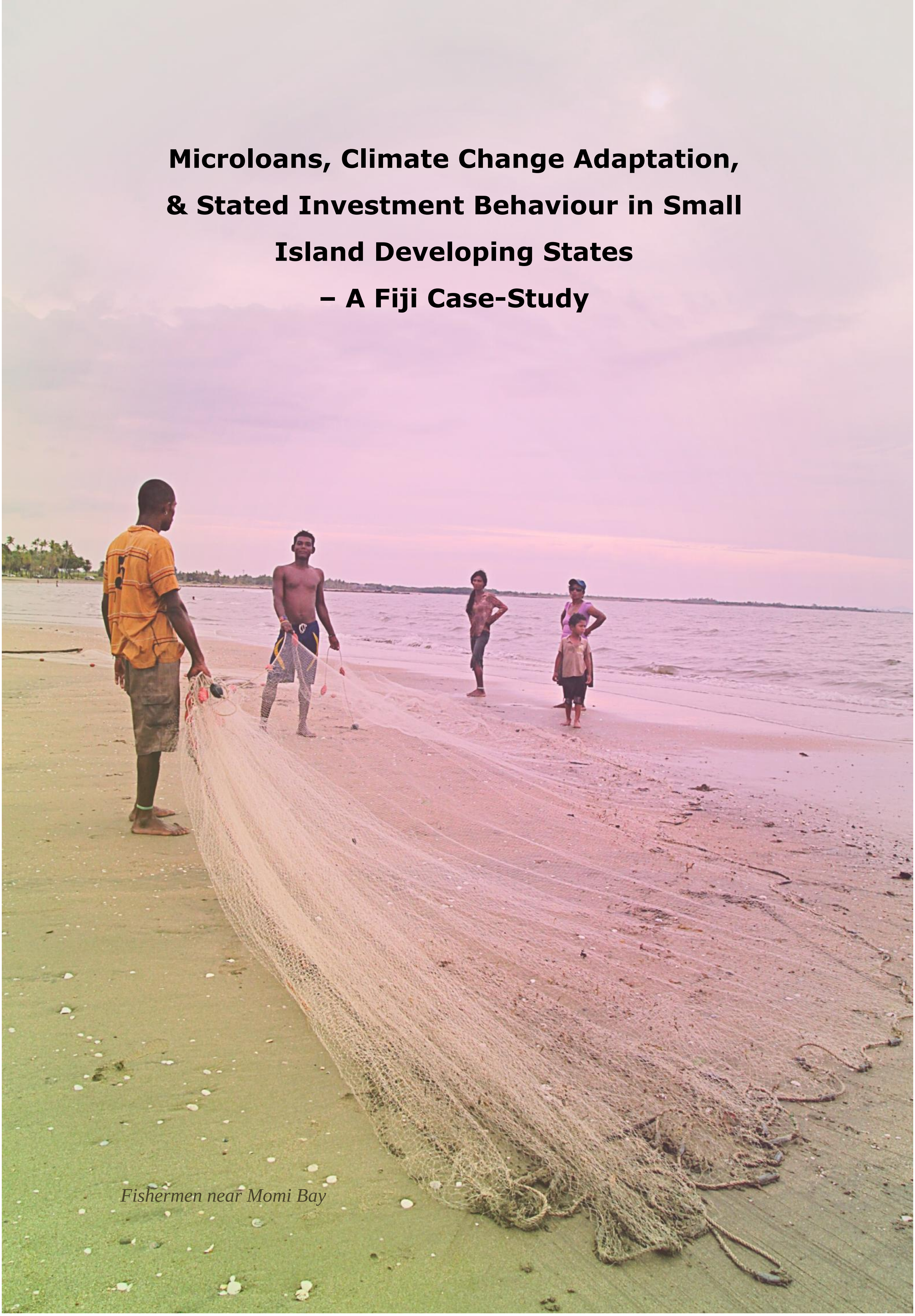

Fishermen near Momi Bay

ABSTRACT

Anthropogenic climate change and environmental degradation impacts are no longer a worry for the distant future but a real concern for the present. Small Island Developing States (SIDS) and the poor, who often live by fragile ecosystems, are amongst the most vulnerable and exposed to the impacts of climate change. For these populations, climate related risks exacerbate other stressors and negatively impact livelihoods, security, and health. For low lying SIDS in particular, an additional fear is that climate change endangers their whole way of life, with their nationhood and culture being slowly engulfed by the approaching sea.

Whilst the need to adapt is apparent, adaptation funding and motivating people to take up adaptive behaviours is a serious challenge. According to the ODI, financing climate change adaptation in the developing world can cost upwards of US$ 100-450 billion a year. Building adaptive capacity through cost effective solutions such as microloans for adaptive investments can be a promising strategy. By utilising the case study of Fiji, this Thesis attempts to unpack the cognitive drivers of climate change adaptive stated investment behaviour through a survey-based experiment (*N*=205). The prominent empirical method employed in this thesis was mediation analysis and specifically path analysis whereby the model specified is driven by theory. The choice of this method is justified through a comparison with multinomial logit.

In the first instance, the antecedents of climate adaptive stated behaviour and the impact of information on subsequent stated behaviour were assessed through the framework of the Theory of Planned Behaviour. In addition perceptions to climate change in Fiji were explored through guided interviews (*N*=50). Overall positive attitudes, subjective norms and perceived behavioural control towards conservation and adaptation positively influenced intention to invest in adaptive strategies though intention only significantly influenced subsequent stated behaviour when information on climate change adaptation was provided.

Next, the efficacy of incentives in engaging adaptive investments was assessed. The results indicated that the use of ‘green’ incentives (whereby loans are contingent on ecosystem impacts) was most conducive to the choice of adaptive investments over non-adaptive. In addition behavioural intention significantly mediated stated investment behaviour under the green incentive condition – which it is argued may show that such incentives crowd-in internal motives for engaging in environmentally protective behaviours.

We also found that ethnicity was a strong positive moderator of behavioural antecedents and subsequent stated investment behaviour.

Lastly the moderators of stated behaviour and its antecedents were examined by exploring resource dependence, perceived shocks, and perceived severity of environmental and other issues. Again, it was found that green incentives were successful in engaging people to take up adaptive investments more so then under a dynamic (whereby loans are contingent on repayement) and a no incentive condition. It was found that perceived shocks, and resource dependence could significantly impact cognitive antecedents of behaviour as specified by the Theory of Planned Behaviour and in particular perceptions of behavioural control. Shocks, resource dependence and perceived severity also moderated subsequent stated behaviour, with greater variability between between adaptive and non-adaptive investment choices under the no incentive and dynamic incentive conditions. The latter had a greater probablity of agents choosing non-adaptive over adaptive investments whilst in the former the opposite was true. Overall the results can be useful for adaptation policies, microloan best practice, and behavioural change interventions in SIDS in particular.

From this point forward, any reference to behaviour as examined by this thesis – specifically microloan investment behaviour refers to stated behaviour.

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ASAP	Adaptation for Smallholder Agriculture
CBC	Community Based Conservation
CBD	Convention on Biological Diversity
CFI	Comparative Fit Index
COP 21	UNFCCC 21st Conference of the Parties
CPR	Common Pool Resources
FLMMA	Fiji Locally Managed Marine Area
ICDPs	Integrated Conservation and Development Projects
IFAD	International Fund for Agriculture Development
IPCC	Intergovernmental Panel on Climate Change
LDC	Least Developed Country
MDG	Millennium Development Goals
MFIs	Microfinance Institutions
NEP	New Environmental Paradigm
ODI	Overseas Development Institute
PD	Prisoners Dilemma
PMT	Protection Motivation Theory
RMSEA	Root Mean Square Error Approximation
SAMOA Pathway	SIDS Accelerated Modalities of Action
SEM	Structural Equation Modelling
SIDS	Small Island Developing States
SRMR	Standardized Root Mean Square Residual
TPB	Theory of Planned Behaviour
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
WLSMV	Mean and Variance Adjusted Weighted Least Squares
WWF	World Wide Fund for Nature

ACKNOWLEDGEMENTS

I take this opportunity to thank my supervisor Salvatore Di Falco for his support and guidance, and the London School of Economics not only for feeding my mind with hopeful ideas and exposing me to some of my heroes, but also for the studentships which helped me fund my PhD. I would also like to extend my gratitude to my examiners, Professor Fredrik Carlsson and Professor Susana Mourato, for their useful feedback.

I cannot begin to convey my indebtedness to Nalini and Athil Narayan for their kindness and hospitality in Suva and my research assistants, Josephine and Solo for their efforts. Additional thanks go out to the Fiji Sugar Cane Growers Council for their hospitality and assistance with my fieldwork in Fiji's Western Division.

To all my beautiful family and friends I lost during the process of this PhD; I love you and miss you – K you were such a big inspiration for me – you showed me that I could find an endless space of wonder and meaning by looking to the earth and the beauty of our natural world. I miss you every single day my friend and I carry you in my heart always.

To my sweet husband and best friend; your confidence in me, even when my own had failed, has pushed me forward up this tremendous and volatile mountain. You have been an inspirational source of support for me. Thank you.

Finally, my loving parents, there are no words to express my gratitude. How can you thank someone for everything? Without your encouragement and belief, I would not be here. You are the best role models anyone could ever have. Thank you.

1 A REVIEW OF ECOSYSTEM-BASED ADAPTATION, MICROLOANS & PSYCHOLOGICAL THEORIES OF BEHAVIOUR

[1]

[1] Nausori highlands – sugar cane farmer walking home.

1.1 INTRODUCTION

A prominent challenge in promoting environmental conservation and climate change adaptation behaviours centres on the creation of pecuniary and non-pecuniary value around common pool resources such that it leads to improved environmental stewardship. New strategies will need to be sought where possible such that the objectives of conservation and development are maintained. One strategy which may show promise in meeting the triple bottom line of sound economic, social and environmental objectives is microloans. Over the last several decades microfinance has transformed into a social movement and has widened its focus from poverty alleviation to addressing the myriad problems that surround poverty such as (but not limited to) empowering women, environmental degradation, lack of education and access to healthcare. In recent years we have seen a greater movement towards microfinance being used as a tool in the struggle to conserve the natural world. Some have put forth the usefulness of microfinance as a positive adaptive strategy against climate change as it enables the diversification of incomes and provides a buffer against shocks (Anderson & Locker, 2002; Araya & Christen, 2004; Agrawal & Carraro, 2010; Polman & Uniyal, 2008). Indeed Microfinance Institutions (MFIs) are picking up on its utility as a strategy to promote positive environmental behaviours alongside social and economic agendas, with popular microfinance databases such as the 'themix.org' showing a growing number of MFIs paying attention to their social responsibility to the environment.

A lack of impact assessments and literature means that there remains a gap in understanding whether microfinance is a viable tool in reaching conservation and climate change adaptation objectives. This thesis focuses on the microcredit[2] component of MFIs. It attempts to unpack some of the processes at work in environmentally responsible applications of microloans by exploring the effect of endogenous behavioural antecedents (specifically attitudes, subjective norms, perceived behavioural control and behavioural intention), exogenous variables (such as exposure to information and threat) and explicit microloan incentives on climate adaptive investment behaviour.

As those most vulnerable to the effects of climate change also live within fragile ecosystems, it is important to look at climate change adaptation and conservation in conjunction. In doing so we are referring to ecosystem-based adaptation. Ecosystem-based adaptation is a term coined by the Convention on Biological Diversity (CBD). It refers to

[2] Microcredit is the extension of small loans to the poor. Such a loan is referred to as a microloan.

“[the integration of] biodiversity and ecosystem services into an overall adaptive strategy [which] can be cost-effective and generate social, economic and cultural co-benefits and contribute to the conservation of biodiversity” (Secretariat of the Convention on Biological Diversity, 2009, p9.) At its core such adaptation looks at the impact of climate change on humans and nature, taking into consideration the indirect and direct impact of climate change on conservation targets, ecosystem processes and human communities. Strategies are focused on the restoration and conservation of ecosystems which in turn help people adapt to the impacts of climate change. It includes strategies such as: mangrove restoration for coastal defense and flood regulation, agro-biodiversity conservation (crop diversity) and sustainable land management for soil health.

Ecosystem-based adaptation is important as it does not only focus on human well-being but the well-being of the planet as a whole. The state and quantity of natural capital provide flows of value to human well-being and is known as ecosystem services. Ecosystems provide supporting (for example soil formation and photosynthesis), provisioning (for example crops and fresh water), regulating (for example carbon sequestration and climate regulation) and cultural services (for example spiritual and recreational values). Anthropogenic climate change directly threatens ecosystem services by placing pressure on natural systems and species that are unable to naturally adapt at the current rate of warming. Ecosystems and species which inhabit narrow geographic and climatic ranges such as mangroves, montane forests, and overall island ecosystems are particularly vulnerable to adverse impacts of climate change (TEEB, 2010; Secretariat of the Convention on Biological Diversity, 2009). Such important and unique ecosystems constitute what we refer to as ‘fragile ecosystems’. The fact that much of the rural poor are also clustered around such fragile ecosystems and rely on the resources it provides for subsistence, can compound degradation of the system and poverty of the populations which call it home (Barbier, 2012).

However herein arises an opportunity for microcredit. Microcredit, theoretically, is a tool to empower the poorest and most vulnerable people in society. As such it could show potential in reaching the rural poor who live by fragile ecosystems. From an ecosystem-based adaptation perspective the additional draw of microcredit is in engaging and empowering women. In the Global South women also experience the most acute effects of climate change as they are left to manage natural resource needs (such as water and foraged wood and food) with little legal or social control over resources and limited capital accumulation opportunities (Jones et al, 2010). At the same time women are integral to successful adaptation and conservation measures as they possess critical knowledge and experience in agriculture, food security, livelihoods, income generation, management of households and natural resources in diverse eco-systems (Goh, 2012). By including environmental dimensions to microcredit, the potential to empower women and protect ecosystems seems viable yet we are still at the embryonic stages of understanding how such tools can change behaviour.

In 1794, as the revolution raged in France, Condorcet wrote his masterwork, Sketch for a Historical Picture of the Progress of the Human Mind. In it he put forth the idea that the laws that govern nature need not be limited to the natural sciences. In fact, he proposed that the development of intellectual and moral faculties have similar laws which govern them. Condorcet opened the realm of the social sciences with his optimistic intellectual and social history of humanity (Wilson, 1999) urging us to examine every nook and cranny of why we are who we are. Why is this relevant to this thesis? The fact is that humanity resides in a space which is not separate from the natural world. We were born from it and one day we will return to it. We do not own it, but we are its stewards. In the last few centuries our stewardship has faltered and we have begun to view the earth no longer as a vital component to our being but as a commodity to be used. In fact, the prevailing school of thought is that nature needs to be treated as a commodity to justify saving it. However such a view is short-sighted as it presents the intact value of natural resources as implicitly for those alive at the present time and into the relatively near future (a few generations at best). Indeed novel financing methods are being developed to bridge capital from microloans to the local and global value of intact environmental resources to facilitate environmental stewardship. However at the same time there is much potential of the same tools to create value around good behaviour, for instance through the use of incentives. In doing so you have the potential to create lasting change, for instance; through shifting attitudes and values, the social norm may become one of environmentally responsible behaviour which is passed down to future generations.

To correct the maladaptive relationship which we have adopted it is important to understand the mechanisms which drive environmental behaviour. This thesis seeks to assess the potential of microloans and the deeper cognitive drivers it may tap into to drive adaptive investment behaviours for people living near fragile ecosystems. It does so through the case study of Fiji where a survey-based experiment was employed. The thesis is arranged over 11 chapters. Chapter one sets the scene by introducing the concepts of Common Pool Resources

(CPR), Integrated Conservation and Development Projects (ICDPs), microfinance, theories of environmentally protective behaviours and ecosystem-based adaptation initiatives which have incorporated microfinance within its strategy. The gaps in the literature are identified and wider contributions stated.

Chapter two is very brief. It arranges the scope, contribution and research questions for this thesis. Chapter three looks at the problems climate change poses to Small Island Developing States and smallholders. It presents solutions and illustrates the issues through case-studies. Chapter four introduces the case study of Fiji.

Chapter five is a personal narrative of the research experience. Chapter six introduces the research methodology and also discusses survey based experiments and the design of the psychological survey instrument.

The next three chapters are three different studies. Chapter seven builds an understanding of climate change perceptions of people living by fragile ecosystems in Fiji. Chapter eight, Employing Structural Equation Modelling utilizes the psychological framework of the Theory of Planned Behaviour (TPB), to examine the cognitive antecedents of adaptive microloan investment behaviour and the role of information in inducing behaviour change. Chapter nine looks at whether extrinsic motivation can crowd-in adaptive behaviour. It does so through a path analysis that extends the TPB to understand how contextual factors and microloan incentives impact subsequent adaptive investment behaviour. Chapter 10 weighs up the empirical method employed in the previous chapter by replicating the study but this time using the analytical method of multinomial logit. Chapter 11 further extends our understanding of incentives. It borrows the concept of threat appraisal from Protection Motivation Theory (PMT) which is added to the TPB framework to assess the effect of perceived shocks and threats on subsequent adaptive investment behaviour. Chapter 12 draws together findings and draws the thesis to an end.

1.2 CLIMATE CHANGE AS A COMMONS DILEMMA

Following the critical decisions made at the UN Climate Summit in New York in September 2014, the twenty first session of the UNFCCC Conference of Parties will see world leaders attempting to come to a global agreement to reduce emissions and strengthen climate resilience. For scientists, COP 21 is the last chance for our representatives to take action and secure the future for subsequent generations. Whilst there is debate surrounding the economic price of concerted political action, one thing is clear; the price of inaction is far too great. Whilst mitigation remains crucial, the speed at which warming is now occurring highlights the urgency of climate change adaptation. To better understand how such decisions are made, it is important to consider the nature of climate change from a commons and game theoretic perspective.

1.2.1 NATURE OF RIGHTS

The subject of rights to property is already complex and becomes more so when dealing with natural resources such as water, oil or land. To start, let us look at some basic features of property rights. Firstly, it is important to note that it is not the property that is owned but rather the rights to use the property. It is the nature of the rights which will determine how we are able to use the property. The delineation of types of property can be summarised by the excludability and rivalness of the resources in question. Generally private property is owned by a private entity which controls access, withdrawal, management and exclusion of the resource. Public property is owned by all but access and use is controlled by the state. Open access is property which is not owned by anyone and thus no one has the right to exclude anyone (Guerin, 2003). Lastly, the 'commons' refers to resources that are non-excludable as its sufficient size makes it costly to exclude potential beneficiaries. As such the resource is held in common, or shared between or within communities. Natural resources such as land, water, and the atmosphere and man-made resources such as the Internet can be seen as common pool resources (CPR).

The stock and flow of the resource indicates its natural replacement rate. A key problem with CPR is that individuals are drawn to extract more or invest less in the resource than is optimal for the collective, thus arises the CPR dilemma, where individual rationality is detrimental to group rationality. Hardin (1968) describes this as the tragedy of the commons where "ruin is the destination toward which all men rush, each pursuing his own interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all" (Hardin, 1968, p.1244). Ostrom (2000) notes that for many such a dilemma can best be represented by an N-person Prisoner's Dilemma (PD) game where the predicted equilibrium is zero contribution to the provision of the resource. This is known as the 'zero contribution thesis' and assumes that people are rational egoists with individualistic mindsets. Such Homo Economicus reasoning can be applied to anthropogenic climate change. In the traditional PD game, assuming perfect information regarding the payoff structure, the best individual outcome for a country would be to free ride by defecting (and continue producing GHG's at the same rate) whilst other countries cooperate and reduce emissions, thus giving the free rider an economic advantage. Traditionally the pareto optimum outcome would be for all countries to cooperate, whilst the worst outcome would be for all to defect. Unfortunately such a simple model does not take in the complexity of anthropogenic climate change which elicits a problematic payoff structure.

Scientific uncertainty over the magnitude and distribution of negative effects makes it unclear whether total cooperation will be able to significantly halt the hypothesised harmful effects of climate change. Thus countries, in reducing dependence on fossil fuels, may still experience potentially catastrophic, negative outcomes. In addition the distribution of these outcomes may mean that some countries are relatively better off than others which further complicates the game theoretic model as these countries can essentially contribute less to avoid future costs. Furthermore, as the causes of anthropogenic climate change are deeply rooted within our social and economic structures, incentives to switch to a low carbon-economy can create distortions in rent-seeking behaviour with countries attempting to maximise any advantage they can attain from their individual quotas; and companies attempting to arbitrage between geographic production caps (Helm, 2008; Gardener, 2006).

The resulting payoff structures for mitigation and adaptation may be better explained through other games such as: the symmetric assurance, and chicken games, the asymmetric harmony game, and the multi-player tree-correlated equilibrium model. In the assurance game only collective cooperation will produce a joint benefit, driving each player to cooperate only if the other does so too. If one does not cooperate then there is no benefit for the other to do so. In the chicken game, if two coastal smallholders do not prepare for climatic events such as flooding through planting hedges and maintaining drainage through mangroves, then the effects would be disastrous for both. As such both parties should cooperate but it is not necessary as one would need to pick up the slack if the other did not as the cost associated would be too great. The harmony game takes place between two unequal players and requires communication between parties. Here, cooperation is the best strategy as no externality for non-cooperation exists thus no incentive to free-ride. An example of harmony can be shown through the example of the Montreal Protocol which saw all United Nations member states ratify the treaty. Widespread adoption and implementation of the international agreement is a unique example of international cooperation and has resulted in significant improvements in ozone health. The tree-correlated equilibrium model (Forgó, Fülöp & Prill, 2005), plays out like a chess game. Each player has one move in a given sequence. Once all players have moved then the next round begins. Here the best strategy will depend on the results of the preceding round.

Returning to the general game theoretic model of the PD game, Ostrom (2000) notes that generally those who envision the commons through such a game fall into two camps when it comes to the management of CPRs. One promotes the role of a central government to effectively govern the commons whilst the other advocates converting the commons into smaller units of private property thereby incentivising people to take up optimal use patterns. Looking at the latter, neoliberal's have long held that the absence of clear private property rights is the greatest institutional barrier to economic development and human welfare. For neoliberals, state deregulation and privatisation of assets are necessary to not only preserve resources but to allocate it to its best possible use. Private property rights in distinguishing individual vs public rights creates scarcity of the resource/property thus giving it value which is argued to be the best way in which to conserve resources (Thobani, 1995). Furthermore it creates competition thereby improving efficiency and productivity, and lowers prices according to true market values thereby controlling inflationary tendencies (Harvey, 2005).

However, the tragedy of the commons can be extended into private property as well. An example can be found in the case of the American Dust Bowl – here farmers in the 1930's went about extensively tilling fragile soils in private lands, causing widespread draught which resulted in wind erosion and extreme dust storms. These storms covered the land, devastating its productive capacity. The inefficacy of governing the commons through private property can be illustrated through the prisoner's dilemma (Thompson & Kutach, 1990): if everyone followed their own self-interest as private property rights would urge, the resulting outcomes will likely be suboptimal to the individual and the self. When applied to the Dust Bowl, it shows how individual property owners making self-interested decisions can cause ecological and social disasters. Sinden (2007) argues that perhaps to preserve soil and water resources, coercion is necessary. Furthermore, Freyfogle (2003) states that in dividing up common land, you risk increasing externalities by reducing accountability, a by-product of which can be increased political tensions and a crisis in management.

1.2.2 COOPERATIVE BEHAVIOUR

An alternative view point regarding the management of CPRs is presented by Gardener, Ostrom, and Walker (1989). They attempt to explain the many examples of cooperation in real world commons dilemmas by turning to cultural evolution. They put forth that cooperative behaviour was an integral component to adaptive fitness in the early development of our species. As such, regarding resource use, we learnt to adopt coordinated strategies that would lead to positive joint and individual payoffs. Learning social norms and being able to identify deceit and trustworthiness in members would have been a select advantage. Indeed it is argued that social problem solving alongside ecological conditions were integral in the evolution of our cognitive adaptations. According to the Ecological Dominance-Social Competition model, competition with conspecifics and reciprocity based coalitions were integral to the evolution of our vast and highly complex cognitive abilities (Flinn, Geary & Ward, 2005). She puts forth an indirect evolutionary approach as an alternative to the standard rational choice theory.

Within the indirect evolutionary approach she accounts for different types of resource users as participants in a collective action problem as their levels of conformity to social norms of trust and reciprocity will elicit differential intrinsic preferences over outcomes (Ostrom 2000). The types of resource users she identifies are rational egoists, norm users and conditional co-operators. For rational egoists, the social norm of reciprocity is not valued, whilst norm users will behave in accordance to the level that they value conforming to a norm. Conditional co-operators are trustworthy users to begin with who reward trust with further trustworthy behaviour. Payoffs will depend on the players type and the level of information available regarding other players. Ostrom (2000) shows that those who adopt conditional cooperation strategies are better able to survive in dilemma situations if some conspecifics are also norm driven and some information about other users is also known. The level of cooperative behaviour is impacted by a plethora of contextual factors however a consistent finding is that CPR users are more likely to sustainably manage the use of the resource when they are left to organise their own strategy for its management over externally imposed rules.

An example is given by Shiva (2002) and the management of water in India. Shiva (2002) states that water has been managed as a commons throughout human history. The transition of India from a water abundant to a water stressed nation is attributed to the demise of this collective management of water which was the key to water conservation and harvesting. Collective management has the power of social capital, group norms, trust, tradition, and group sanctions which guides sustainable use and conservation of a resource. For Shiva (2002), eroding community control, introducing private property rights and new technologies violates the water cycle. As a consequence scarcity becomes inevitable. She warns that the public-private partnerships (whereby private property rights are assigned to certain assets) operate under the guise of democracy, accountability and public participation, but in fact such partnerships involve the transfer of public funds to privatise public goods.

Indeed such public-private partnerships can exacerbate negative externalities (such as further environmental degradation) in an attempt to provide a cost-efficient service (Lee & Floris 2003). Furthermore, with resources such as water, which is integral to all life, assignment of private property rights can exclude vulnerable populations who do not have the capacity to attain rights or purchase water from the rights owner. Such issues do not necessarily mean the removal of private property rights, in fact, when looking at conservation, public-private partnerships can enhance resilience as they can bring in a unique profit motive which may not exist for a public entity (Andonova, 2010). Yet it is important to keep in mind that if the use of such market-based instruments is appropriate in managing the commons, then factors such as the independence of the judiciary, the existence of corruption within the judiciary, and the ability of individuals and businesses to enforce contracts must be considered for fair outcomes (Scott, 2002).

The commons need not be seen in Hardin's (1969) stark view. Many studies have shown the power of the commons in preserving resources if certain conditions are met. Agrawal's (2003) review of three studies show that these conditions pertain to: 1) aspects of social capital[3] (such as group norms, solidarity and size), 2) the characteristics of the resource (whether it has well-defined boundaries, riskiness of the resource, etc.), 3) institutional regimes (monitoring, sanctions, regulations) , 4) the external environment (considering linkages with state, as in power and governance structures and adequate compensatory measures for resource conservation and 5) the availability of technological means through which to exploit the commons. The effectiveness of the type of right assigned will depend on the context within which it is legislated. In collectivist cultures with strong social norms, resource users' management of common property may be the way to go whilst in more

[3] Social capital brings together people through shared norms, values and understandings that facilitate co-operation.

individualistic cultures and perhaps the domain of the rational-egoist, other solutions may be sought.

For Ostrom (1990), the design principles which lead to sustainable common pool resource use regimes have been identified as:

- Clear boundary rules which delineate the population effected by the resource use regime and importantly with whom social norms are formed.
- Acknowledgement of local resource use traditions, a clear indication of how much, when, and how resources are to be harvested as well as allocating benefits in proportion to inputs.
- Resource users are actively involved in making and modifying resource use rules. This enables the creation of mutually accepted rules in line with local traditions.
- Monitors who are accountable to resource users or are in themselves resource users. They are tasked with not only monitoring the state of the resource but also user behaviour.
- The use of graduated sanctions whereby the seriousness of the rule infraction is taken into consideration. This acknowledges small infringements such that the rule breaker is aware that their behaviour is observed and may then take corrective measures to step in line with norms, or may escalate infractions at the risk of higher sanctions and potential exit out of the group.
- Access to local conflict resolution platforms to deal with resource use grievances in order to maintain rule conformance.
- Some level of legitimacy regarding the local-users resource use regime is necessary by the local or national government so that they are not undermined by the entrance of other potential resource users.
- The need for nested regimes when dealing with large scale CPR problems.

Ostrom (1990) does not see the application of her principles to be a panacea to CPR management regimes, instead they do provide a framework through which we can explore those factors which can impact the capability of people working in collaborative management of CPRs. Some have argued that these design principles do not pay adequate attention to the contextual background of the resource regime, and instead, predominantly focuses on the community's internal conditions (Husain & Bhattacharya, 2004; Edwards & Stein, 1999). The significance of external actors on CPR management is just as important, especially

NGOs and Intergovernmental Organisations who can provide an interesting array of resources to its management and which in itself are influenced by exogenous factors. Edwards and Stein (1999) argue that such external actors require greater representation within the design principles to be able to elicit contextual analysis. The debate of self governance of the commons will continue as the nature of our planet places us in such a dilemma. That self governance has worked in some instances but failed dramatically in others (as the story of man-made climate change attests too) requires alternative solutions to be sought when necessary. One such solution came in the form of Integrated Development and Conservation Projects (ICDPs).

1.3 INTEGRATED DEVELOPMENT AND CONSERVATION PROJECTS

In the decades preceding Our Common Future, and the Millennium Declaration, the link between poverty and environmental degradation has strengthened. This is evident in the Millennium Development Goals (MDGs) which comment on the poverty-environment nexus and the mutually reinforcing relationship between poverty and environmental degradation. Thus poverty reduction and environmental protection have come to be seen as complementary goals (Dasgupta, Deichman, Mesiner & Wheeler, 2005).

Such shifts in discourse have manifested itself in movements away from the traditional ‘fences and fines’ approaches to conservation, where generally local users are excluded, to more holistic Integrated Conservation and Development Projects (ICDPs); an umbrella term housing within it concepts such as Community-Based-Conservation (CBC). Incorporating local development with conservation saw ICDPs enjoy a rapid period of growth over the last three decades. However from its earliest days the approach has garnered much criticism with some stating the crucial links between conservation and development has remained nonexistent (Barrett & Arcese, 1995). Regardless, such strategies have drawn considerable amounts of donor funding directed at conservation (Hughes & Flintan, 2001) and though there remains criticisms, the use of microfinance and credit lending models by ICDPs to facilitate its developmental agenda, can provide insights into the use of microloans in ecosystem-based adaptation.

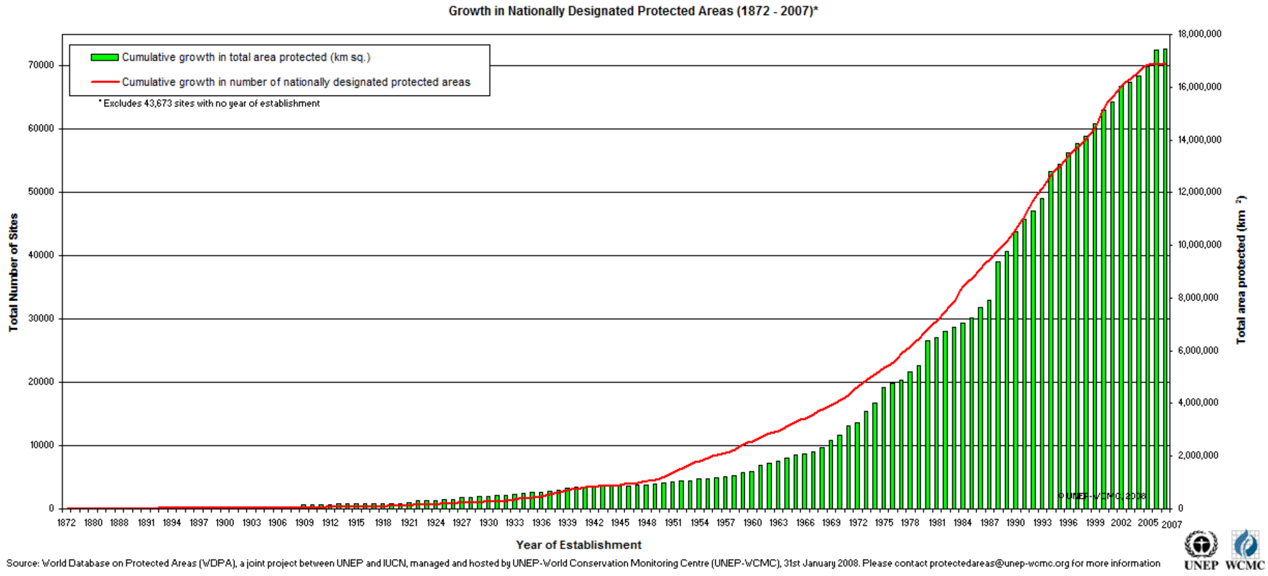
ICDPs were popularised in the mid 1980s. It represented a new approach to synergistically address the issues surrounding conservation and development in the Global South. The interrelationship between the environment and development was increasingly entering the global discourse as evidenced by the 1972 United Nations Conference on the Human Environment and the subsequent creation of the United Nations Commission on Environment and Development in 1983.

It was during this time that the world saw an exponential growth in protected areas (Figure 1.1). Foremost, protected areas were envisioned as a means through which to protect species and conserve biodiversity (Lee, Sodhi & Prawiradulaga, 2007). There are many types of protected areas, allowing differing levels of user rights in an attempt to curb the increasing fragmentation and conversion of habitats to address the significant loss in biodiversity in the last several decades[4]. Naturally this growth would come at a price. Often, the costs and benefits generated by such areas are not evenly distributed. Benefits are felt globally and nationally whilst the costs are more so borne locally. Indigenous communities, dependent on the land and the resources that had shaped and given life to their cultures were suddenly faced with displacement through physical translocation and/or restrictions on access to resources, impacting upon their livelihoods and traditions (Krueger, 2009).

The growth in protected areas was also followed by a period of intense wildlife exploitation within certain of these areas. With 1.1 billion of the poorest people living in biodiversity hotspots, the links between development and conservation became harder to ignore (Araya & Christen, 2004). To address the dual needs of the local community and species, conservationist begun taking a more ecosystem or landscape approach towards conservation whereby the inclusion of local communities within and around protected areas was seen as potentially aiding in achieving conservation objectives (Mackinnon, 2001). The ICDP approach was thus born.

[4] The Convention on Biodiversity Biological Indicators Partnership (2010) indicating wildlife populations have declined by more than a quarter in the last 35 years whilst the recent Living Planet Report (2014) reported a 52% decrease in wildlife populations since 1970.

FIGURE 1-1: GROWTH IN PROTECTED AREAS (1872-2007)) - (UNEP-WCMC, 2012)



ICDP is more of an umbrella term. It has been applied to a diverse range of projects each sharing a common goal; attempting to preserve the biological diversity of ecosystems through linking conservation efforts within protected areas with poverty alleviation strategies for those living within buffer zones (Wells, 1999).

Over the years the definition of ICDPs has evolved, in essence it is an adaptive term that incorporates concepts of decentralisation, community participation, and sustainable development amongst other things. Furthermore such projects range in size and scope, reflected not only in project design and implementation but in the different types of organisations spearheading efforts (Damania et al., 2008). For instance, in its early days the projects were largely run by small NGOs before being embraced by global actors such as the World Bank Group's Global Environmental Facility (GEF). For GEF, ICDPs enabled the engagement in projects to empower and benefit local communities living by protected areas through small scale poverty alleviation strategies to large scale programs that could integrate conservation with regional and national development goals (Jansen & Shen, 1997). It is perhaps this flexibility and the promised benefits which added to the popularity of ICDPs at that time. To enable biodiversity conservation, increased local community participation, more equitable sharing of benefits and economic development for the rural poor is alluring (Mckinnon, 2001).

Despite its popularity, no clear set of strategies in meeting the goals of ICDPs have been developed. Instead it opts for hybrid methods such as community-based-conservation

(CBC), wildlife management, eco-tourism, and agricultural based methods (Agrawal & Redford, 2006). The seemingly broad body of practices utilised by ICDPs do display underlying similarities. These are displayed by Peters (1998) who identifies four basic strategies utilised by ICDPs linking conservation with development. These are: management of protected areas, the establishment and maintenance of buffer zones, compensating or enabling viable substitutes to local people, and promoting local and social development.

Some of these strategies are evident in the CBC approach wherein the key aspect is the community focus. Management of resources is carried out primarily by the community relevant user groups but it also involves locally and nationally relevant institutional and private stakeholders. This makes optimum use of social capital, existing (or assigned) resource rights, local governance, traditional and local information, self-interest and self-enforcement capacity (Govan, 2007). CBC is therefore a collaborative approach to management which shifts the power balance in conservation decision making from top-down to bottom-up. Importantly it utilises the motivating force of the community to drive conservation. Keeping in mind Ostrom's (1990) design principles, well set-up Community Based Natural Resource Management with well defined user rights can be very fruitful to conservation efforts by including stakeholders at every level of design and management.

In addition, CBC is foremost conceptualised as a conservation initiative (Tai, 2007) and assumes the following: biodiversity conservation will succeed only if local communities receive sufficient benefits and participate in its management therefore having a stake in conserving the resource (Mehta and Kellert, 1998). Furthermore it assumes that conservation and development are complementary and can be achieved in concert. Lastly the locus of 'blame' is placed upon the community – it is internal factors, representing local people and their subsistence practices, rather than external factors, such as market demand for protected goods, which pose the greatest threat to conservation in protected areas. These assumptions of CBC are mirrored in ICDPs. With Hughes and Flintan (2001), in a review of the ICDP literature, collating the following list of the assumptions behind ICDPs:

1) Through diversification of livelihoods, the exploitation of resources integral to maintaining biodiversity can be reduced, thus improving conservation.
2) Internal factors, representing local people and their subsistence practices, rather than external factors, such as market demand for protected goods, pose the greatest threat to conservation in protected areas.

3) ICDPs are a sustainable alternative to the protectionist approach to the management of local areas. (Hughes & Flintan, 2001)

1.3.1 KEY PROBLEMS OF ICDPS

However, it is these unexamined assumptions which have been attributed to the often mediocre performance of ICDPs (Herrold-Menzies, 2006). In particular, a search of the literature revealed the following key issues emerging from ICDPs linked to these assumptions. Firstly ICDPs see local rural populations as the problem rather than solution to habitat destruction (Horwich & Lyon, 2007) but clearly this is not always the case. For example, external interests in wildlife trade and forest products place pressure on PA's globally as does corruption within governance structures. This leads to the second issue whereby ICDPs are foremost designed to address the environmental problems arising from local livelihood practices. In doing so, they cannot address issues that arise from external sources such as the demand for illegal wildlife products that drives the activity of poachers, or inefficient/contesting policies (Damania et al., 2008; Herrold-Menzies, 2006). Winkler (2011) suggests that ICDPs need to cover a wider policy base to be successful with more encompassing tax and subsidy regimes.

Another concern surrounding ICDPs is that the provision of alternate employment opportunities may further deteriorate, rather than ameliorate, conservation objectives. In the first instance, alternative livelihoods are seen as complements rather than substitutes for activities that degrade the ecosystem (Engel et al, 2008). Secondly it has been shown that in some instances new sources of income are more likely to be complementary to existing exploitative activities as households attempt to maximise their incomes (Ferraro & Kiss, 2002). Kiss (2002) gives the example of the CAMPFIRE project in Zimbabwe where incomes generated by trophy hunting fees were invested into the expansion of agriculture into wildlife areas rather than conserving wildlife habitats. Furthermore as disposable income increases it is possible that demand for resources will also increase, placing further pressure on ecosystems (Herrold-Menzies, 2006).

Considering these criticisms new opportunities offered by ICDPs must be attractive enough to outweigh those offered by activities leading to further environmental degradation. However if benefits are highly attractive it may draw in migrants to the area, in effect further straining resources within the protected area. Thus well established property rights are integral such that rewards remain within the targeted community (Gaveau et al, 2009). In addition, Winkler (2011) shows that ICDPs often are unable to achieve optimal levels of conservation because of externalities associated with the local communities. Thus the success of ICDPs will largely depend upon the strength of traditional local governance structures and the power relations therein. As such successes may be misleading with powerful actors within the community benefiting more than others (Locher, 2006; Damania et al., 2008).

For many the concepts of conservation and development are mutually exclusive. Invariably you cannot have one without sacrificing the other (Brosius & Russell, 2003). For instance Peters (1998) finds that the local people viewed conservation within the Ranomafana National Park in Madagascar to occur at the cost of development with villagers struggling to meet subsistence needs. Peters (1998) found that the western ideals prevailing over the Ranomafana ICDP failed to take into account the longstanding traditional land-use practices and the deep seated cultural norms governing them. Furthermore the Ranomafana ICDP urged an unequivocally biocentric agenda, placing preservation above and beyond the needs of local residents thereby further alienating communities which invariably would be detrimental to nature (Peters, 1998).

An example that incorporates some of these issues is the Sundarbans (West Bengal) eco-region. The last of the great mangrove forests, this region is fed by the deltas of the mighty Ganges, the Brahmaputra and the Meghna, forming a unique habitat for many rare and endangered species. The human population is dependent on the land to meet their subsistence needs and thus frequently clash with other local species, having converted vast areas of the forest into paddy fields and shrimp farms (Gopal & Chauhan, 2006). The rich biodiversity of the region is threatened by anthropogenic activities that regulate river flow upstream for human needs causing changes in sedimentation, fresh water inflow, and increased salinity (Gopal & Chauhan, 2006).

The eco-region is isolated, which means that for those who call it home, poor infrastructure, lack of adequate education, healthcare, and modern energy services are major barriers to their development. Furthermore it has weak/misaligned institutional arrangements with limited economic opportunities. In order to enhance biodiversity conservation and meet the development needs of the local population within the region two large-scale ICDPs were implemented. One was funded by the Asian Development Bank (ADB) and the Global Environment Fund (GEF), and the other by the United Nations Development Programme, but neither had any formal linkages (Danda, 2007).

For the Sundarbans eco-region, competing interests complicated conservation and development objectives from the offset. On the one hand, the eco-region has been shown to be of great global significance, and is designated as a World Heritage Site and Biosphere Reserve. Locally however, for its inhabitants the region is seen as a 'great provider', allowing people to meet their subsistence needs. Nationally the Ministry of Environment and Forest recognised the significance of the region as a biodiversity hotspot and have attempted to protect various aspects of it. However the Ministry of Renewable Energy viewed the region as an unbounded source of energy, constructing a full-scale tidal power station next to the sanctuary, without clear assessments of how such an action would impact the already fragile ecosystem. In addition, by blocking off vital waterways, the power station would negatively impact the rural poor within the region. Furthermore, within the eco-region competing conservation interests became an issue with marine and forest conservation placing differing demands on the local population, and often leading to alternate livelihoods which were counterfactual to overall conservation goals (Danda, 2002). Having faced opposition from local communities and NGOs, The ADB/GEF funded ICDP closed half way through implementation. It was argued that the project lacked social and environmental impact assessments, that the needs of the local resource users were not met, and benefits from eco-tourism and other initiatives were largely being realised by outsiders rather than the local communities in addition to lacking accountability and transparency (Griffiths, 2005).

These problems have led many to question the effectiveness of ICDPs with many reporting that ICDPs have achieved neither conservation nor rural development objectives (Browder, 2002; Peters, 1998; Horwich & Lyon, 2007; Brosius & Russell, 2003). The World Bank, in a review of ICDPs in Indonesia found that only very few such projects could claim to have enhanced conservation biodiversity conservation within the region (Wells et al, 1999). Though such negative reviews of ICDPs are daunting to overcome, we can still learn from its successes. There are inspiring examples where ICDPs have achieved remarkable successes in not only promoting the conservation agenda but in fostering local support, ameliorating local development and increasing the area of land under protection for biodiversity. Commonly in these successful models, the development component of ICDPs incorporates some form of microlending as a strategy.

1.4 AN INTRODUCTION TO MICROFINANCE – THE GRAMEEN BANK

The notion of development is not static; it evolves with emerging practices and worldviews. For instance, the nation or society, once the standard unit of development, has now been displaced by concepts such as regionalisation and globalisation. The state, which once stood as the conventional agent through which development occurred is no longer the sole focus, with international institutions and market forces emerging as new drivers of change. There is change underfoot with 'traditional' development ideas such as modernisation and westernisation being challenged as cultural diversity is re-examined and environmental sustainability has pervasively entered the agenda (Pieterse, 2002).

Microcredit and microfinance are development initiatives which have evolved with the shifting trends in development theory. It is a concept which has informed theory as much as it has been guided by it. Microfinance refers to the provision of financial services such as small loans, savings, fund transfers and insurance to the rural and urban poor whilst microcredit solely refers to the provision of small loans to this same population (Crichton, 2009). Microfinance as such typically includes a microcredit component. There are various strands of microfinance utilising different lending models such as associations, bank guarantees, rotating savings and credit associations, cooperatives, credit unions, Non-Governmental Organizations, for-profit banks and the group lending/ Grameen community banking model. Essentially models differ in how funds are governed and from where they are sourced. Here we will focus on the Grameen model popularised by Muhammad Yunus.

Microfinance has become a worldwide movement with the microcredit summit campaign (Daley-Harris, 2009) reporting 3552 microfinance institutions reaching 106.6 million of the poorest clients in 2007. In spite of the hype, microcredit and microfinance remain controversial as their contributions as well as effects on poverty alleviation have rightly come under scrutiny. So it bears careful scrutiny when these tools spread into new domains such as environmental protection.

Whilst microfinance is an old concept dating back to the 19th century when credit cooperatives were introduced in Germany (Ghatak & Guinnane, 1999) and to the ancient rotating savings and credit associations whose existence is pervasive in developing countries (Besley, Coate & Loury, 2001), its popularised form was pioneered by Muhammad Yunus who wished to challenge the overwhelming poverty that plighted his home country of

Bangladesh. Yunus saw that the governmental institutions were ineffective and incapable of solving the abject poverty and that quite a different structure would be required that could enable the people of his country to live outside of such deprivation. The ensuing Grameen Bank, owned by the poor borrowers (Grameen Bank, 2009), would merge profit maximisation - the foremost value of conventional economics - with a novel humanist approach to development by realising that financial systems could in fact operate within the bounds of social values which sees each person as having the right to credit, growth and development (Fuglesang, Chandler & Akuretiyagama, 1993).

The neoliberalist approach of microcredit to alleviate poverty has been widely supported by the World Bank, International Monetary Fund and the United Nations since the 1980's (Weber, 2002) as it falls within their dual sided development framework. This framework joins sound economic policy with social and institutional reform which espouses participatory tactics to empower the poor who are not seen as liabilities but as assets (Taylor, 2004). The support of high level donor agencies, NGO's and political leaders enabled the proliferation of Grameen-like models of microcredit and microfinance institutions. Instigating these models as 'best practice' poverty alleviation tools (Bateman & Chang, 2009).

The concept of microfinance is simple. As with any retail bank it provides financial services and loans which are repaid along with interest. Although unlike normal banking institutions, the main difference is with the clients and loan amounts. Microfinance institutions commenced by lending to the poorest of the poor, namely women living below the poverty line, by providing them with minute loans at affordable interest rates. These women tend to have no collateral therefore making them high risk clients. To get around this many microfinance institutions employ a novel group lending method through which social collateral is formed.

For the Grameen Bank, social collateral is formed by specifying that in order to acquire loans, the landless poor must form a group of five members from the same village who are in a similar economic situation and who share mutual trust and confidence in each other. The group elects a Chairman and Secretary who then become responsible for acquiring, managing and repaying loans. The group members meet on a weekly basis to make loan repayments and also to place a specified amount into savings which goes into a 'collective group savings fund'. This fund then becomes a sustainable banking system, with deposits feeding more loans and also enabling group members to withdraw and invest funds from their account to enable greater returns. Each withdrawal must be approved by every member of the group (Fuglesan, Chandler & Akuretiyagama, 1993). A further characteristic of the Grameen credit system is that the lenders meet with the borrowers thus opening up banking services to isolated and marginalised populations who cannot leave their villages or slums for various reasons as disparate as cultural traditions or lack of transport (Panos, 1997).

For some, Grameen Bank has been an overwhelming success story, distributing US$8.26 billion worth of loans since its inception in 1976 to 7.93 million clients, of which 97 per cent are women. Grameen (2009) reports its loan recovery rate at 97.89 per cent, which is surely to be applauded in a time of such global financial unrest. From its inception, Yunus and Grameen have since inspired thousands (Gutierrez-Nieto, Serrano-Cinca & Mar Molinero, 2007) of microfinance banks and programmes the world over. Whilst the methods employed in delivering their service differs according to context and objectives, each entity shares the same ideals as the Grameen Bank – the poor need not be seen as unskilled beneficiaries, but rather as clients striving for a better life through dignified employment (Bornstein,1997).

1.4.1 CRITICISMS OF MICROFINANCE

When done right, research has shown the successes of microfinance, for instance it builds strong communities through building social capital, it enables skills development, rewards entrepreneurship, it empowers women, significantly improves standards of living, and contributes to sustainable economic development (Crichton, 2009). Yet, microfinance cannot be seen as a panacea. Its rapid growth and the profit which exists at the base of the pyramid have left some questioning the impact it has upon the poor, and on ecosystems. For instance Ellerman (in Bateman, 2010) questions the viability of impact assessments utilised by MFIs. The current methodologies evaluate client versus non-client impact, with differences viewed as a consequence of microfinance. However without assigning true counterfactuals, the resulting assessments can be grossly misleading as it does not compare one development intervention with another but rather with no intervention at all.

Further failings emerge when looking at impact assessments even when randomized control trials are utilised. These are: displacement, and client microenterprise failure. Essentially the former relates to non-client entrepreneurs being displaced by incoming microenterprise entrepreneurs who overcrowd market spaces, ignoring the concept of fallacy of composition. Client microenterprise failure comments on survivor bias commonly demonstrated in impact assessments. Only the stories of successful micro-entrepreneurs are ever recorded even though most microenterprise programmes are faced with failure. Bateman (2010) states that such failure can indeed push the poor individuals into a spiral of ever greater poverty as they must bear the associated social costs (for instance shame) and the termination of a vital income stream.

In addition to these failings, it has also been argued that by emphasising on financial sustainability (thereby needing no donor aid) such institutions are not able to meet broader welfare needs for instance disaster relief for all citizens (Panos, 1997). Contrarily it can be argued that by providing insurance and savings to clients that these institutions in fact provide an effective safety net in times of trouble. For instance the macroeconomic role of microfinance during times of financial unrest has been questioned with conflicting findings. Marconi and Mosley (2006) argue that minimalist microcredit institutions could in fact intensify financial unrest, whilst microfinance institutions tended to be more resilient.

In relation to empowerment, it has been argued that such programmes can actually lead to disempowerment with tensions increasing between women over loan repayment, and between spouses as men have been shown to withdraw their own income as women begin earning. An additional concern that became apparent was the difficulty women had in retaining ownership over their earnings (Mayoux, 1999). Furthermore, microfinance can increase the burden on women as they must continue their traditional roles within the informal economy whilst also dealing with running a business with the added stress, responsibility and pressure of not defaulting on loans thereby bringing about social consequences upon themselves and their family (Bateman, 2010).

Furthermore, Bateman and Chang (2009) demonstrate that the neoliberal nature of microfinance has three critical failings. Firstly it ignores the role of scale economies by flooding markets with an over-supply of inefficient micro-entrepreneurs who stifle the ability of small and medium enterprises to grow. This is closely related to the aforementioned issue of displacement. Secondly Bateman and Chang (2009) further argue that microfinance, in enabling liberalisation, ignores the previously introduced fallacy of composition; as facilitating a constant flow of new entrants into the informal sector will only saturate markets driving incomes and retail prices down and further degrading life conditions especially for slum dwellers. Lastly Bateman and Chang (2009) argue that according to neoliberal ideals of deregulation, there has been an increase in the number of microfinance institutions, which has driven interest rates up. The consequence is that such institutions regress to the level of informal moneylenders, encouraging debt rather than savings. An additional criticism concerns the reach of such institutions. The World Bank estimates the potential market for microfinance to be 3 billion adults, of which only 5 million are able to receive loans (World Bank, 2007).

1.4.2 MICROCREDIT AND COMMON POOL RESOURCES

So what has microcredit in particular have to do with conservation, and ICDPs? The fact is that microcredit has recently extended into an array of different applications such as the provision of loans to support water and sanitation facilities, energy needs, etc. Microcredit, although typically seen as a development aid for reducing poverty and stimulating economies, can also be applied directly or indirectly to environmental sustainability and as a strategy to reach the goals of ICDPs. For instance Anderson and Locker (2002), through an e-mail survey to 147 members of the Microcredit Summit, identified how three central tenets of many microfinance institutions indirectly encourages the sustainable use of common pool resources such as forest resources which is characterised by high subtractability and high exclusion costs.

These tenets are: extending credit to the poor, targeting women and the concept of group lending and social collateral. They argue that the extension of credit to the poor for enterprise development enables income generation which in turn can change the demand for common pool resources and the technology for their use. Anderson and Locker (2002) note that whilst activities made possible through loans could be damaging to these same resources, for instance enabling chemical intensive agriculture, research shows a demand for increased environmental quality is positively correlated to rising incomes. Anderson and Locker (2002) also note that women tend to be the stewards of natural resources, which enables them to develop an intimate understanding of local ecosystems. This, they argue, provides an incentive for women to uphold and, when necessary, improve the quality of common pool resources and the natural environment. Finally Anderson and Locker (2002) maintain that through group lending, microfinance institutions facilitate the development of social capital. As we have seen earlier, social capital refers to the networks of linkages between people which can have a positive effect on the overall productivity of the community. It includes concepts such as goodwill, reciprocity and trust. They argue that through social capital a shared sense of responsibility is created for common pool resources, encouraging sustainable and equitable use. In effect group lending becomes the vital mechanism through which to check and enforce adherence to social norms, which form an important component of CPR management (Ostrom, 1990).

1.4.3 MICROCREDIT AND ICDPS

In regards to ICDPs, the popularity of microredit, and its design as a development tool for those at the bottom of the pyramid theoretically makes it a readily available and often well established strategy through which to reach the 1.1 billion poor who live within biological hotspots (Agrawal & Carraro, 2010). Araya and Christensen (2003) argue that microfinance can aid in abating the unsustainable resources use practices of these communities by providing: loans for asset building, insurance to protect against unforeseen shocks, opportunities for livelihoods diversification, and social infrastructure. In addition microcredit with its lending requirements can indeed help to raise the productivity of the poor by enabling them to invest in eco-agricultural techniques and skill development which otherwise would not be available to them. Thus Araya and Christensen (2004) argue microfinance can contribute to the triple bottom line of sustainable use of natural resources, sustainable livelihoods for those living in buffer zones and sustainable financial institutions.

When looking at microcredit and ICDPs, it is important to note that whilst microcredit is seen as a valuable support to diversify livelihoods, thus enabling less of a reliance on natural resources, it will only be successful in reaching conservation goals as specified in ICDPs if an appropriate link to conservation is made. Without forging such linkages the long-term sustainability of ICDPs is threatened, as they do not enable the appropriate attitudinal and behavioural changes which make conservation a natural aspect of everyday life (Flintan, 2003). Whilst microinsurance and microsavings have obvious benefits for climate change affected futures, microcredit has been linked to conservation in three ways in particular: the first is by way of environmental conditions placed on loan contracts, with access to the loan or repayment being dependent on carrying out certain conservation behaviours or prohibiting other behaviours such a fishing with monofilaments (Ndiaye, 2008). The second relates to selective lending. Selective lending is evident in programmes such as Grameen Shakti or Water.org. In the former, loans are only extended for the provision of solar PV technology whilst in the latter, microloans are provided to communities for potable water and sanitation. The third way in which microloans are linked to conservation is by holding the natural resource as collateral. Here, for example, the successful management of an ecosystem drives favourable repayment conditions and the likelihood of future lending. Such a method is evident in snow leopard conservation in the Annapurna Conservation Area Project (Gurung, 2003) a review of which will shortly follow.

The suitability of these different types of microloans to meet conservation and development objectives will be dependent upon the context within which the initiative takes place. For instance an ICDP which utilises microcredit by making loans conditional on intact ecosystems, will have different property right requirements to selective lending models. In addition effective change can only be achieved via rigorous and unbiased impact assessments that can identify best practice of microfinance with a specific environmental focus. To the best of the author’s knowledge such impact assessments have not surfaced. Indeed microfinance also fits well with certain of the assumptions of ICDPs as it a) contributes to the diversification of livelihoods through alternate income generating activities and b) it too views local people as the champions of their lives, with external factors being less of a focus. Importantly it addresses the aforementioned key problems present in ICDPs which will be discussed in the case studies.

1.5 ATTITUDE AND BEHAVIOUR

In addition to understanding the tools used to attain healthier ecosystems it is of significance to better comprehend the drivers of environmentally protective behaviour within such schemes. In the last few decades environmental psychology has collated an impressive body of insights into how we perceive and interact with our physical environment. These insights have indicated the multifaceted nature of how we use and value resources, pressing home the notion that the crisis in the depletion of resources is largely a social phenomenon, resulting from faulty decision-making and its subsequent actions (Edney, 1981). Whilst climate change is invariably a global problem a search of the literature revealed psychological texts for the most part to be limited to Western nations. As such theoretical frameworks have be developed and tested predominantly in the West, with very little application on those communities that will be effected the most – namely the poorest of the poor living within vulnerable ecosystems in the Global South.

For instance Chokor and Mene (1992) displayed that the values placed by rural Nigerians on natural areas had little to do with ecocentric motives (reasoning in favour of nature for the sake of nature) and more to do with its value as a food source – which generally is not a value held by western populations. Those living in poverty in the Global South often inhabit extremely fragile environments and are subjected to the tangible effects of climate change. They experience ever greater occurrences of droughts and extreme climate variability which threatens their very existence. In western nations, climate change predominantly remains a distant threat and would thus elicit different cognitive adaptive strategies (Oskamp, 2000) which invariably would also impact upon social dilemmas involving resource use.

Here we give a brief overview to a set of relevant theoretical models and concepts. These are: 'The theory of planned behaviour' (Ajzen, 1991), implicit connections to nature (Shultz et al, 2004), 'value-belief-norm model' (Stern, 2000), 'structural developmental theory' (Kahn, 1999), and more generally to our understanding of inter-psychic and behavioural responses. Each of these theoretical models and concepts is bound together by the concept of morality and each deals either directly or indirectly with attitudes.

1.5.1 THE VALUE BELIEF NORM (VBN) MODEL

Within environmental psychology, the concept of environmental attitudes has for the most part been the focus of study. Kaiser, Wolfing & Fuhrer (1999) found that almost two thirds of environmental psychology journals between 1965 and 1995 examined environmental attitudes with many attempting, with no consistent results, to tease apart causal relationships between attitudes and socio-demographic variables such as socio-economic status, age and gender (see Wiidegren, 1998; Davidson & Freudenberg, 1996; Chalwa & Cushing, 2007 respectively).

The relationship between attitudes and behaviour remains a dubious one. For decades, it has been shown that there is little consistency between attitudes and subsequent behaviour (Fazio & Zanna, 1981; Swim et al, 2009). This led to the creation of two major theoretical frameworks applied to environmental behaviour in particular, namely the 'Theory of Planned Behaviour' (TPB) and the 'Value Belief Norm model' (VBN).

Stern (2000), an eminent scholar in environmental behaviour, defines environmentally significant behaviour from an impact-oriented and intent-oriented perspective. The former perspective defines behaviour from its impact on the environment. Its study would include relatively easily quantifiable measures such as energy use or water use. An intent-oriented perspective in contrast is defined by the actor's motivation to behave in a way that is beneficial to the environment. Intent-oriented research attempts to unpack the behavioural ecology[5], motivations, internal and external barriers that drive environmentally responsible behaviours (Whitmarsh, 2009). Stern's Value-Belief-Norm model builds upon value theory and norm-activation theory to present a specialised model directed at environmental behaviour. It posits that a causal chain of values, attitudes, beliefs and norms result in pro-environmental behaviours.

The value set consists of egoistic (concerned about own welfare), social altruistic (concerned about the welfare of others) and biospheric (concerned about the welfare of the biosphere) values. The second construct of attitudes relates to the individual's environmental worldview or human/environment relationship. Typically this is measured via Dunlap and Vanliere's New Environmental Paradigm (NEP) scale. The NEP scale is the most widely used measure of environmental concern (Dunlap, 2008) and attempts to tease apart one's worldview as either biocentric or anthropocentric. Thus the VBN assumes that egoistic, social-altruistic and biospheric value orientations mediates beliefs which in turn affects personal norms, which essentially are internal moral standards. This then leads to behaviour. Stern (2000) notes that personal moral norms are the crucial element predisposing an individual to behave pro-environmentally. The VBN has been applied widely to environmental behaviour and activism however its application in the Global South seems to be limited.

1.5.2 THE THEORY OF PLANNED BEHAVIOUR (TPB)

The TPB originated through the Theory of Reasoned Action (TRA; Fishbein & Ajzen, 1975). It has since become one of the most widely applied frameworks for predicting human behaviour (Armitage & Connor, 2001). The TRA proposed a framework through which to assess rational, volitional, and systematic behaviour (Fishbein & Ajzen, 1975). It states that behavioural intentions are determined by a person's attitudes and subjective norms. Attitudes are ones beliefs regarding the behaviour weighted by our evaluation of the importance of these beliefs whilst subjective norms refers to the beliefs of relevant others, weighted by the importance we give to their viewpoints. A critical factor within the TRA and subsequently the TPB is that general attitudes are viewed as external to the model, and the focus instead is attitudes towards the behaviour in question (Fishbein, 1979). Behavioural intentions in turn

[5] Behavioural ecology is broadly defined as the study of the fitness consequences of behaviour – it asks how behaviour evolved and the adaptive consequences thereof.

capture the motivational factors or drive that pushes us towards the act of performing or not performing the behaviour. Intentions are seen as the most proximal determinate of volitional behaviour. The attitudinal and normative constructs within the theory have been shown to influence the development of moral behaviour (Vallerand et al, 1992). This is significant as environmental issues generally take on a moral element. For instance, keeping in mind the state of solar technology today, when considering the installation of solar panels on your house you do not only think of the fact that you will save money on future power bills but also perhaps that you will reduce your carbon footprint which is for the good of the global commons. Similarly if you lay a living roof, you are considering the benefits to the ecosystem you inhabit, the joy it brings you and perhaps also to your neighbours. If all your neighbours have similar roofs, and you get on with them and value their opinions, you would be more inclined to lay your own.

The TRA in itself is a successful model (Bagozzi, Wong & Bergami, 2000; Bright, Manfredo, Fishbein & Bath, 1993) however the criticisms against the assumption of the behaviour in question as being rational, volitional and systematic led to the development of the TPB. The TPB will be discussed in greater detail in Chapter 3, however the key difference between the two theories is that the later one adds the construct of perceived behaviour control as a determinant of intention (Ajzen, 1991). This allows for factors outside of volitional control to be considered, such as ease of access to resources. Looking at the example of the living roof, if you do not have a supplier nearby from whom to buy the appropriate waterproof membranes or vegetation, then regardless of one's intention you'd be severely limited by factors outside of your control.

The TPB has been applied across many contexts – from sexual behaviour in adolescents in Sub-Saharan Africa (Aarø et al., 2006) to conservation in the West (Kaiser, Hübner & Bogner, 2006). The TPB states that behaviour is a function of one's attitude towards the behaviour, subjective norm and perceived behavioural control. Therefore a positive attitude, a positive subjective norm, and high perceived behavioural control would be related to stronger intentions to perform the behaviour. With its roots in explaining health related behaviour, the TPB has shown great flexibility in explaining behaviour across contexts. The VBN model in contrast came into being specifically to understand environmentalism. Kaiser, Hübner and Bogner (2006) in a study exploring conservation behaviour in a sample of university students found the predictive validity of the TPB and VBN model to be high, though the TPB was better at explaining its embedded concepts.

1.5.3 STRUCTURAL DEVELOPMENTAL THEORY

Unlike the TPB and VBN models, structural developmental theory came into fruition to explain cognitive development in children; commenting on the nature of knowledge and how we acquire it. Structural developmental theory originated through the pioneering work of Piaget. It is a cognitive theory as it utilises behaviour to understand how the human mind develops. Piaget noticed that a newborn baby displays biological patterns of action, for instance through demonstrating a sucking reflex to gain nourishment. However it is only as the baby develops day by day that it will hone this reflex through psychological assimilation such that it can differentiate its source of nourishment from other parts of its mother’s body. Thus Piaget concluded that our initial biological processes are transformed into more complex cognitive structures as we interact with the world (Piaget, 1970). In sum, the theory posits that learning involves the transformation of knowledge which occurs as a child develops ever more active and original thinking schemes which include moral reasoning (Kahn, 1999).

Kahn (1999), focusing on children, applied the theoretical framework of structural developmental theory to examine their relationship with nature. He ultimately provides a psychosocial explanation for Wilson’s (1984) biophilia hypothesis which essentially states that human beings have an innate affiliation with nature. His cross-cultural study is interesting in that it looks at impoverished communities in America, Brazil and Portugal. Through a series of semi-structured interviews Kahn and his colleagues found that children living in economically impoverished urban communities and those living by tropical forests each displayed an abiding affiliation to nature. In addition children seemed to embed environmental reasoning within their wider understanding framed by their interactions in the social and natural world.

1.5.4 ENVIRONMENTAL CONCERN AND SELF-CONSTRUAL

Chokor’s (2004) investigation into environmental concerns and resource values of the rural poor living by the Niger Delta is one of a handful of studies that seeks to understand how environmental values mediates the use of common pool resources in such populations. He cites literature on social dilemmas and group behaviour. His study utilised questionnaire survey, open-ended responses, discussion frameworks and rating scales to ascertain environmental values and priorities held by resource scarce people in Nigeria. He found that these groups are environmentally rational however their lack of assets and resources means that they are unable to embrace traditional environmental conservation measures. Importantly Chokor (2004) found that self perception is a key element in subsequent environmental reasoning, with self-interest rather than community or common-good evaluations driving environmental thinking and decision-making. Such findings are important in developing a better understanding of natural resource issues and the development of appropriate interventions to target them.

A subsequent investigation by Arnocky, Stroink and DeCicco (2007) on self-construal adds to Chokor's (2004) work. Self-construal connotes one's perception of self which according to Arnocky and colleagues (2007) is a dynamic concept consisting of cultural influences, values and the inclusion of others in self. How we perceive ourselves will ultimately influence our environmental attitudes. Arnocky and colleagues (2007) explain that the often weak relationship found between environmental attitudes and environmentally protective behaviour may be a consequence of the type of environmental concern held by people which is in turn shaped by our perceptions of self.

Self-construal is of particular importance when investigating social dilemmas such as those presented by the use of commons. Through an experimental manipulation, Arnocky et al (2008) were able to investigate how much one's perception of self predicted action in the face of a commons dilemma. Students from an American university were asked to complete a set of measures looking at self-construal, environmental concern and cooperation in a commons dilemma. Utilising the latter in the form of a questionnaire rather than the more traditional game scenarios enabled the creation of a situation utilising hypothetical in-group and out-group members, in which competition, cooperation with others and cooperation for the sake of the environment (the common good) could be assessed. Arnoncky et al (2008) found that self-construal directly related to environmental concern, cooperation and behaviour. In addition, they found that it determined how one would behave in a commons dilemma with people demonstrating more independent conceptualisations showing greater self-preservation behaviour, as was found in Chokor's (2004) study. However Chokor also found that this was driven by a necessity that a university student in America may not experience.

In the Global South, when one is faced with survival would such simple representations work in understanding behaviour? Kahn (1999) states: "a theory of behaviour without reasoning can only come up short (p. 58)." With such little research into reasoning in regards to environmental protection in the Global South we cannot adequately understand the drivers of behaviour.

1.5.5 THE SIGNIFICANCE TO MICROCREDIT

Through the theoretical principles and examples discussed we can see that attitudes are an important though not entirely powerful predictor of conservation behaviour, indeed factors such as the resources available to us, values, norms, beliefs about ourselves and others play significant roles. Why is this of significance for microfinance and conservation? In the case of microfinance much work has been conducted within the South exploring notions of social capital, group behaviour, and norms however very few studies have delved deeper into attitudes and how entrepreneurial desires may be fostered.

In the case of microcredit institutions targeting conservation, a search of the literature revealed that no entirely psychological perspective has been explored. How do these institutions foster behavioural changes such that long after loans have gone people maintain their environmentally protective behaviours? As we have seen, how one behaves involves a complex mosaic of cognitive processes, influenced by socio-economic and cultural situations. If microcredit institutions instil the wrong values, or utilise incentive schemes in a short sighted manner then it is likely conservation behaviour will not be maintained. When done correctly however it can result in sustainable behaviour change.

Interestingly one of the advantages of ICDPs as identified by Abbot et al (2001) was in attitude and behaviour change. They noted that often we focus on the outputs rather than the outcomes of such programmes. They looked at one component of an ICDP instigated in the Kilum-Ijim forest in the Bamenda highlands of Cameroon. The component they focused on was that of the 'livelihoods programme' whose core assumption was that through developing income and livelihood opportunities, the local users would place less pressure on the forest ecosystem. They found that with time, attitudes towards the protection of the forest and demarcation of its boundary became more positive, so much so that the majority shifted from a negative view of forest conservation to a supportive view. The project changed attitudes through its long-term presence (beginning in 1987) which allowed people to reap the benefits of a healing ecosystem and let go of any suspicions and contempt that arose as the forest areas were marked for conservation.

1.6 THE CASE OF SUB-SAHARAN AFRICA

Indeed these considerations can shed new insights into microfinance in Sub-Saharan Africa where resource pressures, spatial characteristics, and cultural norms provide new challenges. The Sub-Saharan context is a good way to highlight the differences that arise in ecosystem-based conservation across contexts. In the new century, Africa as a continent has displayed impressive amounts of growth, with high levels of natural and human capital driving progress. Yet despite this, Africa continues to be the poorest and most unequal continent in the world (Anderson et al, 2006). Indeed, it remains a disheartening fact that irrespective of the laudable efforts by governments in striving to achieve the United Nations Millennium Development Goal (MDG) targets some of the world's poorest people still represent the majority of the population in Sub-Saharan Africa. Accordingly the United Nations Industrial Development Organisation (2004) has stated that Sub-Saharan Africa represents the final frontier in the fight against abject poverty.

Ethiopia, lying in the horn of Africa, is an interesting example of Sub-Saharan growth. In the last decade Ethiopia has shown slow yet steady economic growth however this has not been enough to leverage its people out of desolation, with Ethiopia ranked as 173 out of 187 in the United Nations Human Development Report (UNDP, 2013). The remaining 12 countries fall within Sub-Saharan Africa, with a total of 33 out of 41 countries ranked as 'low development' coming from the region. Nigeria, ranked at a 142, has the highest population in this region whilst Ethiopia has the second highest.

Sub-Saharan countries ability to reach development targets is hindered by natural and anthropogenic environmental threats. Whilst in the start of this century the region's macroeconomic situation has slowly been stabilising its endurance is clearly threatened by climate change. Scenarios have shown that for Sub-Saharan Africa, climate change will present unparalleled threats (McIntyre et al, 2009). The region is already experiencing climatic variations which pose significant risks to countries due to low adaptive ability and high sensitivity within socio-economic systems. Ethiopia already has the added burden of reporting the largest number of environmental refugees relative to its population density. These are people who were no longer able to secure livelihoods because of environmental factors such as drought and desertification. These in turn feed into socio-political and socio-economic circumstances exacerbating conflicts over resources, informing political agendas and negatively compounding development aspirations (Myers 2002). Indeed climate change has been reframed from solely an environmental threat to being a security threat (Brown, Hammill & McLeman, 2007).

As most Sub-Saharan economies are agriculturally driven (McIntyre et al, 2009), with small to medium sized enterprises being considerable contributors to the economy, the scope of environmental threats becomes evident. Currently, Ethiopia leads the way as the largest producer of coffee, maize and wheat in Africa (Francesconi and Heerink, 2010). To accommodate agricultural needs, significant proportions of forest area have been converted into pastures throughout Sub-Saharan Africa (McIntyre et al, 2009). Yet in Ethiopia and Sub-Saharan Africa in general, food insecurity remains an issue. Studies have shown that in part this may be due to the degradation in forest cover (McIntyre et al, 2009; Clover, 2003).

Forest area as a percentage of total land area, as represented in the World Development Indicators Database has decreased from 29% in 1990 to 26% in 2009. These figures are disheartening for in Africa, forests constitute an integral part of livelihoods for the poor. Kaimowitz (2003) notes that tens of millions of people in Sub-Saharan Africa rely on forest products, with the poorest households generally being the most dependent especially in times of crises. In such populations, people rely on forests for food, medicinal plants, fuel wood, and charcoal. As forests offer many integral ecosystem services their degradation can result in reduced agricultural capacity (Kaimowitz, 2003) and less resilience against negative climate events.

Realising that sometimes those who are dependent on forests are also the cause of their degradation, governments have assigned protected areas. As we have seen earlier, this results in the displacement of local forest dwellers and impacts on the subsistence practices of bordering communities. In Ethiopia, 85% of the population lives within rural areas with the majority dependent upon natural resources. With 80% of the rural population living in highlands, 97% of original highland vegetation has been lost and still increasing numbers of rural poor with resource needs live within and surrounding protected areas (Challenges, n.d). With the rise of development strategies such as microfinance, these populations are now able to benefit from financial services which may remediate their dependence on forest resources, though such strategies should be implemented with caution.

A recent comprehensive review by Stewart and colleagues (2010) has shed light on the impact of microfinance on poverty in Sub-Saharan Africa. Through a systematic review of the literature they concluded that micro-savings and microcredit can potentially improve the lives of the poor, however microcredit also can do much harm, potentially plunging people deeper into poverty. They found considerable evidence that clients can choose to consume more rather than invest in their futures. Invariably this leads to an inability to repay loans thereby increasing their debt rather than relieving it. Stewart and colleagues (2010) did report that micro-credit and micro-savings did have a positive effect on health and food security though the latter was not observed across the board. In addition they found that it resulted in increased client expenditure and a greater accumulation of assets. However the mixed results, and overall negative conclusion points to need for greater research assessing the viability of microfinance in Sub-Saharan Africa. Indeed with greater client expenditure and the increased proliferation of microfinance in Africa, there becomes an urgent need to assess the environmental impacts which arise from spending.

Within rural Ethiopia, microfinance has been pursued with vigour, with the country being one of the early implementers of regulated microfinance (Gobezie, 2007). Unfortunately, the reality remains that in very poor Sub-Saharan countries like Ethiopia the supply of financial products to the rural poor is constrained by inadequate policy design, regulation, organisational behaviours and incentive problems along with the remoteness of populations (Gobezie, 2005). Poor policy and regulations can impede growth in MFI's by limiting competition (such as through interest rate ceilings) and adaptation to contextual needs. In addition without strict supervision and monitoring policies, effective and sustainable rural financial intermediaries can be crowded-out by MFIs operating as charities without the added discipline afforded by market terms (Gobezie, 2005). Furthermore incentives must run in both directions – the provider of financial services in countries where MFIs are government regulated will determine their performance based upon these incentives whilst the performance of the MFI will drive borrowers incentives to repay loans and save.

In Ethiopia MFI's have largely sprouted as replications of the Gramen model. Theoretically, considering the collective solidarity represented in rural Ethiopian life, such a model would seem conducive to the context. However the Grameen model was designed in Bangladesh, a country with extremely high population density such that groups live in close proximity to each other thereby facilitating loan guarantees via information symmetry (Gobezie, 2007). This sharply contrasts with the situation in Sub-Saharan Africa where populations are spatially distant. Of course this scattered living style coupled with poor infrastructure connotes further implications for the viability of sustainably providing microfinance services to the very poor. With populations living in remote and hard to reach areas far from each other, the costs of providing services becomes a significant hindrance (Gobezie, 2007). In addition Gobezie (2005) shows that in some localities the group lending model can be an impediment to microcredit, with religion – a glue for solidarity – dictating how one maintains their personal finances. For instance some Muslim Ethiopians are forbidden by their beliefs to pay or receive interest. Therefore they do not seek loans nor save in banks (Gobezie, 2005), whilst in Bangladesh, Islamic microcredit has been designed to go beyond some of the prohibitions of Sharia law.

Thus, as is the case in much of the African continent, whether in lieu of or in addition to various credit lending models, multifaceted traditional risk sharing mechanisms are already entrenched within subjective norms and can indeed impact upon Grameen type lending methods. In addition Gobezie (2005) notes that within rural Ethiopia certain alternative income generating activities are restricted by cultural norms. Curiously such activities are usually those that are environmentally friendly and do not disregard indigenous knowledge. For instance creating handicrafts, tannery, pottery and blacksmithing. Consequentially Gobezie (2005) reports that only 5% of loans were directed at such non-agricultural based activities. Thus cultural norms dictate the use of loans which in turn may shape the targeting and marketing of loans by MFIs who in turn are driven by their own incentive mechanisms.

This along with the state of land rights - which have largely remained under the possession and control of the state, with usufruct rights of differing degrees of formality awarded to land users (Gavian and Ehui 2011) - would indeed impact on the ability of conservation and development initiatives to successfully incorporate microfinance or credit lending models. It is clear that the need for such services exists as displayed in the case of Ethiopia. For instance, Flintan (2000) reports on the WWF sponsored ICDP in the Bale Mountains National Park in Ethiopia; here local communities communicated the need for financial services to enable diversification of livelihoods. Such services were suggested in the form of microfinance however a search of the literature did not reveal whether microfinance was eventually instigated.

There are some successful examples of ICDPs incorporating microfinance in Sub-Saharan African context, one such example will be displayed in the case study of Senegal in the following section. However these examples for the most part do not come from rigorous impact assessments. In addition there remains little research on the psychological and cultural barriers that may affect the uptake and use of loans. Furthermore the way in which loans are distributed and activities monitored to assess its impact upon developmental and environmental agendas bears further consideration.

1.7 WWF WEST AFRICA MARINE ECO-REGION (WAMER) – SENEGALESE CASE STUDY

Senegal lies nestled along the coast of West Africa surrounded by abundant forests and coastlines. In Senegal the fisheries industry remains the most lucrative export market. However in recent years, the increasing reliance of the people and indeed the economy on fishery products has resulted in overexploitation, subsequently threatening livelihoods, food security and biodiversity. This has further been compounded by the degradation of agricultural production systems in rural in-land areas which led to the migration of people to coastal regions placing ever greater strain on resources and space.

Microfinance arrived into Senegal under this context, with political leaders and development professionals pushing microfinance as a tool to enable people to lift them-selves out of poverty. WWF WAMER realising the potential of microfinance in diversifying livelihoods incorporated lending models into its conservation strategy in Senegal. This strategy included actively engaging in the creation of several Marine Protected Areas (MPAs), utilising the principles of community-based management. Here we focus on the case study Popenguine.

Popenguine provides an interesting case, with community driven conservation initiatives being developed and implemented long before the involvement of WWF WAMER. The initiative commenced in 1987, preceding the classification of the Popenguine forest as a natural reserve – an action provoked by intense resource exploitation. The women of Popenguine with the help of reserve officials and the Peace Corps established the 'Regroupement des Femmes de Popenguine pour la Protection de la Nature (RFPPN). The group was tasked with protecting and managing the natural resources held within the reserve. In 1996 RFPPN took it upon themselves to sensitise other villages subsisting off the forest by creating a collective – Collectif des Groupements de Femmes Pour la Protection de la Nature (COPRONAT). Starting with only a few members the collective grew to 1,555 women each trained in managing mangrove nurseries, reforestation, waste management and environmental education. (Najatang, 2002). The women significantly contributed to the restoration of the mangrove ecosystem and the preservation of biodiversity within the reserve and its surrounding areas. For instance they managed to reintroduce numerous indigenous trees, flora and fauna with 195 species of birds reappearing to the reserve (Najatang, 2002).

Expanding the conservation agenda to include development objectives, in 2005 WWF WAMER established mutual savings and credit operations. The mutuals were divided into community and institutional structures. The community structure included members and governing bodies whilst the institutional structure included WWF and the technical/functional components required in the creation of mutuals. Only residents of the territorial area within which the mutuals operate could apply for membership which was secured with a 3,000FCFA payment. Once a member, women (and a small percentage of men) could commence applying for loans but these were attached with strict conditions prohibiting activities that could be detrimental to conservation. These included: fishing with monofilament and/or explosives and the felling of trees and other degrading forestry activities. Interest was charged at one percent of the total loan amount, which was then partly used to fund community development projects. For the most part, 93.9% of credit in Popenguine was destined towards commerce, with activities including recycling materials into jewellery and other gift products which were targeted for sale to tourists (Ndiaye, 2008).

The socio-economic status of communities improved as did conservation which benefited the local people by improved ecosystem services and providing revenue from tourism. The initiative has been tremendously successful, winning the UNDP Equator Prize in 2006 and has been replicated throughout Senegal and West Africa with the women of Popenguine providing training to these new collectives. In addition the COPRONAT has empowered women, enabling them to be active participants in policy development (Ndiaye, 2008).

Popenguine commenced as a solely conservation based initiative led by the community. The women became the stewards of protecting and maintaining the fragile ecosystem which formed a part of their culture and livelihoods. As such it could be that they already had developed complex emotional connections to the land which shaped their attitudes and values such that when the land became too degraded they were inclined to act positively. In their actions it would seem that they gradually developed a culture of conservation driven by ecosystem based incentives. When merged with micro-credit and development objectives, additional livelihood incentives were developed however these would remain embedded in and reliant on the wider benefits offered by conservation.

1.8 THE ANNAPURNA CONSERVATION AREA PROJECT (ACAP) - PROTECTING SNOW LEOPARDS

ACAP, established in 1986, was the first and largest conservation area in Nepal. It has widely been recognised for its innovative approach to protected area management, seamlessly linking multiple land use practices such that biodiversity conservation and development of rural communities have flourished. ACAP has included many activities such as the local management of forests, seedling planting for distribution to private and project plantations, eco-tourism through the development of world renowned trekking routes, eco-agriculture, introduction of alternative energy sources and education in conservation to name a few (Hughes & Flintan, 2001). ACAP, linked with corridors to other conservation areas within Nepal, has been a successful model in snow leopard conservation (Ale & Karky, 2002). The ACAP approach is highly participatory in nature with local communities taking charge of many activities. In particular the management of wildlife was encouraged via the creation of legally formed ‘local’ committees.

Microfinance in ACAP has been applied effectively to the conservation of snow leopards in two ways. The first is through the creation of a revolving community fund, sustained through park levies in the form of entrance fees. In essence accessing funds would require communities to provide environmental assets as collateral for loans. Credit was thus extended with the condition of the asset driving the loan – creating an incentive to conserve the asset. The funds enabled local conservation bodies to be self-sustaining, giving complete ownership over the project and giving them the ability to form different conservation bodies with economic incentives to protect the environmental asset (Gurung, 2003).

With consensus from local community members, snow leopards – who are present in four of the six buffer zones – were identified as a species in need of protection. The ensuing snow leopard conservation committee would go on to make use of funds to finance various activities such as creating alternative pastures, hiring local herders and investing in infrastructure such as schools through which local communities and tourists could engage in awareness building activities (Ale & Karky, 2002). Such services would build social capital, strengthening communities and their resolve to engage in conservation activities. Furthermore as the committee consisted of local actors, it viewed the local population as the solution rather than the problem to achieve effective conservation. Additionally the legal position of the committee provided it with a certain amount of voice to address external factors that may have impacted development and conservation goals.

The second and more traditional way in which microfinance has been applied in the successful conservation of snow leopards is in the Upper Mustang biodiversity conservation project. Here the population is extremely poor, with agricultural practices barely covering subsistence needs. As a consequence people were having to rely more and more on unsustainable resource use practices to feed themselves. Microfinance has been used as a tool to revitalise the economy, impacting on conservation by creating alternative income generating activities (Ale & Karky, 2002). The project successfully developed a self-sustaining community owned microfinance institution where community members could access savings, credit groups and community trust funds. The Community Resource Action Committee (CRAC) was assigned with managing the system, whilst also acting as the steering body for biodiversity conservation within the region through setting up activities such as a livestock insurance scheme. Such schemes compensate farmers for livestock depredation by snow leopards and wolves thus avoiding retaliatory killings (Ale & Karky, 2002).

Furthermore women were targeted to access loans to enable them to diversify livelihoods through purchasing livestock. Women in these communities often experience greater levels of poverty with very little land and property rights. In addition women are generally engaged in 'non-market' work in the care economy (Gurung, Tulachan & Gauchan, 2005). Through loan schemes women not only are empowered but the benefits of the ICDP was more evenly distributed as it targeted those groups that hold the least amount of power (namely women). In this ACAP example we have seen that the incentives to engage in conservation were great enough to ensure conservation objectives were met. As such conservation and development goals were not seen as mutually exclusive.

1.9 KANCHENJUNGA CONSERVATION AREA PROJECT

Another successful example of microfinance as a tool to achieve ICDP goals is evident in Kanchenjunga Conservation Area Project (KCAP) an ICDP in East Nepal. Here as in Annapurna and Popenguine, the project also includes a women's development approach which creates a direct link between women, conservation and development. Women are directly involved in conservation through awareness raising activities, maintaining tree nurseries, and wildlife monitoring. In addition they engage in community development schemes such as infrastructure development and were required, through the establishment of managerial bodies, to operate within the different political levels within the community. The microfinance scheme distributed funds using the traditional Grameen method. Women form cooperatives through which they were provisioned funds for village development activities, girls' scholarships and accessing loans for alternative income activities (Locher, 2006).

As we saw with the other case studies women play a significant role in the use and management of natural resources which provides them with a strong incentive to conserve them. As such each of these ICPD case studies have acknowledged the integral role of women in conservation. The KCAP project has recast the role of women in conservation, effectively addressing externalities existing within the community and providing a crucial access point for women to engage in conservation and development activities (Locher, 2006). Furthermore the alternate income generating activities do not clash with the conservation goals of ICDP and instead are complementary to it. Activities include: Kitchen gardening, sewing training and horticulture and the implementation of environmental and social programmes. The latter not only aids the community but generates income through eco-tourism. By raising awareness in tourists, external factors to environmental degradation are also addressed. In just five years KCAP had seen an increase in forest cover and became a self-sustaining project run entirely by the local community (Gnyawali, 2007).

1.10 MICROCREDIT AT CAOHAI NATURE RESERVE – A LESS SUCCESSFUL MODEL

Caohai Nature Reserve in China is another instance in which microfinance has been applied to ICDPs but perhaps with a little less success then that achieved in Annapurna. The Caohai Nature Reserve was formally established in 1985 in one of the poorest regions within the Guizhous province. Here the reserve houses 89 villages, each of which were heavily reliant on subsistence activities that led to the rapid degradation of Caohai Lake. Such activities included: the draining of wetlands, clearing wooded hillsides, trapping waterfowl and fishing during spawning season. The enforcement of restrictions to limit resource use was an increasingly difficult task, with villagers vehemently resisting conservation efforts. Thus in 1993 the International Crane Foundation (ICF) and the Trickle Up Program (TUP) commenced a microcredit programme (Herrold-Menzies, 2008).

The programme commenced by extending small grants to farmers with no repayment conditions. These grants were offered as a way to instigate micro-enterprises, testing villager's management abilities. Once villagers were able to demonstrate that they could indeed manage their micro-enterprise, they were able to access a revolving microcredit based community trust fund with repayment obligations. Interest accrued would return to the community trust fund such that villages could utilise the money to engage in community projects, such as improving village wells, or loan it out to members (Herrold-Menzies, 2008).

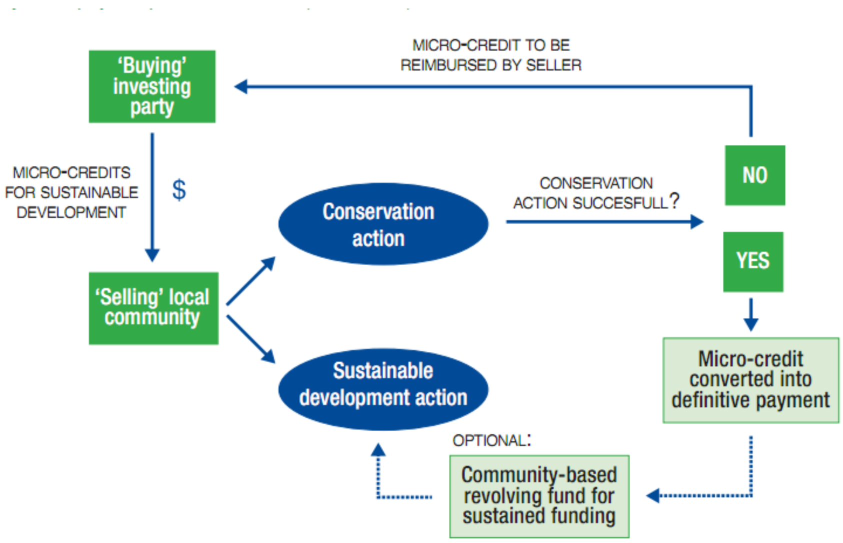
The scheme led to empowerment of farmers and significant improvement in water quality and household livelihoods; however it had mixed results when looking at the environmental impacts of alternative income generating activities. In some instances farmers could raise more pigs whilst in others, by absorbing surplus labour; it enabled people to shift away from engaging in illegal activities. Crucially though, the evolving credit system eased tensions between reserve officials and villagers, such that villagers would co-operate by following enforced bans on fishing during spawning season. Through strengthened social capital – arising from the revolving credit scheme – it allowed the local community to self-police conservation activities between and within villages (Herrold-Menzies, 2006).In spite of this, in Caohai the conservation goal has yet to be achieved. Microcredit as a component of the ICDP was crucial in building alliances, reducing tensions and opening lines of communication but perhaps in this instance it was more so a development strategy, highlighting the argument that development and conservation are perhaps opposing goals.

1.11 BIO-RIGHTS

As we have seen, microfinance can be an important addition to an ICDP if it is handled correctly. If it is not, then it could overpower conservation objectives by shifting the focus to development. Recently a new form of loan, termed Bio-rights, inspired by microfinance and payment for ecosystem services schemes, and directly linked to conservation objectives has come into fruition. Bio-rights meet all the assumptions of ICDPs. To recap, these are as follows: the diversification of livelihoods will improve conservation as it reduces the unsustainable exploitation of resources; local people and their subsistence practices are the key threat to conservation within protected areas; and it is a sustainable alternative to protectionist measures (Hughes & Flintan, 2001).

Bio-rights is a novel approach to conservation combining traditional conservation and development measures with market-driven instruments. It came into fruition in 1996 and is the brainchild of Wetlands International. As such, it has been applied, for the most part, in the context of wetlands. Within this approach microcredit is extended to local communities who then must actively participate in meeting specified conservation and restoration targets as stated within the loan criteria. If the community meets their targets then credit is converted into definitive payments, and communities need not pay back their loans (van Eijk & Kumar, 2009; Figure 1.2). As such the Bio-rights model sees the potential of local communities as the stewards of conservation.

FIGURE 1-2: SCHEMATIC DIAGRAM OF BIO-RIGHTS APPROACH[6]



Ideally funding for Bio-rights would address the market failures whereby ecosystem services have been undervalued such that low-cost availability of environmental services have led to widespread degradation thereby constricting long-term use. Thus, funding of Bio-rights can generally be seen as an assessment of flows with funding acquired from those who benefit the most from the sustainable management of resources. However as attempts to address such market failures have a long way yet to go multi-lateral and bi-lateral aid can also be applied (van Eijk & Kumar, 2009).

Wetlands International clearly states that the Bio-rights approach to conservation is not a silver bullet and is a tool to be used in conjunction with others. The literature is sparse on this strategy however those results which have been presented do seem promising. Though there are clearly constraints in the approach and these are presented by the limited contexts in

[6] Local communities in receipt of bio-right micro-credits, upon the successful completion of conservation or restoration of ecosystem services, can either convert credit into a one-off payment or reinter their loan in a community-based revolving fund - (van eijk & kumar, 2009, p.23).

which it can be applied. Foremost for bio-rights to be successful – van Eijk and Kumar (2008) state the need for local communities to hold formal property rights over land and resources. If the community does not hold such rights then the approach can be in conflict with the intended land use plans of the legal land owner, thereby jeopardising the viability of conservation initiatives. As communities living in and around fragile ecosystems typically do not have such rights this limits the scope of application.

In addition, for the Bio-rights approach to be successful and sustainable it requires full support from the community as discordance would likely result in conflict land and resource use objectives which could complicate the project's viability. Typically such support can be attained in extremely homogenous societies which are few and far between (Ruben and Pender 2004). Importantly – as we saw earlier, the sustainability of conservation subsequent to Bio-rights will be conditional upon the reasons behind which communities choose to engage in the initiative. If an appropriate link to conservation is not made and communities cooperate in activities mainly for the financial incentives then the long-term sustainability of maintaining conservation efforts is threatened (van Eijk & Kumar, 2008; Flintan, 2003). Appropriate behavioural and attitudinal changes will thus ensure long-term sustainability after purely financial incentives for conservation have gone.

1.12 BIO-RIGHTS IN BERBAK-SEMBILANG NATIONAL PARK – SUMATRA

The Berbak-Sembilang National Park in Sumatra covers 162,700ha of which 90% is peatswamp forests. Peat swamps offer many ecosystem services and in the Berbak region are integral in flood control, flow regulation, water supply, the prevention of saline water intrusion and Carbon sequestration which together maintain the integrity of surrounding ecosystems and also provide a habitat for numerous species of plant, insects and animals (Noor, Cahyo, Wibisono & Suryadiputra, 2007).

However land conversion and logging in the upper catchment of the Air Hitam Laut river, as well as illegal fishing and collection of non-timber products, have threatened the peat swamps with increased incidence of droughts and fires which results in the release of millions of tonnes of Carbon Dioxide into the atmosphere (Koopmanschap, Vehmeyer, & Snellen, 2003). In addition the unsustainable management of the ecosystem led to increased regional poverty (Wetlands International, 2009).

In an effort to conserve the Sumatran peatswamp forests, Wetlands International (2009) stepped in, instigating a two year project which applied their novel bio-rights model to the national park. The project generated alternative livelihood options through the provision of microcredit with conservation conditions attached to loans. With the aid of two local partners the project was able to reach 23 community groups living in and around the peatswamp forests (Wetlands International, 2009).

Seeing the local community as key players in protecting the forests, the project incorporated them as valuable project partners, including them in design and decision stages from early on. Through consultation with the community and local authorities, the following focal areas were defined:

a) Diversifying income such that people are less dependent on wetlands for subsistence needs.
b) Protecting and restoring peat swamps. Stakeholders took charge of monitoring, restoration (planting seedlings), and fire prevention activities.
c) Awareness and the development of policy. Park managers, local authorities and local communities were encouraged to work alongside each other in the management of the wetland (Wetlands International, 2009).

To achieve the diversification of incomes, training for wetland restoration and diversification of livelihoods was instigated along with market analysis to advise local people on the crops and products that would be most productive for them to provide to local markets and the avenues through which to go about it. In addition the development of community plans/proposals detailing business plans, the amount of funding required for activities to be undertaken and also agreed upon conservation activities were submitted. If the proposals were approved then microcredit and revolving funds were initiated. Here, the Bio-rights model specified areas of peat swamps that communities would need to maintain, planting and caring for seedlings till maturity. The microloans and revolving funds provided the incentives for local communities to preserve the peat swamps, as if communities were able to maintain the long-term survival of a specified amount of seedlings then they would not need to repay loans (Wetlands International, 2009).

Individuals were able to apply for loans through their community groups to invest in their chosen income generating activity. At the individual level the loans were not subject to repayment with interest if the borrower met the conservation conditions specified in the loan criteria and community proposals. In the case of the Sumatra, this was achieved in the form of planting and maintaining a certain amount of trees dependent on the size of loan sought. Upon the successful completion of projects, the communities involved opted to have repaid loans enter into a revolving fund rather then switch over to grants as the original Bio-rights model conceptualises. These revolving funds could then be used by other bordering villages – creating a sense of community and a culture of conservation whilst at the same time limiting issues surrounding migration into successful conservation areas (Wetlands International, 2009).

Protection and restoration of peat swamps thus took place through tree-planting and the diversification of livelihoods into conservation activities such as setting up fire-brigades, with members receiving compensation for their time. Women also were taught how to grow seedlings which could be sold to outsiders and provided free to other nearby communities. Awareness raising activities took place incorporating park managers, local authorities and local communities whilst the development of policy was achieved by actively seeking a champion of the cause. This came in the form of the Governor of South Sumatra who pushed forward the work of the community fire brigades who became local heroes for their work (Wetlands International, 2009).

Whilst no in-depth impact assessment was carried out, the project reported increased incomes and yields from crops, with some farmers able to expand their farms thereby increasing local employment opportunities and others diversifying away from chicken farming to raising cattle and growing rice seedlings. The focus on development, limited timeframe and lack of funds meant that the ecological impact of the project were not able to be ascertained in any detail however forest fires did significantly decrease as did the amount of illegal logging. Together these would have reduced threats to biodiversity, protecting the habitats necessary for the various endangered species to flourish (Wetlands International, 2009)

Unfortunately recent studies have shown that degradation continues to threaten the remaining peat swamps in Indonesia. Logging, land conversion to palm oil for bio-fuel, and drainage are issues that extend beyond the small area of peat swamps that is protected (Yule, 2010; Wibisono and Pusparini 2010). By not addressing external drivers nor running detailed impact assessments long term sustainability and viability of the project cannot be ascertained, hence the effectiveness of Bio-rights in this case is not clear. The same is true for the other case-studies presented. There is not much critical research available on the processes which have driven success or failure. There is no tie in with cognitive drivers which should be integral when looking at any initiative which attempts to change behaviour. Such insights would be priceless for best practice.

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2 SCOPE, RESEARCH QUESTIONS AND MAIN CONTRIBUTION OF THIS THESIS


[7]

[7] Newly raised livestock platforms in a smallholding by the river which had been damaged by floods.

2.1 SCOPE AND RESEARCH QUESTIONS

So far we have seen different ways in which to manage resources for the good of the collective. We have drawn out the dominant themes as being ecosystem-based adaptation, microfinance and behaviour. Whilst we have seen that microfinance is being used more and more in ecosystem-based adaptation, there remains very little critical research on its efficacy. It seems plausible that microloans can increase adaptive capacity however we do not know which processes drive its success and which may lead to an illusory short term change in behaviour. In order to build a comprehensive understanding of how we can engage people to take up adaptive behaviours through microloans, a sociopsychological perspective would be invaluable. After all, applied psychology is all about understanding, explaining and changing behaviour. With the problem set that climate change poses, the importance of a psychological perspective on the design of initiatives becomes ever more pertinent as one could crowd-out intrinsic drivers formed of our beliefs and value, through the introduction of extrinsic rewards.

As the most vulnerable populations live within the developing world and by fragile ecosystems it is important to understand the deeper motivators of their behaviour. These populations face an entirely different set of problems than others. For a middle class family in London for instance, climate change is experienced in a completely different way to a farmer living by the Bale eco-region, or a family in the Sundarbans, or coastal dwellers in a South Pacific island nation. Policymakers are aware that in order to attain sustainable development, and to put in place effective adaptation strategies at the local and national levels, will require behaviour change (UNFCCC, 2005). As such understanding the drivers of adaptive behaviour is a pertinent topic within the context of policy formation.

In addition to meet the triple bottom line of environmental, economic, and social development for SIDS and other developing economies, seeking cost-effective solutions where possible is necessary. In these contexts, climate change adaptation financing is limited and can end up diverting critical funds from other sectors (Schalatek et al, 2012). Microloans with environmental objectives can help international and national actors meet the objectives laid out within the Pacific Island region's Nature Conservation and Protected Areas Framework and the Mauritius Strategy of Implementation, amongst other national and international agreements for conservation, development and adaptation in SIDS.

The thesis investigates the microloans, incentives and stated climate change adaptive investment behaviour and perceptions through the following sets of questions:

Chapter 7

1. What are the local perceptions of climate change in Fiji?

    - Islanders are used to climate variability. In Fiji climate has always been very variable but the severity of extreme events has been increasing in the last decade. As such we would expect that people are aware of changes in weather but perhaps link it to natural rather than anthropogenic processes

Chapter 8

1. What are the antecedents of stated adaptive investment behaviour?

    - According to the Theory of Planned Behaviour, positive subjective norms, attitudes, and perceived behavioural control will lead to a greater intention to perform a behaviour.

    - As such we hypothesis that positive set of intrinsic motives would be reflected in positive intentions to conserve and protect natural ecosystems.

    - As intention is the most proximal determinant of behaviour – we hypothesis that positive intentions will increase the probability of choosing adaptive over non-adaptive investments.

2. What is the effect of information on stated climate change adaptive investment Behaviour?

    - According to knowledge deficit theory access to information will allow people to make better informed choices - therefore providing information on the benefits of adaptive behaviour should be reflected in more adaptive stated behaviour. Thus our hypothesis is that information will increase the probability of choosing adaptive investments.

Chapter 9

1. What are the behavioural drivers of climate adaptive investments under different microloan incentive conditions

- According to the theory of planned behaviour, behavioural intentions are the most proximal determinant of behaviour. Intention in turn is influenced by activity specific attitudes, subjective norms, and perceived behavioural control. As such we hypothesis that : a) regardless of incentive condition behavioural intention should mediate investment choice. b) attitudes, subjective norms and perceived behavioural control should moderate behavioural intention.

2. Can environmental conditionality on loans induce uptake of climate adaptive investment behaviour?
    - We hypothesis that green incentives, if congruent with internal drivers of behaviour will crowd-in internal motivations - aligning intentions with subsequent stated adaptive investment behaviour.
    - Green incentives will thus increase the probability of adaptive investments especially if people are already that way inclined.
3. Do demographic and contextual factors impact stated behaviour?
    - We hypothesis that the demographic variables of ethnicity and gender would influence stated behaviour. Specifically, for Fijians, their cultural and spiritual connection to Vanua, the land and sea, is hypothesized to lead to the choice of more adaptive investment portfolios. In addition it is hypothesized that this will also be reflected in the antecedents of behaviour, with Fijians being inclined to positive attitudes, subjective norms particularly.
    - Studies have shown that women are more inclined to environmentally protective behaviours. As such we hypothesis women to choose more adaptive portfolios over men.
    - Income and access to microcredit have also been shown as facilitators of adaptive behaviour. As such we hypothesis that higher incomes, access to credit and having a current microloan would be correlated with greater uptake of stated adaptive investments.

Chapter 10

1. Is mediation analysis the most appropriate empirical method for this research
    - This research hinges on an established theoretical basis thorough which to examine stated investment behaviour. It is argued that because of the constraints of the data and causal schema of the theory path analysis is the more

appropriate method to use. However multinomial logit can be a complementary method.

Chapter 11

1. Are threat appraisal and resource dependence moderators of the cognitive antecedents of behaviour as specified by the Theory of Planned Behaviour?
    - Where threat appraisal is defined as exposure to shocks - according to the Protection Motivation Theory when a threshold level of threat is experienced it instigates coping appraisal (or our efficacy to deal with the threat) which then mediates intention to act on the threat. In Fiji, with flooding and cyclones increasing in severity and frequency our alternative hypothesis is that shocks and resource dependence will impact the cognitive antecedents of behaviour.
2. Do global and local shock exposure, resource dependence, and the perceived severity of environmental and socio-political issues pose a barrier to the adoption of stated adaptive investment behaviour?
    - The response options available to people will form their coping response which will be reflected in their choice of investment portfolios as either maladaptive or adaptive investments.
    - We hypothesis that the different incentive conditions will influence coping response. If people have positive internal motivations (which is reflected in behavioural intention), then we hypothesise that a) people will take on an adaptive coping response in congruence with their internal motivations when faced with shocks and perceived severity of issues and b) that this effect will be strongest under green incentives which will facilitate adaptive coping response.

In summary, this thesis takes on a sociopsychological perspective to understand climate adaptive microloan investment behaviour in order to understand how we can motivate those who are amongst the most vulnerable in society to become more resilient to the impending and worrying prospect of anthropogenic climate change. The central contribution of this thesis has been to advance a sociopsychological understanding of stated adaptive investment behaviour, showing how people in a developing world context think about climate change, how they perceive risks and how these in turn impact stated microloan investment decisions.

2.2 CONTRIBUTIONS

In terms of novel contributions: to the best of the author's knowledge, this study is the first to look at the cognitive antecedents of stated adaptive microloan investment behaviours. In addition it is the first to look at the efficacy of incentives in driving stated adaptive investment behaviour and the first experimental study to look at the impact of information on subsequent stated investment behaviour.

Regarding contributions to existing literature: this thesis adds to the literature on microcredit and in particular its role in ecosystem-based adaptation. It also adds to the literature on smallholder agriculture in Small Island Developing States.

In addition it adds to our understanding of psychological models of climate change adaptive behaviour – in particular it extends the scope of the Theory of Planned Behaviour by applying it to environmentally protective behaviour in the context of a developing economy. It also adds to the literature on behavioural economics through its investigation of the extrinsic motivators of behaviour. Lastly it contributes to research on building climate change adaptive capacity for vulnerable populations and identifies microloans as a viable tool to increase adaptive capacity.

In regards to practical contributions**:** the research has important implications for microloan and climate change adaptation best practice and specifically the efficacy of microloan incentives to enable SIDS smallholders to adapt. It has shown that access to information can influence adaptive investment behaviour and that the appraisal of threats can differ in the presence of pecuniary incentives and does influence subsequent stated behaviour. In regards to methodological contributions: this research used a novel survey-based experiment to investigate the effect of different design aspects of microloans on subsequent investment behaviour, and compares the use of multinomial logit models with path analysis.

2.3 REFERENCES

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3 CLIMATE CHANGE, SMALL ISLAND DEVELOPING STATES, AND SMALLHOLDERS


[8]

[8] Children in Mana Village

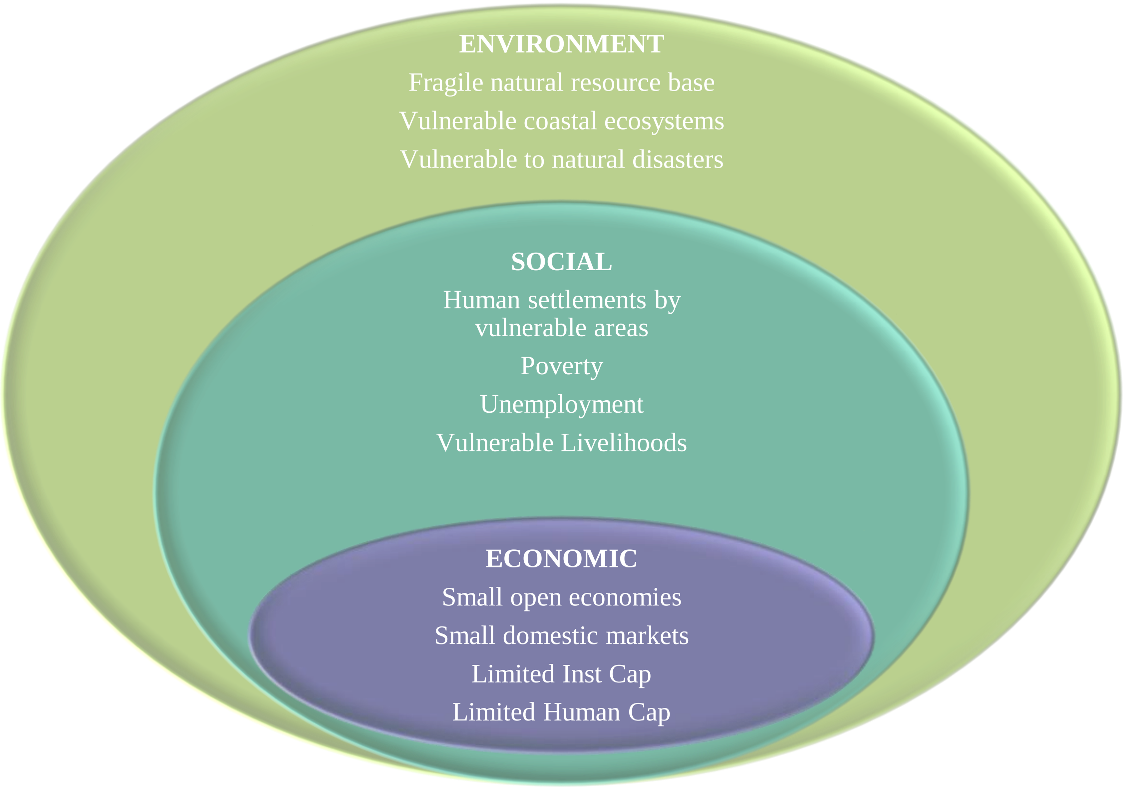
3.1 THE CASE OF SMALL ISLAND DEVELOPING STATES (SIDS)

In the previous chapter we presented case studies from Sub-Saharan Africa, Nepal, China, and Indonesia. The focus of this research however is that of Small Island Developing States (SIDS) which are the most vulnerable in the world to the effects of anthropogenic climate change (UNFCCC, 2005). As for other developing nations, for SIDS climate change threatens to impede growth and development. However an additional existential threat exists for a number of low lying states. Whilst SIDS do share many social, economic and environmental similarities (Mimura et al, 2007), one particular constant is their rich terrestrial and marine ecosystems upon which the people have a high level of dependence for livelihoods (Pelling & Uitto, 2001).

In the next several decades the IPCC predicts significant changes in climate will be felt throughout the globe with islands nations and their fragile ecosystems being particularly at risk of climate related damages (Mimiura et al, 2007). Small island states represent areas with the highest vulnerability and lowest adaptive capacity to climate change. These nations, built on fragile ecosystems, account for just a fraction (1%) of global Greenhouse Gas (GHG) emissions but are amongst the first nations to feel the consequences elicited by anthropogenic climate change. As early as 1992, there was recognition of SIDS' special status regarding environment and development. Agenda 21 states: 'Small island developing states and islands supporting small communities are a special case both for environment and development. They are ecologically fragile and vulnerable. Their small size, limited resources, geographic dispersion and isolation from markets, place them at a disadvantage and prevent economies of scale."

Whilst small and often isolated, these island ecosystems are of global significance. An array of SIDS rest within the most threatened of the World's 34 biodiversity hotspots (Brooks et al. 2002). Oceanic island ecosystems contribute disproportionately to biodiversity compared to their land mass, with one in six of the earth's known plant species occurring on such ecosystems. The high degree of endemism makes SIDS rich stores of evolutionary data which is of global value. In addition they provide atmospheric gas (including CO2) regulating services and climate regulation services whose beneficiaries are global (UNEP, 2014).

FIGURE 3-1: THE VULNERABILITY OF SIDS



3.2 THE PROBLEM

3.2.1 TWO DEGREES CENTIGRADE OF WARMING

There is overwhelming scientific evidence that we are now living on a planet where global temperatures are warmer than it has been for most of the last 11,000 years. The Intergovernmental Panel on Climate Change (IPCC) has identified the amount of carbon dioxide which can be emitted before the accumulation of GHGs in our atmosphere reaches a point of no return. This tipping point is expected to result in an increase of two degrees centigrade (2°C) of global average mean surface temperatures above pre-industrial levels.

In order to limit the rise in global temperatures to 2°C of warming, the carbon quota estimated by the scientific community is one trillion tonnes of carbon (1,000 PgC). 52% of this target had already been utilised by 2011, and it is anticipated that if emissions continue unabated then we would have burned through the quota by 2045. Indeed 2015 marks an important phase of warming, as we are set to breach the 1°C of warming threshold (WMO, 2015). With this 1°C of warming, the impact on natural earth systems will exacerbate the accumulation of GHGs. For instance thawing tundra will release methane and other GHGs, and as ice caps melt the amount of solar radiation reflected back into space will also decrease.

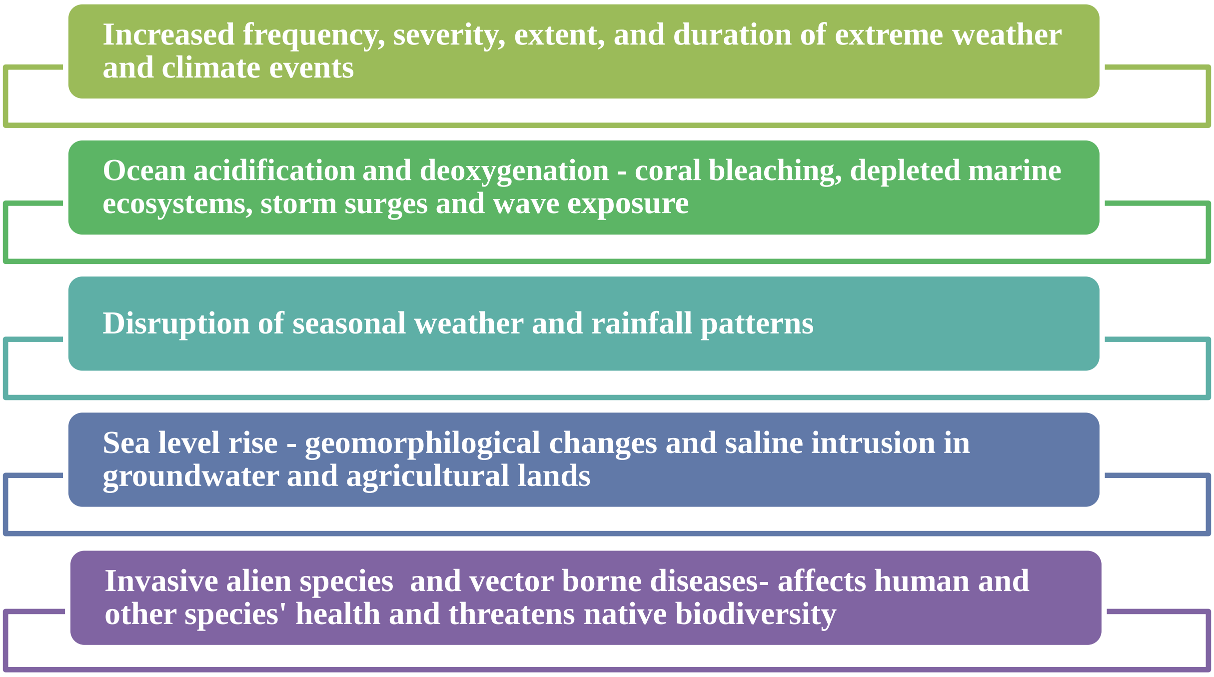
What needs to be done to meet this target? Emissions will have to be curbed by an estimated 36 billion tonnes a year. Also existing commitments will have to be honoured, in addition to pursuing new actions. Greater reductions are needed ensure that emissions peak by 2020 and thereafter steadily decline. In addition the stocks of fossil fuels which are in reserve (estimated at 1,053 PgC) would have to stay in the ground if the carbon quota is to be met.

The 2°C target has been adopted by countries within the United Nations Framework Convention on Climate Change (UNFCCC), with most countries submitting their Intended Nationally Determined Contributions (INDCs) to the UNFCCC ahead of COP21. The intended national contributions as it stands will not be consistent with meeting the 2°C target with accumulated emissions from the INDCs amounting to between 55-56bn tonnes a year by 2030(Boyd, Turner & Ward, 2015).

For SIDS, even under the 2°C warming scenario, the challenges will remain significant – just taking the example of rainfall – for Caribbean SIDS the IPCC projects that they will experience more drought conditions, whilst some Pacific SIDS will be wetter. Essentially under the 2°C scenario all the aforementioned impacts will be intensified: the rate of climate change will become too rapid for some species to adapt; the risk of mass coral bleaching will become very high, affecting over half of all reefs; sea level could rise above one meter; crop production would be at high risk; and more extreme and severe weather events will prevail (Schelussner, & Hare, 2015).

The cost of climate change will further place a strain on already limited resources – the overall cost of climate change for Pacific SIDS under the 2°C scenario would reach between 2-3% of GDP per annum by 2100, affecting SIDS development trajectory. Adaptation costs under the 2°C scenario are estimated to be around 0.5% of GDP per annum (ADB, 2013). Climate change effects on agriculture production, fisheries, human health, tourism and well-being will have the consequences of decreasing national income while increasing key social and infrastructure costs. SIDS will need support to meet these costs.

FIGURE 3-2: A SUMMARY OF CLIMATE CHANGE IMPACTS ON SIDS



3.2.2 MORE FREQUENT AND SEVERE WEATHER AND CLIMATE EVENTS

Within the last two decades hurricanes and cyclones in the Atlantic, Pacific and Indian Oceans have been becoming more powerful and consequently destructive. A well-publicised and particularly devastating impact of climate change for SIDS is *more frequent and severe weather and climate events* – Recent examples include Hurricanes Ivan, Tomas, Katrina, Cyclones Pam, and Winston, and Typhoon Haiyan which caused considerable damage to infrastructure and affected livelihoods.

Even when they are not as devastating these weather events cause considerable loss and destruction. Tropical storm Erika caused an estimated US$41 million in damages and losses to the agricultural sector in Dominica. These were associated with infrastructure damages, loss of land and livestock. Agricultural losses reflected the ability to realise a harvest in accordance with projected production for 2015, in addition to the inability to harvest at the appropriate time and increased expenditures for land preparation and re-treatment. The principal cause of loss and damage was lowland flooding, erosion and landslide. Apart from crop loss and damage, this also blocked farm to market roads and also destroyed some important agricultural operations. Two rum distilleries were destroyed with partial damages to a third. In addition the bay oil distillery and the bay leaf crop in Petite Savanne were completely destroyed. In total Erika cost US$482.84 million in loss and damages across the productive sectors, infrastructure, and social sectors (Government of Dominica, 2015).

In the Pacific region, Small Island States have collectively experienced losses from natural disasters of approximately US$1 billion per decade, increasing to US$4 billion in the 1980s and 1990s (The World Bank, 2012). In 2014 tropical cyclone Ita caused severe flooding which cost the Solomon Islands US$107 million in damages and losses. In 2014 tropical cyclone Ian cost Tonga US$49.3 million in damages and losses. Fiji and Samoa suffered US$108.4 million and US$203.9 million in damages and losses respectively from tropical cyclone Evan in 2012 (Pacific Catastrophe Risk Assessment & Financing Initiative, 2015).

In the Pacific region, the cost to cash crops, infrastructure and buildings at risk of climate change related natural disasters are estimated at US$112 billion (Bettencourt, Pryce, Gitay, 2006). Such events are detrimental to biodiversity, they damage and degrade infrastructure, wipe out crops and livelihoods, displace populations, strain social cohesion and derail the economic development trajectory of SIDS.

3.2.3 WEATHER CHANGES INCLUDING IN RAINFALL PATTERNS AND DROUGHT

In addition to the extreme weather events that are already becoming more frequent, climate change is also predicted to change rainfall patterns. The Caribbean is projected to experience decreased rainfall, whilst increased rainfall is projected for the Indian and Pacific Ocean SIDS (Nurse et al, 2014).

As rainfall patterns change Caribbean SIDS will experience greater drought events as evidenced in the extended 2015 drought. The amount of water that is able to be harvested reduces, whilst the rate of recharge for freshwater lenses and the flow of rivers also decreases leading to prolonged droughts. This negatively impacts agricultural productivity in countries where rain fed agriculture is the norm. In the Caribbean prolonged seasonal dry periods, and increasing frequency of drought, are expected to increase demand for water throughout the region.

The rise in average temperatures can also impact on agricultural output. It is estimated that a one percentage increase in temperature would result in a 5.1% decrease in growth of banana exports. Under the IPCC climate projections, by 2050, banana exports are therefore projected to be minimal with the cumulative yield loss estimated to be EC$165 million.

3.2.4 SEA-LEVEL RISE

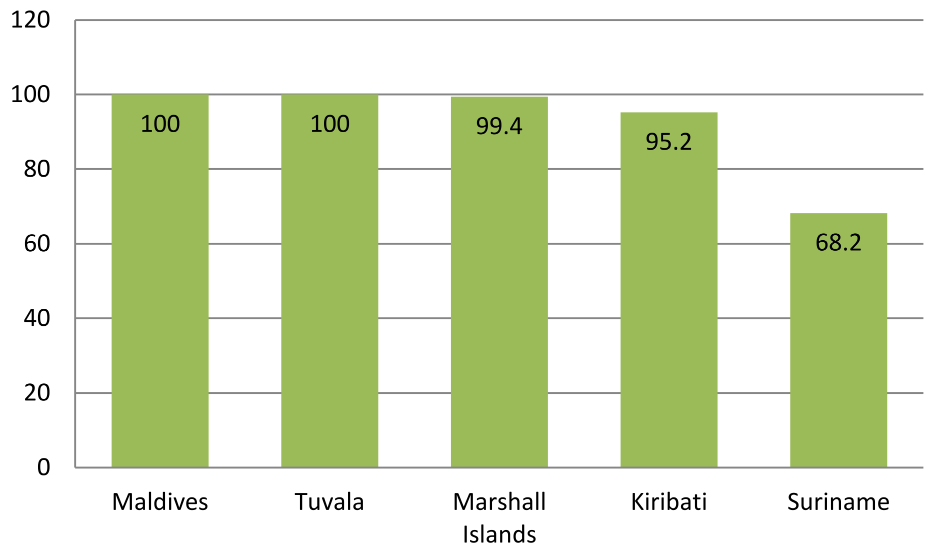
There is a disproportionate impact of sea-level rise on SIDS. For example, the global mean of sea-level rise is 3.2mm per year, however in some SIDS regions, such as the western Pacific sea-levels had risen by 12mm per year between 1993 and 2009 (UNEP, 2014). The result of sea-level rise in SIDS is an increase in:

- Coastal erosion
- Coastal inundation
- Encroachment of tidal water into estuaries and coastal river systems
- Saline intrusion of groundwater acquifers
- Increased salinity in soil
- Increased landward reach of storm surges and sea waves

Saline intrusion to aquifers, in addition to shifts in seasonality and rainfall, will impact access to potable water and limit harvestable volumes of water. Storm surges and sea waves could also further degrade freshwater lenses. Coastal erosion and inundation will place stressors on coastal livelihoods, impacting coastal farm systems, and displacing communities. In addition it also poses an existential threat, whilst an increase in salinity from salt water intrusion will impact crop yield.

Sea-level rise constitutes a major threat to SIDS resource base, and in particular to agriculture. On average 26% SIDS have their land area five meters or less above sea-level, with some Small Islands having a significantly greater proportion of their population living below 5m (refer to Figure 3.3). The United Nations Environment Programme (2014) predicts that the rate of sea level rise is up to four times the global average in the tropical western SIDS. For example between 1993 and 2009, sea level rose by 12mm a year, about four times more than the global average of around 2.8mm. The Carterert Island in Papua New Guinea was arguably the first official island to have to relocate 2600 citizens because of sea-level rise.

FIGURE 3-3: TOP 5 SIDS WITH HIGHEST PERCENTAGE OF POPULATION LIVING 5M OR LESS ABOVE SEA-LEVEL[9]



The encroaching sea could deplete agricultural lands, impacting livelihoods and food security. Coastal small holders may be forced to abandon their farms. This could result in internal migration (UN-OHRLLS, 2013), to cities or to other rural lands, or external migration[10] with small farmers opting out of agriculture all together, reducing the agricultural labour force and putting greater strain on food security.

With livelihoods threatened by rising seas, ocean acidification and deoxygenation, coral bleaching, shifts in rainfall patterns, invasive species, disease and sustained, frequent and more extreme weather events – without resilient smallholder agriculture, SIDS may have to increase their import dependence for food and water. This in turn can impact their vulnerability to price spikes and pre-existing pressures to migrate for economic reasons.

3.2.5 OCEAN ACIDIFICATION AND DEOXYGENATION

Ocean Acidification and deoxygenation is negatively impacting SIDS' vast exclusive economic zones. Seawater chemistry is changing due to the subsequent uptake of emissions by the oceans. Whilst some marine organisms are tolerant to acidification, some of the species that form the base of the marine food web, such as phytoplankton, zooplankton, and other shell making marine species (essential to coral reefs) are negatively reacting to

[9] UN-OHRLLS (2013)
[10] With external labour migration, small countries like Kiribati and Tuvalu, whose citizens may migrate to Australia or New Zealand, may find it hard to compete in especially with larger Asian countries.

acidification. The result is: changes in marine assemblages, food webs and marine ecosystems; biodiversity loss; changes in biogas production by oceans and feedback into the atmosphere (Turley, & Gattuso, 2012). Deoxygenation is the loss of oxygen in the oceans from climate change and similarly impacts ocean productivity, nutrient cycling, carbon cycling, and marine habitats (Keeling, Kortzinger & Gruber, 2010).

Fisheries play an important role in the economy, livelihoods, food security and the culture of SIDS. In some SIDS it accounts for 12% of GDP (UNEP, n.d). As marine health continues to deteriorate fisheries, aquaculture, food security, tourism, climate regulation, carbon storage, and coastal protection will be compromised in SIDS.

3.2.6 VULNERABILITY TO INVASION BY INVASIVE SPECIES

Climate change also increases SIDS' *vulnerability to invasion by alien species*. Natural ecosystems cannot adapt as quickly to a changing environment, which can allow alien species to become established and even to dominate. Whilst this impacts biodiversity, it also impacts smallholders, agriculture and fisheries in general. Some regions, with wetter and warmer climates, will also experience an increase in some vector and non-vector borne diseases such as dengue and malaria which will impact human health and consequently carry indirect economic costs.

Because of data gaps, precision of the likely impacts of increased risk of crop pests and diseases due to climate change in smallholder systems in SIDS is not clearly defined. However in recent years there has been a loss of wildlife, property, food and livelihood security in the Pacific Islands caused by ants, fruit flies, termites, and plant pathogens. This has cost millions in in terms of cash and subsistence incomes, pest control, and human health (Thaman, 2014).

The Taro Leaf Blight (TLB) is one example of a disease that is impacted by climate change. Temperature and rainfall are important in the spread of the disease. For those regions where taro is cultivated, and where climate change will result in warmer and wetter conditions, the spread of TLB may be accelerated (FAO, 2010).

In a survey of smallholders in the Caribbean SIDS, farmers found that crop their yields were being impacted by a greater incidence of pests and disease. They also found that the productivity of agricultural lands was decreasing. They were concerned that incomes were being further and negatively affected as a result of having to meet the additional cost of pesticides to deal with biological threats. This was also compounding the already existing income pressures (not climate related) from various factors including lower international prices and increasing freight chargers and praedial larceny (Laurent & Sharma-Khushal, 2015)

3.2.7 DISPLACEMENT IN SMALL ISLAND STATES

According to the Internal Displacement Monitoring Centre, in 2014, 17.5 million people were displaced by weather-related hazards, with 1.7 million being displaced by geophysical hazards, and an average of 22.5 million people being displaced each year by climate or weather-related disasters in the last seven years. These numbers are only expected to grow as climate change effects take hold in the coming decades. One estimate is that 200 million people will be displaced by 2050 as a result of climate change related disruptions such as changes in rainfall patterns (Myers, 2005).

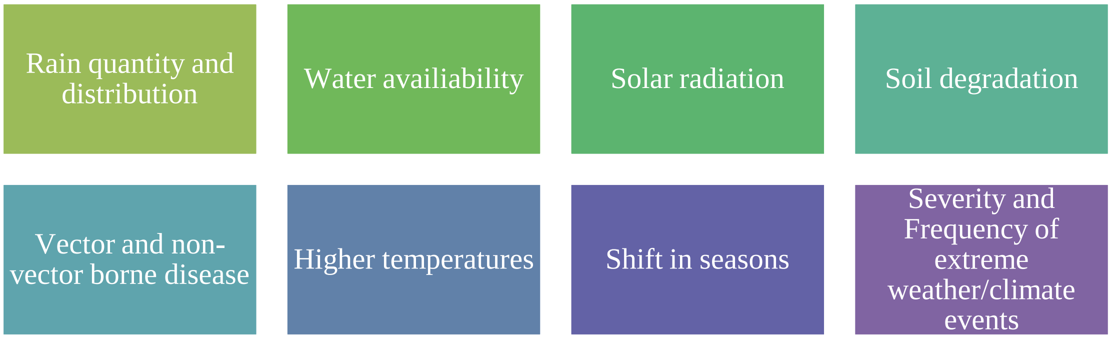
Population movements are influenced by interconnected and dynamic processes which can make it difficult to estimate future displacements from a single source. To illustrate the complexities of migration, we can look at the case of Fiji. There, trade liberalisation through the end of the Lomé Convention and the trade component of the Cotonou Agreement, coupled with the expiration of land leases[11], increased severity of natural disasters, and governance failures has resulted in reduced production, unemployment and deeper impoverishment of sugarcane smallholders. Consequently, many of these smallholders are moving from rural areas to urban squatter settlements (The Eurpoean Commission, 2006). Such settlements tend to be in highly exposed locations that lack basic amenities, leaving inhabitants highly vulnerable to climate risks. In addition the loss of vital social networks leads to a heightened social vulnerability to climate change. This is something which is shared amongst island states and particularly in smallholder communities. Traditional values, social cohesion and collective identities are a major component in the resilience of local communities in Pacific islands (Mimura, et al 2007).

[11] Greater than 80% of land in the Pacific Islands is under customary ownership and managed by indigenous groups. Such indigenous ownership steeps the land with social and spiritual beliefs and collective and individual identity is tied to the land.

3.2.8 CONSEQUENCES FOR SMALL FARMERS IN SIDS

Some of the handicaps that agricultural production in SIDS face are: smallness, remoteness, geographical dispersion, vulnerability to natural disasters, limited access to markets, lack of human and technological capacity, price volatility, growing populations, weak governance structures and land tenure security. These problems are compounded by the negative impact and consequences of climate change.

FIGURE 3-4: CLIMATE CHANGE IMPACTS OF SMALLHOLDER AGRICULTURE



The dependency of SIDS on agriculture and their competitiveness in markets differs. In some SIDS, agriculture accounts for approximately 50% of GDP and 75% of employment whilst in others, it accounts for less than 10% of GDP, employing 20% of the workforce (FAO, 1999). The agricultural capacity of SIDS also differs, and whilst data limitations make it difficult to understand the true number and distribution of smallholders globally, let alone in SIDS, smallholders do constitute a large majority of agricultural producers in SIDS. These small farmers on average operate one hectare of cropland. The World Bank's Rural Strategy defines smallholders as those with a low asset base, operating less than two hectares of cropland (Dixon, Tanyeri-Abur, & Wattenbach, n.d). The definition of smallholders differs between countries and between agro-ecological zones (IFPRI, 2005), with definitions by scale being relative to national contexts (Morton, 2007). The following table gives an indication of farm size for a sample of SIDS for which data was available. As we can see, the majority of holdings are less than one hectare.

TABLE 3-1: SMALLHOLDER HOLDINGS BY SIZE IN SELECTED SIDS[12]

	Census	<1ha	1-2ha	2-5ha	5-10ha	10-20ha	20-50ha	50-100ha	100-200ha	200-500ha	Total
American Samoa	2003	4064	1867	926	189	40	8				7094
Cook Islands	2000	1403	236	82							1721
Fiji	1991	41320	11211	18703	12703	6332	3173	1407	551		95400
Samoa	1999	1108	5954	13408	11970	9553	11389				52382
Dominica	1995	800	1922	1654	443	89	69	30	14	5	9026
Grenada	1995	15534	1372	978	243	74	76				18277
Jamaica	1996	130247	28548	3886	1351	795	263	164	205		187791
Saint Lucia	1996	5375	1102	712	121	42	28				7380
	Total	199851	52212	40349	27020	16925	15006	1601	770	5	379071

Despite the differences that may exist between smallholders in SIDS, agriculture has always played an important role in their economic history and subsistence agricultural production remains universally vital to their economies, nutritional status, and social well-being, as does the production of cash crops for export. Because of their geophysical and geospatial characteristics which restricts agricultural production – reflected in low diversity of crops and food products – and their great distance from markets, export led development is often undermined in SIDS, with high import dependence challenging food security and green growth. Whilst their smallness does provide barriers, it can also be seen as a great opportunity for smallholder agriculture. The reason being that smallholders are generally characterised by smaller applications of capital and higher use of family labour and other family-owned inputs (Thapa, & Gaiha, 2011), as such modestly financed projects in SIDS can have a significant impact and bring substantial socio-economic benefits (IFAD, 2014).

3.2.9 VARYING IMPACTS ON SMALLHOLDERS

With different population dynamics, policies and agricultural practices in place, the specific issues faced by each small island state in its agricultural sector means that the compounding impacts of climate change will be different across SIDS. In addition, the complexity of impacts will vary according to socio-political circumstances. Haiti for instance ranks 153 on the Human Development Index, the development issues are many, including food insecurity which is intensified by natural disasters. Following the earthquake in 2010 that caused widespread devastation, a cholera outbreak spread through the country. This outbreak remains the largest in recent world history. Population pressures, corruption, poor governance and a lack of infrastructure compound efforts for smallholders in Haiti to become

[12] Data source: Lowder, Skoet & Singh (2014)

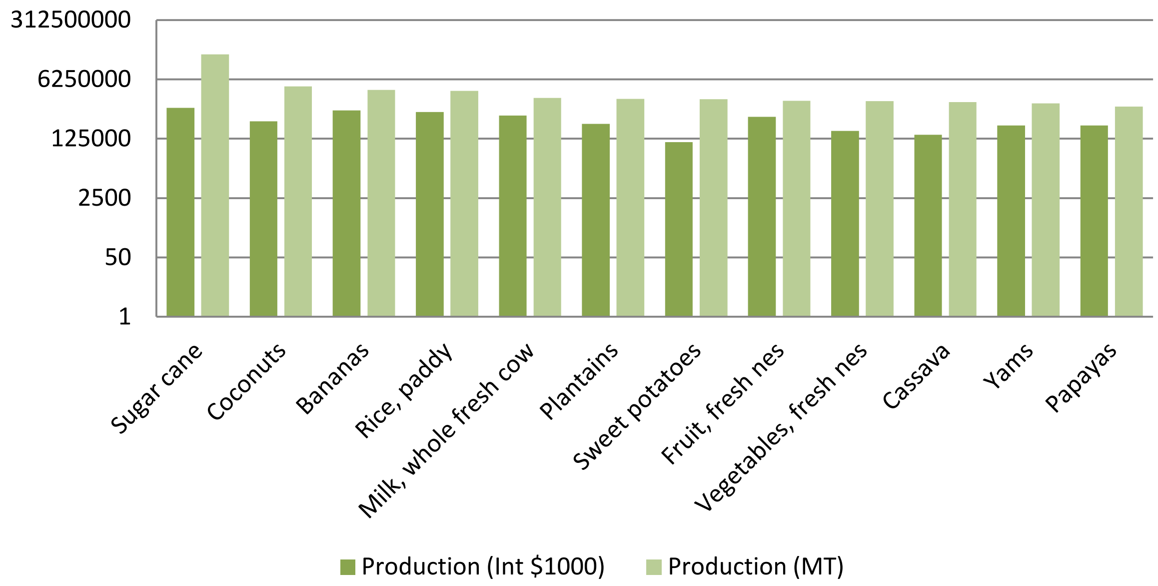
resilient. Compare this to the Bahamas which ranks 42 on the HDI, it shares the common vulnerabilities of SIDS but because of its development status and stronger governance, small farmers may have greater risk resilience.

Climate change impacts on SIDS smallholders will vary according to the farm system and its location and the interaction between weather, topography, soil types, water availability, crop diversity, livestock, and the type of trees used in agro-ecosystems (Oritz, 2012). There is however, strong consensus (Nurse et al, 2015) that climate change will impact smallholder agriculture in SIDS via rain quantity and distribution, water availability, reduced solar radiation, soil degradation (salinization, erosion, and humus depletion), vector and non-vector borne diseases, higher temperatures, shifting seasons and of course the increased severity, and frequency of extreme events such as tropical cyclones, hurricanes, floods, and droughts.

Furthermore, these impacts can influence important ecosystem services such as pollination and soil biodiversity. In addition, the rate of climate change may exceed the rate of adaptation for natural systems, including crops. Crops that were once strong and viable in one region may no longer be suitable, whilst another region may gain the advantage.

For example, one projection shows that an extended dry season (by 45 days) will decrease maize yields by 30-50%, sugarcane yields by 10-53%, and taro yields by 35-75% in the islands of the Pacific. Whilst a greater than 50% increase in rainfall during the wet season on the windward side of some larger islands would cause taro yields to increase by 5-15%, it would also reduce rice yields by approximately 10-20% and maize yields by 30-100% (Singh, 1994). As we see in Figure 3.5, decrease in sugarcane yields will prove costly to many SIDS.

FIGURE 3-5: TOP PRODUCTION IN SIDS – 2012 (WHERE INTERNATIONAL COMMODITY PRICES ARE USED TO CALCULATE THE TOTAL VALUE OF EACH COMMODITY)[13]



In summary climate change will be costly to SIDS even under the 2°C of warming target. The cost to SIDS could reach between 2-5% of the GDP per annum. Smallholder agriculture in SIDS is particularly vulnerable to climate change. Climate change poses a threat to smallholder production which is exacerbated by the challenges that SIDS already face, namely: Smallness, remoteness, geographical dispersion, vulnerability to natural disasters, limited access to markets, lack of human and technological capacity, price volatility, growing populations, weak governance structures and land tenure security. The consequences for small farmers are increased volatility in yields, prices, and competitiveness, with negative impacts on livelihoods, subsistence, and food security.

3.3 INTERNATIONAL COMMITMENTS – THE SAMOA PATHWAY

There is no doubt a global awareness of the special case that SIDS present for sustainable development. SIDS, multilateral and bilateral partners have made previous commitments to the sustainable development of SIDS (Figure 3.6). World leaders renewed these commitments at the conclusion of the United Nations Third International Conference on Small Island Developing States held in Apia, Samoa through the adoption of the Small Island States Accelerated Modalities of Action (SAMOA Pathway; UN, 2014). At the conference,

[13] Data Source: FAOSTAT – Production (2015)

new pledges amounting to approximately USD1.9 billion were made for the implementation of the Pathway.

FIGURE 3-6: PREVIOUS COMMITMENTS ON SUSTAINABLE DEVELOPMENT

1) Rio Declaration on Environment and Development, Agenda 21
2) Programme for the Further Implementation of Agenda 21
3) Plan of Implementation of the World Summit on Sustainable Development (Johannesburg Plan of Implementation), including chapter VII, on the sustainable development of small island developing States, and the Johannesburg Declaration on Sustainable Development,
4) Programme of Action for the Sustainable Development of Small Island Developing States (Barbados Programme of Action)
5) Mauritius Strategy for the Further Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States (MSI), and MSI+5
6) The outcome document of the United Nations Conference on Sustainable Development, entitled "The future we want".

The SAMOA Pathway provides direction, measurement tools and milestones towards sustainable development. In addition it aims to build climate change adaptive capacity, develop partnerships, and gain access to funding and other resources. However without concrete implementation measures these and the earlier commitments to provide support are of little value.

This concern is being addressed; the UN has developed a SIDS Action Platform to chart progress and in addition it has facilitated the discussion of the position of SIDS in the post-2015 development agenda.

For small farmers, the task of adaptation can be overwhelming. However it is encouraging that the international community is offering support. It is with the support of their governments and through collaboration with others, both within their regions and internationally, small farmers can take collective action to adapt and build the required resilience to climate change.

Paragraph 63 of the Samoa Pathway makes the following commitments relating to food security and nutrition:

"63. ... we are committed to working together to support the efforts of small island developing States:

a) To promote the further use of sustainable practices relating to agriculture, crops, livestock, forestry, fisheries and aquaculture to improve food and nutrition security while ensuring the sustainable management of the required water resources;
b) To promote open and efficient international and domestic markets to support economic development and optimize food security and nutrition
c) To enhance international cooperation to maintain access to global food markets, particularly during periods of higher volatility in commodity markets;
d) To increase rural income and jobs, with a focus on the empowerment of smallholders and small-scale food producers, especially women;
e) To end malnutrition in all its forms, including by securing year-round access to sufficient, safe, affordable, diverse and nutritious food;
f) To enhance the resilience of agriculture and fisheries to the adverse impacts of climate change, ocean acidification and natural disasters;
g) To maintain natural ecological processes that support sustainable food production systems through international technical cooperation."

3.3.1 MAURITIUS AND BEYOND, QUERIES AROUND PROGRESS

Small farmers in SIDS are critical to the domestic production of food which is central to helping these often remote and low income countries meet their long term food security needs. This issue had been addressed since 2005 in the Mauritius Strategy of Implementation which came during a period of declining investment in agriculture (FAO, 2005)[14]. Five years after the MSI, MSI+5 called upon the international community to prioritise food security and continue enhancing efforts of SIDS to foster agricultural production, productivity and sustainability.

There is a lack of data on successful implementation on the agreements and on tracking the progress of smallholders in building their resilience. However, with external factors like increasing food prices, continued high import dependency (Figure 3.7), and occurrence of extreme events (Figure 3.8) we can see that this will be an ongoing process.

In Samoa, it was realised that implementation of commitments has been slow. A more integrated approach to the sustainable development was called for, with greater support

[14]FAO (2005). International Meeting to Review the Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States. Statement of the FAO Director-General. Retrieved from: ftp://ftp.fao.org

needed from the international community and all stakeholders. Partnership agreements across a diverse range of actors, including public-private partnerships were secured at Samoa.

FIGURE 3-7: FOOD IMPORTS (% OF MERCHANDISE IMPORTS)[15]

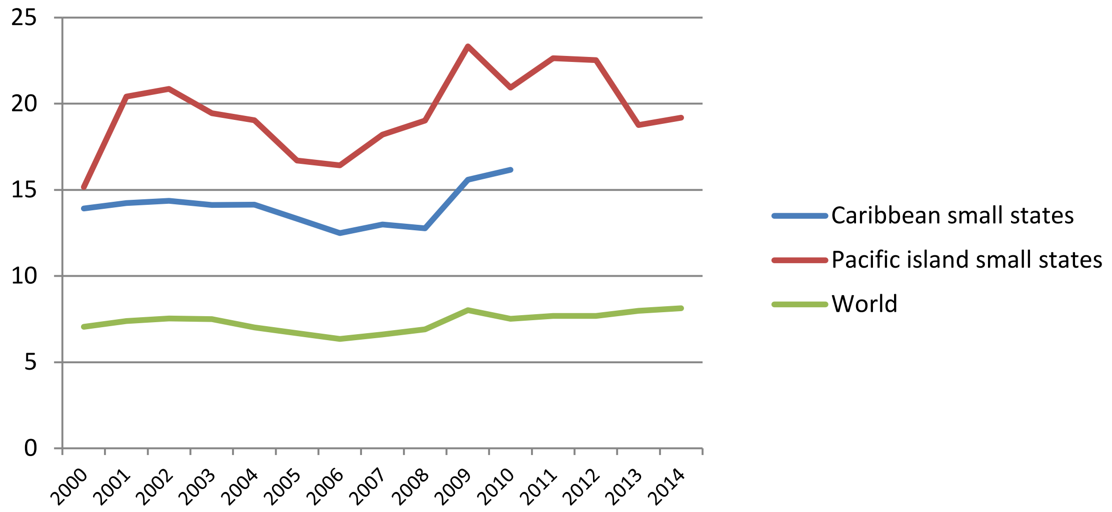
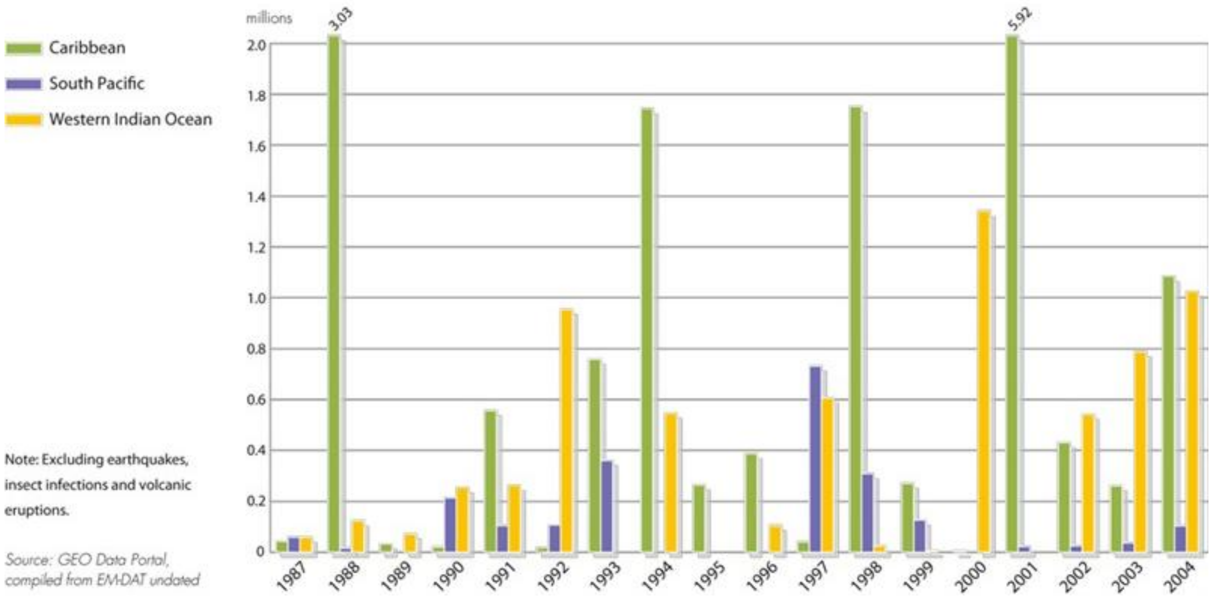


FIGURE 3-8: NUMBER OF PEOPLE AFFECTED BY NATURAL DISASTERS IN SIDS[16]



In summary the SAMOA Pathway and subsequent Milan Declaration highlighted the urgent need to develop food security in SIDS, with multi-lateral trading systems and trade policies playing a critical role. Implementation would be achieved through developing

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15 Data source: World Bank Data – Indicators (2015)

16 Data source: Global Environment Outlook – GEO4, 2007

partnerships, the technology facilitation mechanism and financing. These offer SIDS an important basis for seeking support for the support required by small farmers to adapt and build residence to climate change.

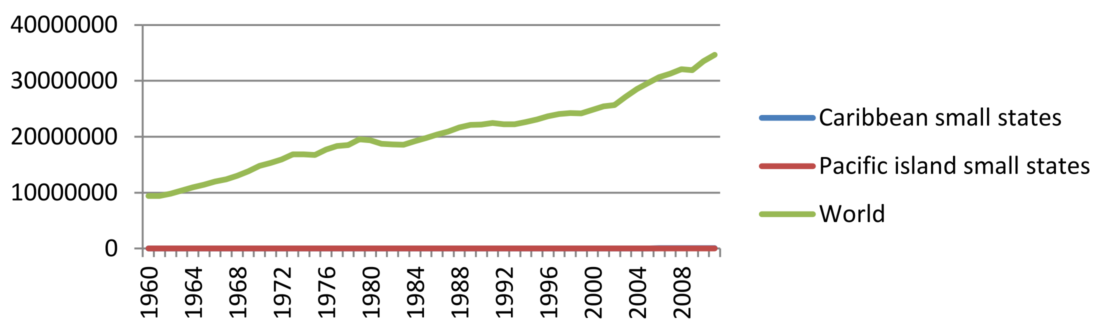
3.4 SOLUTIONS FOR SIDS

3.4.1 MITIGATION OF CLIMATE CHANGE

Globally, agriculture accounts for approximately 19-29% of GHG emissions (Vermeulen, Campbell, Ingram, 2012). To meet the 2 degree target in 2030, reduction in emission from agriculture will need to be in the region of one gigaton of CO2 equivalent a year (Wollenberg, et al, 2007). At current rates, this would seem impossible, with massive innovation and scale required. Whilst it is difficult to quantify the amount of emissions attributed to smallholders, because of the scale of the problem leaving them out of the mitigation conversation is not an option, indeed smallholders will be a critical part of the solution especially as small farmers produce 70% of the World's food needs.

We already know that SIDS are low carbon emitters (Figure 3.9). The meagre emissions that are attributable to them is for the most part due to their dependence on fossil fuel imports, with one estimate stating that SIDS consume in excess of 220 million barrels of petroleum annually (Henderson, 2013). That SIDS are willing to mitigate and have indicated so in their Nationally Appropriate Mitigation Actions and in their Intended Nationally Determined Contributions, shows their commitment and determination to reducing the effects of climate change globally. For all their smallness and fragility they have chosen to act to protect the global commons.

FIGURE 3-9: CO2 EMISSIONS (KT)[17]



[17] Data source: World Bank Data – Indicators (2015)

In addition, for SIDS in order to transition to sustainable development and green growth it is necessary to shift away from fossil fuels. The high dependence of SIDS on imported fossil fuels is a major source of economic volatility. SIDS generally have rich renewable energy sources but structural problems and limited resources hinders their ability to convert these to a tangible product.

The development of long-term green growth strategies across SIDS will enable them to create new opportunities, enhance competitive advantages and importantly capture mitigation finance. Whilst agricultural emissions in some SIDS are quite low (Table 3.2), capturing mitigation finance still provides a useful opportunity for SIDS in developing more resilient and sustainable agricultural sectors and ultimately advancing their green economy potential.

TABLE 3-2: AGRICULTURE'S CONTRIBUTION TO TOTAL EMISSIONS IN SIDS[18]

Country	Agriculture's contribution to total emissions (%)
Sao Tome and Principe	16
Antigua and Barbuda	12
Cook Islands	11
Palau	9
St Lucia	7
Seychelles	5
Mauritius	4
Barbados	2
Tuvalu	2
Trinidad and Tobago	0
Belize	0
Niue	0

3.4.2 LOW EMISSIONS AGRICULTURE

Low emissions agriculture is still a relatively new field and the development of appropriate policy, financing and incentive measures are still being investigated. However research has shown that the largest decrease in emissions from agriculture can be realised

[18] Data retrieved from: Richards, Wollenberg, & Buglione-Gluck, 2015

through restoration of degraded lands (particularly through tropical peatlands and forest conservation), improved cropland and grazing land management, and cultivated organic soils. Further mitigation potential has also been found in water and rice management, set-aside land, land use change and agroforestry, livestock management and manure management (Smith et al, 2008).

For some SIDS smallholders mechanisms like Reducing Emissions from Deforestation and Degradation (REDD+) have been explored (for instance in Fiji and Papua New Guinea). REDD+ is a financial mechanism to create value around the carbon stored in forests. It offers developing countries an incentive to reduce emissions from deforestation and degradation. For smallholders climate smart agricultural practices such as agroforestry and other activities to decrease forest degradation and enhance carbon stocks, (such as mangrove restoration) can capture the benefits of REDD+. However the realisation of and implementation of REDD+ benefits would require strong institutions, and support from a wide range of stakeholder groups including producer and supply chain companies, financiers, non-governmental and civil society organisations, governments, as well as smallholders and their representatives, which are often found to be underdeveloped in the SIDS context.

A recent project which could show promise is that of the Guyana Low Carbon Development Strategy (LCDS), developed in partnership with the Government of Norway. Guyana and Norway signed a memorandum of understanding wherein it was agreed that Norway would provide US$250 million to Guyana by the end of 2015 for avoided deforestation which are measured against indicators of enabling activities and of REDD+ Performance. The Guyana REDD+ Investment fund (for which the World Bank acts as trustee) is the financial mechanism through which financial support is channelled. A reported US$190 million performance based REDD+ payments have been made to Guyana. The lessons learnt from the LCDS could provide an example of best practice for SIDS.

In summary mitigation is an important consideration for green growth and sustainable development in SIDS. Reducing energy import dependence and harnessing a sustainable energy future will protect the economy of SIDS and smallholders from external energy shocks. In addition mitigation will enable smallholders to create new opportunities and capture mitigation finance.

3.4.3 BUILDING RESILIENCE AND ADAPTATION

Adaptation is defined as: the actions that people take in response to, or in anticipation of, projected or actual changes in climate, to reduce adverse impacts or take advantage of the opportunities posed by climate change. Whilst mitigation refers to actions taken to prevent, reduce or slow climate change, through slowing or stopping the build-up of greenhouse gases in the atmosphere (Tompkins & Adger, 2003).

Building resilience at the smallholder level must target both the physical and direct consequences of climate change but also the commercial consequences. This would involve safeguarding against the increased frequency of extreme weather events that include hurricanes, cyclones, floods and drought. These events will persist even if we manage to curb warming below a reasonable level. Reducing exposure to risks is therefore paramount.

Building resilience to climate change in small holder agriculture combines mitigation and adaptation to realise the goal of sustainable development and to create communities that are able to withstand shocks.

3.4.4 ADAPTATION

There is widespread consensus on the need for smallholders in SIDS to adapt to climate change in order to create resilient futures. Smallholders are a critical contributor to development, food security and poverty reduction in SIDS. With exogenous pressures of food prices and climate events, more people in SIDS are at risk of being driven into poverty. By helping smallholders and working towards developing a competitive and sustainable agricultural sector, SIDS can anticipate far reaching benefits, an important one of which will be enhanced food security.

Adaptation projects are widespread in SIDS with measures to increase resilience at the regional and national levels at various stages of implementation. Ground-level projects looking at structural aspects of agriculture are in operation as are projects that involve strengthening institutions, policy, and regulations. These projects are being implemented by a wide array of actors which include the EU and UN agencies which also serve as Global Environment Facility (GEF) implementing agencies (activities include projects sponsored by GEF and non-GEF funded projects), multilateral financial institutions, bilateral development assistance agencies, private and civil society partnerships.

Through National Adaptation Programmes of Action (NAPAs), Least Developed SIDS have been able to identify their most urgent adaptation needs. Introduced by the UNFCCC, NAPAs are meant to be action oriented, country-driven, and flexible and based on national circumstances. However there is some concern that agriculture is underrepresented in some NAPAs (Huq & Huge, 2010).

The way that food is grown, processed, distributed and consumed has a profound impact on the environment, societies, and economies. Smallholder adaptation and mitigation is not solely a process to create resilience against climate change but an opportunity to realign practices for people, planet, and prosperity.

Smallholder adaptation would have to look at governance, technical, cognitive and cultural aspects, paying particular attention to identified barriers to adoption. Some of the barriers to adoption of adaptation interventions in SIDS have been identified as:

- A lack of focus on the adaptive capacity needs of Local Government or Island Councils and communities.
- Inadequate and inflexible support from international adaptation funding modalities for system transformations or to address root causes of vulnerability.
- Failure to recognise the significance of cultural knowledge and practices in shaping adaptive choices of communities in SIDS (Kuruppu & Willie, 2015).
- Inadequate financial support and political will to facilitate focused targeted and market-driven research for development.

3.4.5 CLIMATE SMART AGRICULTURE

It is possible that through low emissions and climate smart agriculture that we can realise co-benefits of adaptation and mitigation. Climate smart agriculture (CSA) was developed by the United Nations Food and Agricultural Organisation (FAO). They have defined CSA as "integrat[ing] the three dimensions of sustainable development (economic, social and environmental) by jointly addressing food security and climate challenges. It is composed of three main pillars:

1. Sustainably increasing agricultural productivity and incomes;

2. Adapting and building resilience to climate change;

3. Reducing and/or removing greenhouse gases emissions, where possible.

CSA is an approach to developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change" (FAO, 2013).The method of CSA is holistic and site specific, with planning being highly farm, commodity and context specific. It attempts to understand, through a participatory process, the trade-offs and choices that farmers must make to become resilient to climate change. The CSA approach is achieved through ecosystem-based adaptation, which is defined variously as:

- The use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change – CBD
- The use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people and communities adapt to the negative effects of climate change at local, national, regional and global levels – UNEP
- The use of the biodiversity as part of the overall adaptation strategy to help people adapt to adverse impacts of climate change – GEF & IUCN

There are several key components to this approach.

1. It is context specific. It does not attempt to seek a global unifying solution as none exists.
2. It aims for inter-sectoral and consistent policies, identifying interactions between sectors and stakeholders, preferably with management at the cabinet level.
3. It seeks financial support for smallholders to transition, linking finance opportunities from the public and private sectors,
4. It does not try to reinvent the wheel and respects traditional ecological knowledge, scaling up exiting successful practices where appropriate
5. It understands that reform cannot be achieved by ignoring farmer's needs. Thus it prioritises strengthening livelihoods by improving access to services, knowledge, resources (genetic and otherwise), financial products and markets
6. It identifies barriers to adoption at all levels starting with the smallholder
7. Disaster Risk Reduction is a key priority. Strengthening institutions, building resilience and better preparedness across levels and sectors and accessing financing are vital to the CSA formula
8. It considers climate change mitigation as a co-benefit especially in low-income agricultural-based populations.

Broadly, there are four major types of actions which can lay the foundation for effective CSA across agricultural systems, landscapes and food systems. These are:

1. Expansion of evidence base and assessment tools enabling the identification of sustainable and adaptive agricultural growth strategies for food security which could also have mitigation potential.
2. Building policy frameworks and consensus for implementation at scale
3. Enabling farmer management of climate risks and the adoption of suitable agricultural practices, technologies, and systems through strengthening national and local institutions
4. Developing financing options to support implementation, linking climate and agricultural finance (CCAFS & UNFAO, 2014).

The CSA approach has attracted its fair amount of criticisms. A few of which are: inadequate understanding of CSA at the local smallholder level (where emissions reductions is perhaps less of a concern); lack of monitoring and accountability (Nambiza, 2014); a need for clearer political agendas and agricultural sector transformation pathways to abate confusion around the purpose of CSA (Caron & Treyer, 2016); it risks diluting or taking away from the agro-ecology movement; it is dominated by corporate/vested interests; it lacks a clear definition with standards and exclusions; it fails to address some key issues around land rights and seed systems; and underrepresented costliness of instigating CSA practices (MaCarthy, Lipper, & Branca, 2011). However the CSA approach remains promising and can essentially be seen as an umbrella term which groups the various agricultural adaptation, conservation, and mitigation practices together. So across the value chain, from smallholders to consumer, stakeholders can have access to a large toolkit of methods to build resilience against climate change.

Techniques in the CSA toolkit include and are not limited to:

- Ecosystem-based approaches
- Conservation agriculture
- Integrated nutrient and soil management
- Mulch cropping
- Cover cropping
- Alterations in cropping patterns and rotations

- Crop diversification
- Organic agriculture
- Land fragmentation (riparian areas, forest land within the agricultural landscape)
- Reintroducing Endemic and traditional crops
- Linking value chains
- Microfinance development and access

The CSA approach identifies adoption of adaptation measures as an important consideration. In doing so it realises that adaptation does not occur in a controlled space. Whilst creating measures is one challenge, ensuring the correct adoption of those measures is at times the bigger challenge. This is a subject that behavioural economists and psychologists have been grappling with for decades. Financing needs to consider the dissemination of adaptive solutions, implementation and adoption by stakeholders.

3.4.5.1 MICROCREDIT IN THE CSA TOOLKIT

The ability of smallholders to adapt to climate change is affected by their capacity to access technological interventions and training. Accessing microfinance can be challenging for farmers as they face rural constraints of low population density, isolated markets, seasonality, and highly covariant risk from exogenous factors such as climate, crop disease, and price movements. Nyasimi et al (2014) argue that increasing access to financial services is a key component of the CSA approach as it provides farmers with more input options – such as purchasing certified seeds – to increase productivity. Whilst microfinance can open up weather-based insurance schemes, and building risk reserves through savings, microcredit can enable prudent risk-taking. With their roles in land management and food security, women are key participatory stakeholders in the CSA infrastructure. Many microfinance institutions explicitly and consistently target women, which can empower and mobilize them to engage in CSA (Nyasimi et al, 2014).

Microfinance institutions, by partnering with other agricultural organisations, can help clients finance CSA incrementally whilst also bringing to them the training and resources which can help them to mitigate and adapt (Rippey, 2012). For instance DFID Kenya designed a Smallholder Climate-Smart Agriculture Program to be delivered through its 'Finance Innovation for Climate Change Fund'. The program supports the scaling out of innovative private sector investments in agricultural adaptation/mitigation and resilience and providing repayable grants to selected agribusiness partnerships led by microfinance institutions for lending to small scale farmers and value-chain actors. Farmers contracted to such microfinance partnerships have the option to take loans to produce commodities in line with CSA values. Farmers can use their loans to invest in activities that will increase their production efficiency (such as soil fertility management, purchase of appropriate seeds, and water harvesting) (Chesterman, & Neely, 2015).

3.5 DISASTER RISK REDUCTION

Climate change adaptation and Disaster Risk Reduction (DRR) should be pursued in concert in order to mitigate the negative effects of climate change and to reduce the risks and vulnerabilities that it presents. Indeed the two are interrelated with the methods used in one, being appropriate to the other. Despite this policy integration is still weak, with an unproductive distinction existing between these two related concepts in the Pacific SIDS at least. These distinctions however are not as apparent at the community level, where initiatives to minimise risk and create resilience through adaptation often operate within a policy vacuum (UNISDR & UNDP, 2012). Indeed if we examine some of the methods to reduce risk from environmental and climate change impacts we will see that there really need not be a distinction between the two. These include: Diversification; the adoption of climate resilient crop varieties; sharing losses through insurance and other capital market mechanisms such as private reinsurance and collateralized markets; early warning systems and its communication to end-users.

The integration of DRR into agricultural policy and its application across the agricultural value chain can facilitate the identification of barriers to production and detect private sector and market orientated approaches to reduce risks and create resilience.

3.6 PARTICIPATORY VALUE-CHAINS

The FAO define a sustainable and inclusive value-chain as “the full range of farms and firms and their successive coordinated value-adding activities that transform raw agricultural materials into food products that are sold to final consumers and disposed after use, in a manner that is profitable throughout the chain, has broad-based benefits for society and does not permanently deplete natural resources.” (FAO, 2014)

FIGURE 3-10: AGRICULTURAL PARTICIPATORY VALUE-CHAIN

If the small farmer can get a larger share of the price paid by the final consumer of his product, then he/she is evidently better off and consequently in a less precarious and vulnerable position.

Value-chain analysis takes place at all levels of production, with value being determined in end-markets. If a smallholder is using green technologies, lowering emissions, and conserving local ecosystems, then this is additional value that they are adding to their product, but one that can only be captured when consumers buy the product. Certification bodies such as Fairtrade, Rainforest Alliance, Bird Friendly, Soil Association and the Gold Standard can help smallholders capture this value. For instance, Fairtrade is working on developing the Fairtrade Carbon Credits Standard. This would be an add-on to the Gold Standard – a well-known carbon verification scheme. It will aim to enable producers to actively participate in the production and trade of carbon credits through climate smart agriculture, green energy, and forestry projects, capturing the value of emission reductions in the production process.

Smallholders in SIDS face market integration challenges which can be problematic for food security and rural livelihoods. Poor economic geography, costly marketing infrastructure, and the lack of domestic value adding opportunities means that smallholders find it hard to compete in niche export and domestic markets. There are opportunities for domestic market integration, especially through linkages to the tourism industry. However a paradox that SIDS smallholders face is that often hotels and supermarkets prefer to import produce rather than sourcing from local farmers. Purchasing managers cite erratic supply, quality, quantity, high transaction costs and unreliable delivery and transport logistics for domestically grown fresh produce (Bammann, 2007).

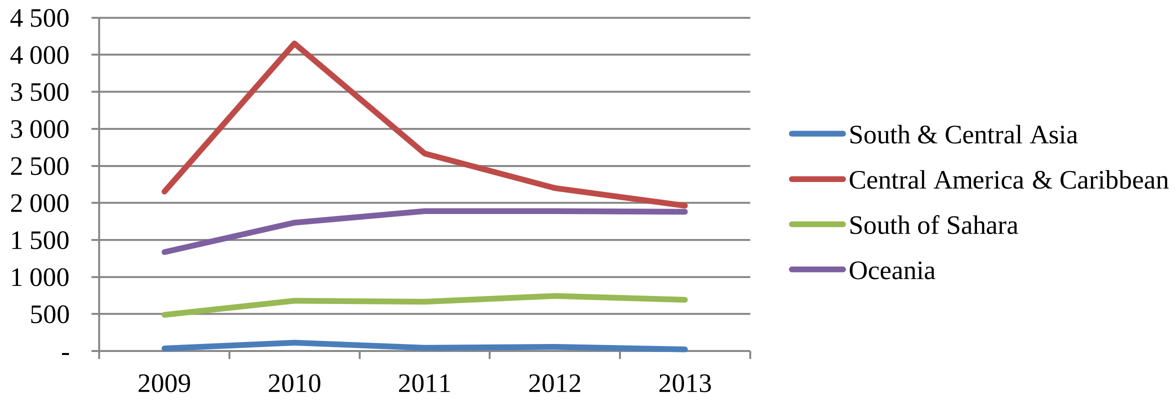
Addressing these barriers by consolidating stakeholder needs, product diversification, more efficient and sustainable processing technologies, sustainable waste minimisation, better infrastructure, and policy integration are integral to the success of climate smart agriculture, and to meet the triple bottom line of sound environmental, social, and economic development.. As CSA practitioners reach critical mass, it will become institutionalised. In order to get to this stage, project implementers would need:

- To ensure the involvement of different stakeholder groups, with increased sector coordination
- Support the professionalisation of farming enterprises
- Shift away from project-based interventions to looking at driving structural change and regulation through programmes and market mechanisms
- Mainstream sustainability until it becomes a licence to operate (Molenaar et al, 2015).

3.7 ADAPTATION FINANCE

The picture of adaptation finance is encouraging. There has been a large increase in public adaptation related finance in recent years. There was an estimated US$24.6 billion (range US$23-26 billion) in 2012/13, of which 90 per cent was invested in non-OECD countries. However how much of this is channeled to SIDS is unclear. As we can see from the figure below, net Overseas Development Assistance (ODA) to SIDS has remained quite stable since 2009. The sharp increase in 2010 in the Caribbean region is attributable mainly to Haiti.

FIGURE 3-11: NET ODA RECEIPTS TO SIDS IN US$ MILLIONS[19]



SIDS will need access to greater financial resources in order to adapt. Financial support for improving smallholder agriculture could come from the traditional sources of development and environment finance as well as performance-based funding. The latter would include the sale of carbon credits (through for instance REDD+ mechanisms) or certified commodities, payments for ecosystem services, and Nationally Appropriate

[19] Data Source: OECD DAC (2015)

Mitigation Action budgets, however this would require the development of better data and research infrastructure to measure emissions and carbon stocks, and subsequently capture mitigation finance to its full extent. In developing performance-based mitigation finance, SIDS can realise co-benefits of improvements in livelihoods and food security. Therefore it is important to enable the relevant infrastructure for SIDS to tap into this pool of financing.

The largest global financing source for smallholders is the Adaptation for Smallholder Agriculture Programme (ASAP). This was launched by the International Fund for Agricultural Development (IFAD) and aims to channel climate finance to smallholder farmers so they can access the information tools and technologies that they need in order to build resilience to climate change.

In summary climate change adaptation is critical in creating resilient smallholders in SIDS. Through processes like CSA small holders can reduce risk from environmental and climate change impacts whilst also developing opportunities for green growth. Adaptation however does not occur in isolation and would require systemic change. This would require expanding research and development of sustainable and adaptive agriculture, building cross sector policy frameworks, strengthening national and local institutions to enable management of climate risks at the smallholder level and developing novel financing options for widespread adaptation measures.

3.8 CASE STUDIES OF CLIAMTE CHANGE IMPACTS ON SMALLHOLDERS IN SIDS

3.8.1 HURRICANE IVAN IN GRENADA

In September 2004 Hurricane Ivan reached Grenada as a category three storm, in less than eight hours Ivan had devastated the island’s socio-economic infrastructure. 28 people were killed, and the OECS estimated that 90% of housing stock was damaged (equivalent to 38% of GDP), 90% of hotel rooms were damaged (equivalent to 29% of GDP), the agricultural sector sustained major losses equivalent to 10% of GDP with the two main commercial crops of nutmeg and cocoa making no contribution to the economy for six to eight years following the hurricane. The list of damages continued with losses to schools, eco-tourism and cultural heritage sites, telecommunications and electricity installations leading to an estimated financial loss of US$900 million, over twice the country’s GDP. Prior to the hurricane, Grenada was projecting a positive economic growth rate of 5.7%, but in the wake of the devastation negative growth of -1.4% was projected (OECS, 2004). As it moved towards Jamaica, Ivan was classified as a category 5 storm, devastating communities there also.

This is the power of natural disasters. In the span of a few hours the devastation to communities can be massive, setting development back years if not decades. With projections of increased frequency and severity of extreme weather and climate events, the challenge for SIDS to survive is great. As magnitude and severity increase SIDS with their smaller resource base and limited development options, have a limited capacity to cope. The impact of sequential severe events on island ecosystems could mean that systems are unable to recover to their last best state. Agricultural reduction could decline as soils never recover from erosion, salination, or biological degradation through biodiversity loss.

In Grenada, regenerating nutmeg and cocoa production post hurricane proved slow with the population characteristic of farmers being a hindering factor as older farmers lacked the incentive to replant crops with a long-term income profile. In addition the loss of matureshade trees for cocoa production and the time intensive task of saving old and standing nutmeg trees meant recovery would take longer than expected (The World Bank, 2005)[20].

FIGURE 3-12: IMPACT OF HURRICANE IVAN ON AGRICULTURE IN GRENADA

- Destruction of 70 percent of the 555,000 nutmeg trees. With a predicted reduction in production for five years following the hurricane and associated reductions in foreign exchange earnings of approximately 8%.
- Considerable damages to the physical infrastructure supporting the nutmeg and cocoa industries
- 100% destruction of the 350 acres of bananas estimated at EC$1,440,134.
- Destruction of 15.4% of the 120 acres of citrus estimated at EC$ 2,610,623.
- Total destruction of 114.5 acres of vegetables valued at EC$2,792,000.
- Destruction of minor fruits estimated at EC$2,792,000.
- Around 20% of the 282 acres of roots and tubers valued at EC$837,125.
- 91% of forest lands and watershed were stripped of vegetation.
- The livestock industry incurred estimated damages of EC$ 9,338,117.00 due to the loss of housing infrastructure and stock.
- Damage to 150 miles of farm roads were incurred, with an estimated reconstruction value of EC$28.67 million. (FAO, 2008)

[20] The World Bank (2005). Grenada: A Nation Rebuilding. An Assessment of Reconstruction and Economic Recovery One Year after Hurricane Ivan. Washington, DC: The World Bank.

This case study illustrates the urgent need for investing in disaster risk reduction, resilience building, and climate change adaptation in SIDS.

3.8.2 BANANA PRODUCTION IN THE WINDWARDS

The Windwards banana producers are Dominica, St Lucia, St Vincent and the Grenadines, with approximately 4000 farms, the majority of which are Fairtrade certified. St Lucia has the largest number of farmers. The average farm size is generally less than one hectare and 45% of smallholders are women (Support Caribbean Bananas, nd.).

Banana production in the Windwards is going through a crisis with a loss of more than 20,000 producers since the 1990s. There have been various factors contributing to this decline. These include:

- Increased competition from Latin American banana producers who benefit from lowered import tariffs to the EU
- Increased incidence of natural disasters such as Hurricane Tomas in 2010 and greater prevalence of droughts
- Disease outbreaks and specifically the black sigatoka

With a 1% increase in rainfall, St Lucia's banana exports would be expected to increase by approximately 0.27%, whilst the same percentage increase in temperature is projected to result in a 5.1% decrease in growth of banana exports. Under the IPCC climate projections, by 2050, banana exports are projected to be minimal with the cumulative yield loss to be an estimated EC$165 million (ECLAC, 2011).

The loss of income from banana production will have an overwhelming effect on the livelihoods of smallholders in the Windwards. Significant capital investment by small farmers is required to enable diversification of farm systems and adopt best practice.

3.8.3 TARO CULTIVATION AND SEA LEVEL RISE IN THE REPUBLIC OF THE MARSHALL ISLANDS (RMI)

Taro is an important subsistence crop in the RMI where it was traditionally cultivated in taro pits in an agroforestry system (where coconut, breadfruit, and padanus were also grown). Pit cultivation however differs across atolls, with the practice almost extinct in some. Production of Taro and other crops has fallen dramatically as import staples have become more popular. In addition climate change threatens production through changes in rainfall, rising temperatures, climate variability, and sea level rise. Wetter conditions will benefit some crops such as coconut, breadfruit and cassava, whilst declines in rainfall would hurt most crops and especially traditional subsistence crops such as yam and taro in the RMI.

Sea-level rise in a real concern in the RMI and affects traditional agriculture. Sea level has risen 0.3 inches a year since 1993 and under a low emissions scenario is projected to have risen by 3.9–10.6 inches by 2030 (Pacific Climate Change Science Programme, 2013). Saline intrusion in soil and groundwater aquifers from rising seas are already making cultivation of crops like taro and yam no longer viable in some regions. In addition storm and tidal surges flood taro pits with salt water, compromising the crops (Reti, 2008).

To reduce its dependency on food imports there is a growing interest in subsistence agriculture and particularly Taro production in the RMI. However the challenges of rising sea-levels and shortage in elite seedlings limit progress (Nandwani et al, 2003)

3.8.4 CASE STUDY: SMALLHOLDER ADAPTATION TO COCOA POD BORER IN PAPUA NEW GUINEA

Smallholder livelihoods derived from Cocoa production were negatively impacted by a widespread pest in the East New Britain Province of Papua New Guinea. The cocoa pod borer (*Conopomorpha cramerella*) is a small moth that lays its larvae in the cocoa pod. The larvae then feed on seeds causing them to stick together. The result is undersized seeds of poor quality. The cocoa pod borer decimated harvests in the East New Britain Province of Papua New Guinea leaving many small farmers without income. Total production in the province fell from 22,000 tons in 2008 to under 4,000 in 2012.

The cocoa pod borer will be impacted by climate change. The Pacific Climate Change Science Programme (2013) shows that temperatures have increased at a rate of 0.11 degrees Celsius since the 1950s and rainfall has become more varied in the PNG. Higher humidity and rainfall patterns in cocoa production regions may impact incidence of the moth which favours hot and humid.

A recent study by Curry et al (2015) looked at the interconnections between household responses, the local socio-cultural and economic context of smallholder commodity crop production and the wider institutional environment in which household choices and decisions are made to assess why the cocoa pod borer had such a drastic impact on yield in the East New Britain Province. The arrival of the disease presented smallholders with an all or nothing scenario. At the farm level, the decision was to modernise and shift to a high-input and technically advanced cropping system or remain in their traditional foraging production strategy which is a low-input cropping system. Farmers would be required to adopt more market orientated values, new agricultural practices, and make major lifestyle changes, with more family labour time required and greater investment in cocoa plot. The shift to modernity would not be an easy leap, presenting smallholders with a decision that would require a fundamental shift in their value systems and moral frameworks.

Prior to cocoa pod borer, smallholders in the East New Britain Province would practice a low input cocoa cropping system, with harvesting of cocoa being the main source of cash income. The low input cropping system allowed farmers to engage in other activities to diversify livelihoods. Cocoa plots were interplanted with other crops to be sold at local markets. More time was spent on food crops employing the traditional swidden (slash and burn) cultivation technique. Importantly the low input system meant that family members had time to engage in the important socio-cultural activities that are integral to social wellbeing.

The study found that after cocoa pod borer many famers did not return to cocoa production, with limiting factors being a lack of quality training and support services, the high labour demands which limited labour flexibility across a range of activities, and a reluctance to adapt through adoption of modern farming methods. The latter would mean a radical change in lifestyle and the suspension of indigenous economic and social values that underpin labour, production and social relationships. For instance, such adaptation would require farmers to adopt a savings culture to finance farm inputs. However, historically, cocoa farm income is utilised to meet socio-cultural obligations therefore savings would not always be reinvested into cocoa production. It was found that those farmers who did shift to cocoa pod borer farm management techniques did so with the help of credit facilities.

This study adds to the evidence that smallholder adaptation decision-making is not independent of the environmental, political and socio-economic contexts of farming including the cultural values and historical experiences that have long shaped farming practices. Any adaptation strategy must consider this.

3.8.5 PALAU LAND TO SEA APPROACH TO CLIMATE CHANGE ADAPTATION

With sea level rise and saline intrusion impacting coastal growing areas in Palau, an ongoing Pacific Adaptation to Climate Change project (Ngiraingas, 2014) was instigated that would focus on lowland taro cultivation, upland agroforestry, aquaculture and food processing.

Partnering with local farmers and the Secretariat of the Pacific community, taro production is being tested by identifying varieties which are more resistant to salt. The project is making use of indigenous knowledge in the construction of dikes to reduce saline intrusion to taro crops. To date the project has discovered three new salt-tolerant taro varieties to share across the pacific. Upland farming has not traditionally been practiced in Palau, but this method is being trialled to grow diverse crops such as bananas, lemongrass, soursop, pineapples, papaya, tapioca and taro, through ridge farming to conserve water, intercropping, and the use of organic fertilisers and compost to increase soil health.

The aquaculture project was developed to curb the unsustainable harvesting of mangrove crabs which form an important part of the Palauan diet. The project saw the distribution of 20,000 crablets which were distributed to farmers to rear to maturity and develop sustainable hatcheries expertise.

The project promoted growing and eating local food to increase local food production, reduce reliance on imported foods, and address the non-communicable disease crisis, The project has been training youth in local food processing and cooking, developing new recipes to substitute imported produce with locally grown. Though still in its formative stages, the project is also helping to develop local understanding of climate change adaptation.

3.8.6 CASE STUDY: ORGANIC COCOA IN SÃO TOMÉ AND PRINCIPE

In São Tomé & Príncipe, cocoa constitutes 95% of exports, with the country's unique conditions enabling it to be the world's only producer of the Ciollo cocoa bean – the rarest and most expensive type of cocoa on the market.

In the 1990s however, the cocoa plantations were struggling because of drought, mismanagement, and falling global prices leading many producers to abandon cocoa production. Struggling to make a living, farmers begun to encroach into and clear the biodiversity rich forests of the region. An IFAD supported project sought to change this trend through the establishment of public-private partnerships between local smallholders and organic and fair trade operators in São Tomé and Principe.

The project – titled Participatory Smallholder Agriculture and Artisanal Fisheries Development Programme (PAPAFPA) – commenced in 2003 and would last for 13 years, involving 500 farmers in 14 communities which by the end of the project had benefitted 1800 small farmers, with a total of 2400ha under cultivation for cocoa (IFAD, 2014).

The project went into partnership with Kakoa – a French organic chocolate producer – who ran an assessment on the value of the beans, finding value in the unique cocoa of the region. They committed to buying all organic cocoa produced by smallholders in the region whilst also provided technical and commercial advice alongside IFAD. The smallholders learnt to transition from the production of medium-quality to high-quality cocoa beans.

The organic production of cocoa adjusted traditional cropping methods, which restored and used established shade forests in the region which supplied supplementary crops such as bananas, coconuts, mangos, papaya and breadfruit. The beans were fermented and dried through solar cocoa dryers and smallholders also learnt to minimise waste through the use of correct postharvest storage practices.

A local research station endorsed the cocoa's aromatic qualities whilst an international certifier made sure that the beans produced were in fact organic. Participating smallholders have seen their income increase on average from 25% below the poverty line to 8% above it.

São Tomé & Príncipe’s use of cocoa production as a climate change adaptation strategy has highlighted:

- The importance of facilitating local and regional market access through public-private partnerships
- That sustainable production systems depends on healthy ecosystems
- The importance of incentives for agro-biodiversity through value-chains (Firmian, n.d).

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4 FIJI CASE STUDY

[76]

[76] A stall holder in Namaka. He had relocated from Samoa because his village was threatened by rising seas.

4.1 FIJI BIODIVERSITY

In the previous chapter we introduced the unique case of SIDS, here we reduce our focus to the case-study of Fiji, which forms the backbone of this thesis. As was mentionined in the previous chapter, nearly half of the world's vascular plant and a third of its terrestrial vertebrate species are endemic to 34 biodiversity hotspots. Each hotspot houses an evolutionary treasure trove of endemic species yet only a third of these habitats remain, covering a mere 2.3% of the Earth's land surface. Fiji lies within one of the most threatened of these 34 hotspots - that of the Polynesia-micronesia biodiversity hotspot (Brooks et al, 2002; Watling, 2011). Fiji consists of a group of volcanic islands resting in the South Pacific. The Archipelago includes 322 islands and 522 islets of which 106 are inhabited. The largest island of Viti Levu covers the majority of the land area and houses 69% of the population. The administrative and political capital, Suva, is the largest urban area, outside of Australia and New Zealand, within the South Pacific.

In Fiji, for Viti Levu alone, it is estimated that climate related disasters can incur a cost equivalent to between two and four percent of Fiji's GDP by 2050 (Bettencourt, 2011). In a one degree centigrade warmer world, we have now reached a time where the effects of climate change are no longer a distant possibility but a reality with accelerated rates of climate variability already being felt in Small Island Nations such as Fiji. Not only has Fiji been experiencing an average annual increase in mean temperature by 0.15 degrees Celsius (consistent with global warming patterns) since 1950, but also greater ocean acidification, sea level rise and more extreme weather patterns (Australian Bureau of Meteorology & CSIRO, 2011). These are projected to get worse as we attempt to stabilize emissions to well below two degrees centigrade of warming.

The four major ecosystems forming Fiji's natural asset base are: open sea; coral reefs, lagoons and beaches; mangrove forests and estuaries; and tropical moist forests. A non-exhaustive list of ecosystem services provided by these ecosystems are presented in Table 4.1 along with a 1994 estimate of the monetary value of these services.

TABLE 4-1: VALUE OF ECOSYSTEM SERVICES - FIJI, 1994

Ecosystem	Services Valued	Unit Value (hectare/year)	Total Value (million/year)
Open Sea	Climate regulation	F$56	F$24,253
	Food production	F$0.07	F$31.92
Coral reefs, lagoons &	Recreation	n/a	F$336
Beaches	Disturbance regulation	n/a	F$307.2
	Food production	n/a	Included with mangroves
Mangroves & estuaries	Food production, nutrient cycling & habitat	F$2,402	F$100.88
	Disturbance regulation	F$2,500	F$105
Tropical moist forest	Climate regulation	F$328	F$246
	Water regulation & supply	F$20.6	F$15.45
	Raw materials provision	F$87.9	F$65.9
	Biodiversity preservation	F$14.70	F$11.03
Total	All except climate regulation		F$973.38[77]

Fiji is undergoing a biodiversity crisis. The aforementioned ecosystems are faced with the anthropogenic threats of over-harvesting, pollution and conversion to alternative uses which largely relate to agriculture and tourism. Between 1992 and 2007 alone Fiji had lost 70,000 hectares of forest cover (Lees, 2007). For Fiji, the continuing loss of mangroves, corals and natural forests would not just impact tourism and agriculture in the long-run but through the loss of biodiversity, the archipelago's overall health. Islands possess extremely diverse and fragile ecosystems. They are treasure troves of evolution. The loss of one species can have far reaching consequences. Not only would you have you lost evolutionary data but that loss will impact all the other species which would have adapted in union with the other. In Fiji, of the terrestrial species: 11 endemic bird species are at risk of extinction, a further six near threatened whilst three of the native bat species, two endemic frogs, half of the palm species and a third of the varied reptiles are also classed as threatened (Lees, 2007). The marine species are not much better off with the effects of climate change and more direct

[77] Sistro (1997)

human impacts such as over-harvesting threatening habitats (Knudy, Roelfsema, Lyons & Phinn, 2013; Kronen, Clua, McArdle & Labrosse, 2003).

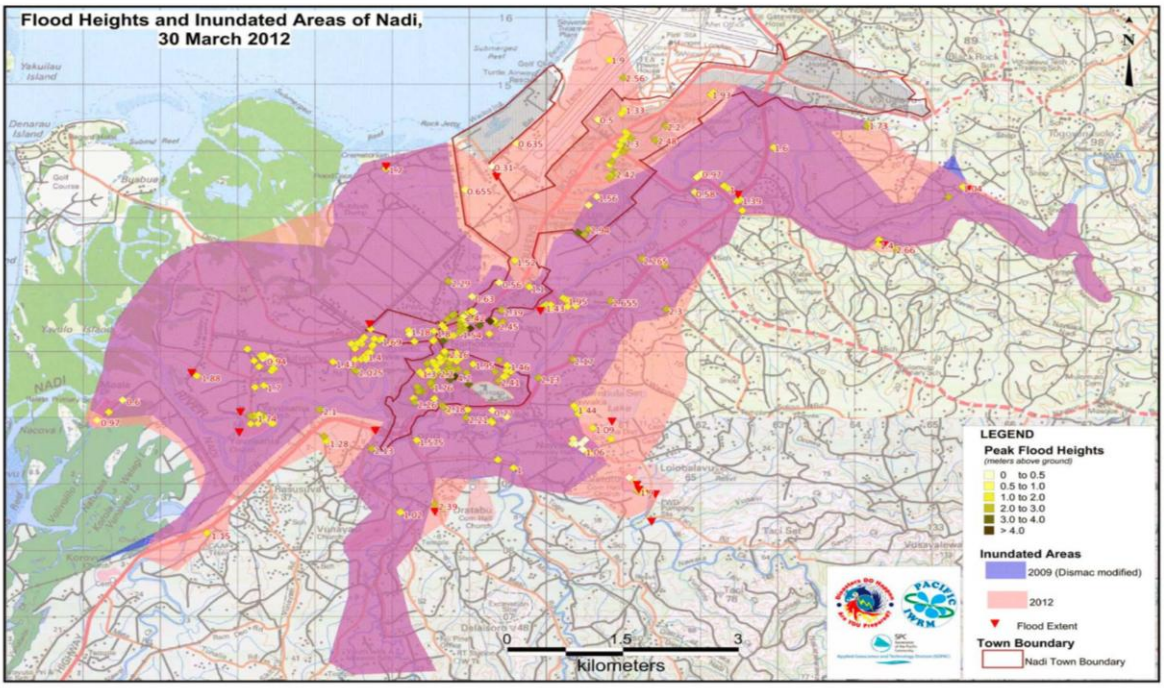
Fiji has taken steps in establishing both marine and terrestrial protected areas to safe guard its natural asset base. During the Barbados Convetion on Biological Diversity Fiji set a benchmark target of protecting 30% of its inshore and offshore marine areas by 2020 however according to the Word Bank (2013) only 0.1% of territorial waters had protected status as of 2010. Locally Managed Marine Areas (LMMAs) however are widespread in Fiji, covering approximately 25% of Fiji's inshore area (UNDP, 2012). The established LMMAs are being widely acknowledged as an ongoing conservation success story (UNDP, 2012) though the picture is not all rosy. The LMMAs can be seen more as 'replenishment fisheries' rather than a protected area initiative (Lees, 2007) and therefore it can be assumed that LMMAs would not be providing a completely effective ecological contribution towards biodiversity conservation (Jupiter et al, 2010). Fiji's terrestrial protected areas in contrast are lacking in protection be it in the form of community based conservation or otherwise. Only 1.7% of Fiji's land area is protected (World Bank, 2013) Tourism, agricultural expansion, land right laws and the timber trade place pressure on the existing protected areas. Unfortunately, Fiji follows the expected trend of many developing nations which fall in biodiversity hotspots. These resource rich nations are generally plagued with corruption and lack institutional capacity (Jameson, Tupper & Ridley, 2002), which can impede conservation efforts.

As Fiji's main sectors are tourism and agriculture, the need for climate change adaptation becomes ever more pertinent. Coral bleaching and coastal erosion will threaten tourism while sugarcane farmers can expect higher variability in sugarcane yields. In Nadi, a mainstay of sugarcane farming and the gateway of tourism, the need to instil adaptation targeting both climatic and non-climatic factors is apparent. The recent 2009 and 2012 flash floods comment on the need to fortify the Nadi catchment to greater occurrences of flooding whilst also combating major contributing factors facing the region such as water demand conflict, groundwater and surface water quality, saline intrusion, drought, deforestation, wetland and mangrove loss, environmental degradation and marine pollution (Wood, 2010).

Tourism is a complicated sector in terms of conservation. Whilst it provides the largest sector contribution to the Fijian Economy, its direct contribution to the average Fijian family is marginal (Malani, 2002). At the same time mainstream resort style tourism places undue pressure on Fiji's terrestrial and marine ecosystems. For instance, in Nadi the Denarau Island resort development saw the clearing of 130 ha of mangrove forest in order to create an 18 hole golf course and an elaborate resort complex. This extreme modification of the ecosystem has resulted in extensive erosion, chemical runoff into the coastal ecosystem from maintaining the grounds, depletion of marine life from habitat loss and an increased risk of flooding (Hall & Page, 2003). As the roots of mangroves act as natural sieves absorbing pollution and sediments, they provide protection to Fiji's prized coral reefs. Their loss would impact tourism and commerce as mangroves are also habitats for reef fish during the earliest stages of their life cycle when they are at their most fragile state.

When seen in conjunction with climate change, the loss of mangrove habitats becomes even graver. Climate change projections have predicted with very high levels of confidence: greater rainfall in the wet season with the frequency of days with extreme rainfall increasing, higher temperatures and a continuation of mean sea-level rise (Mimimura et al, 2007). As mangroves prevent coastal erosion, protecting against swells and strong winds, and also absorb flood waters, there loss would also be the loss of a valuable buffer against the effects of climate change. In Nadi the effects of the loss of this buffer is already apparent. In Figure 4.1 we can see that the 2012 flood plain had increased from the area inundated in 2009. It is apparent that mangrove conservation is a no-regret adaptation response for the wide variety of ecosystem services they perform. However an undervaluation of mangroves continues to see their degradation (Agrawala et al, 2003).

FIGURE 4-1:MAP OF FLOOD HEIGHTS AND INUNDATED AREAS – NADI - (VOCEA, 2012)



In Nadi, the severity and frequency of floods has seen local people begin taking up adaptive measures. For instance, people living within the Nadi river basin, following the floods in January 2009 and that in March 2012, homes that were wiped out were rebuilt on stilts (Figure 4.2). The January 2009 flood alone was estimated to have cost F$113 million in damages. It is projected that with climate change and the increasing severity of cyclones, an increase in wind speed by 20% could result in an increase in cyclone damage by 44-100% (Rao et al, 2013). This along with coastal erosion from sea-level rise and development is detrimental to ecosystems ability to protect against flooding. Ecosystem-based adaptation through coastal revegetation and conservation of mangroves, forests and buffer zones are presented as possible adaptation strategies (Nunn, 2013) but greater support is needed for farmers in the region for whom the 2009 floods had a catastrophic impact with one estimate stating that 42% of farmers were unable to meet their basic subsistence needs, pushing many below the poverty line (Chandra & Dalton, 2010).

FIGURE 4-2: NADI FLOOD ADAPTATION

Unlike Nadi, Suva is protected somewhat from flood waters and the full brunt of cyclones as it sits upon a hilly peninsula between Laucala Bay and Suva Harbour. The Capital was built atop of reclaimed swamps. As the most urban centre amongst the South Pacific Island groups, Suva is an important point of commerce and is politically significant in the region. The city is fringed by Marine Protected Areas (MPA), such as the Suva Lagoon MPA and a 1083.35 hectare terrestrial reserve, Colo-i-Suva. Colo-i-Suva is a large forest park which draws in eco-tourism. It is also the playground for many locals with shaded walks and waterfalls. As communities also live around Colo-i-Suva crime has been an issue, ranging from theft of crops to serious violent crimes (Fiji Police Force, n.d). Colo-i-Suva is a contentious forest park – the vast majority of the native forest habitat was cleared to create a mahogany plantation in the forties and fifties. The plantation remains with its understory sheltering an assemblage of native plants. The park is largely the sole responsibility of a diminished Department of Forestry. It would seem however that the management of the park is to some extent lacking and also further complicated by local land ownership laws. This is not unique to the case of Colo-i-Suva. A poignant example of the lack of management in these parks and reserves is displayed in the case of Fiji's only native mammals - bats.

Fiji has at least six bat species which are important pollinators and seed dispersers in local forest ecosystems (Palmeirim et al, 2007). Of these, the critically endangered Mirimiri Arcondata or Fiji flying fox is endemic. Whilst the flying fox is mainly found on the island of Taveuni, Viti-Levu's rainforests have also attracted bat species such as the vulnerable cave dwelling Notopteris macdonaldi, or Fiji blossom bat. These bats are threatened due to habitat loss, invasive predatory species such as the cat and mongoose, roosting disturbances and over-harvesting (Palmeirim et al, 2007; Malotaux, 2012). Data on Fiji's bats is limited but a recent study found that two of the five known roosting caves for the Notopteris macdonaldi or Fiji blossom bat exist on the borders of Colo-i-Suva forest park with the bats foraging within the park. The Kalabu and Wainibuku roosting caves are threatened by the villages bordering the park who not only encroach upon the park thus threatening the bats habitat but also harvest the bats during the yam season. Waste disposal is also an issue with the Kalabu cave in particular becoming an informal waste dumping site which threatens the bats roosting habitat (Malotaux, 2012; Hubbard, 2004). The bats which forage within the park are also at risk of habitat loss with logging within the forest park being a real concern. As mentioned earlier, Colo-i-Suva is predominantly a mahogany plantation which has now reached harvesting age. The Department of Forestry rent the land upon which the park is formed from the native landowners (Kalabu village; Government of Fiji, 1953) for whom harvesting the mahogany trees once leases have expired is a lucrative option.

The nature of land as leasehold from native landowners complicates matters for conservation and development. Land and terrestrial and marine natural resources are largely owned by indigenous groups in Fiji[78]. The concept of 'Vanua' or land, people and custom, is of great importance to native Fijians grounding them with a sense of belonging. For other Fijian citizens, in order to make use of the land and its resources permission must be sought from the native owners. Regarding marine resources, the controversial Qoli qoli bill of 2007 saw ownership rights of traditional fishing grounds being transferred to indigenous groups. For Indo-Fijians, who are the largest ethnic group behind Fijians constituting 37% of the population and the majority sugarcane farmers, property rights becomes a controversial issue. Around 73% of Indo-Fijian sugarcane farmers have been cultivating their crop on lease hold land (Naidu & Reddy, 2002). Lease expiration and non-renewal perhaps fuelled by the country's political instability following four coups d'état has caused displacement of thousands of Indo-Fijians.

As one would expect, such instability has affected the economic and social structures in Fiji. With increasingly unstable weather events wiping out livelihoods, with investment and jobs threatened as a consequence of the coups, expiring leases and the lack of a democratic process for the past eight years – Suva has seen a surge in slums mainly housing Indo-Fijians. There is not much literature or data on these informal settlements however they are evident in the Suva-Nausori corridor. The corridor has seen the rise in squatter settlements with an estimated population of 82,000 (Storey, 2006). These settlements are evident on the coast and do encroach into the Colo-i-Suva forest reserve and other surrounding forests such as Sawani (Koto, 2011).

FIGURE 4-3: SLUM SETTLEMENT NEAR COLO-I-SUVA FOREST RESERVE

[78] According to the Native Lands Trust Board, 86% of land is owned by indigenous groups through customary titles.

The Suva-Nausori corridor consists of the peri-urban region between the ocean to the south of Suva and beyond Colo-i-Suva in the north. It includes the Rewa river which runs through Nausori. The Rewa delta hosts one of the two largest mangrove ecosystems in Viti-Levu. These mangroves are threatened by reclamation for agriculture, squatter settlements and other anthropogenic activities such as using the mangroves as a dump site (Mohanty,2006; Solomon & Kruger, 1996) . The Sovi basin for which the Rewa river is the largest sub-catchment is also of ecological significance. The Sovi basin is Fiji's main terrestrial biodiversity storehouse. The Sovi basin protected area is the largest in Viti-Levu covering 20,000 hectares. The protected area, formed on a 99 year lease from local landowners, contains pristine native forests and some of the countries rarest biodiversity. The pristine forests are protected from encroachment by their remoteness and provide important ecosystems services such as water security to the settlements downstream (Chandra & Dalton, 2010).

4.2 MICROFINANCE IN FIJI

The slum settlements throughout Fiji lack in basic services (Kiddie, 2010). It does seem as though the slum dwellers have access to government supported and community based microfinance (Kim, 2013). The data on the use and effect of microfinance in Fiji is sparse though it has been suggested that two thirds of marginalised and vulnerable people are excluded from financial services (Sharma & Reddy, 2002 in Sibley, 2007). Urban dwellers' financial exclusion remains unclear (Sibley, 2007). With 40 percent of the population living below the poverty line (Sano, 2008), the potential of microloans to alleviate poverty whilst also reaching conservation objectives is attractive. Especially when coupled with the strong sense of community that grounds the Fijian and indeed Indo-Fijian identity and Fijian's deep seated connection to the land and sea (Sano, 2008).

Microfinance is still relatively young in Fiji. In 1999, following a conference on establishing microfinance in Fiji, the Government of Fiji allocated F$3 million and established the National Microfinance Unit (NMFU) to develop Fiji's microfinance sector. A report on the sector in 2005 by the Punla sa Tao Foundation found that it was lacking. In Fiji rural households have few opportunities for trade as they have relatively comfortable subsistence livelihoods (Pacific Financial Inclusion Programme (PFIP), 2012). Coupled with low population density and spatial remoteness, the traditional Grameen model which was adopted in Fiji was not yielding results. MFIs were experiencing high transaction costs with a low client base. In 2009, a new plan for financial inclusion was envisioned but never deployed. According to the PFIP (2012) financial services assessment, in 2009 there were nine key government backed microfinance institutions in Fiji which had 1,700 outstanding loans of which 540 were delinquent.

Commercial banks which have microfinance branches however are proving more successful. In 2009 the Reserve Bank of Fiji established a requirement for all commercial banks in Fiji to have a microfinance branch (PFIP, 2012). ANZ partnered with the United Nations Development Programme to create a Rural Banking sector in order to reach the 350-400K unbanked population. The service has been extremely popular with 73,000 deposit accounts as of 2011. Rural banking services are offered by way of mobile banking vans. Financial literacy is a key component of the service (Reddy, 2011). Fijians have a strong collectivist culture. Concepts such as 'kerekere' remain important cultural norms. Kerekere denotes unconditional sharing of one's resources, as time and property are seen as communal. Such a concept does not lend well to savings. ANZ however teach clients the importance of meeting one's own financial needs in order to better meet community needs (Hiatt, Hutchens, Ortiz & Powell, 2011)

Savings are offered at 1.75% interest with a required opening balance of F$0.60. To discourage people from overly dipping into their savings there is a F$3.00 cost associated with withdrawal. To qualify for microloans, a client has to have saved for at least six months, and have the backing of their community leader. Effectively collateral thus becomes one's own savings and social capital in the form of community backing. The loan model is that of individual lending. The loans can be applied to any worthwhile purpose and have a term of two years at 19 percent/annum. The minimum loan amount is F$60 and the maximum is F$1200 (Reddy, 2008). Recent data on default rates is lacking, however in a report by Blacklock (2006), the default rate was reported as less than two percent. Other lending models in Fiji are Credit Unions, ROSCAs and Co-operatives such as the Sugarcane Growers Fund (SGF). The SGF is a revolving fund which enables sugarcane farmers to access small loans and provides a buffer in times of disaster. However the author in discussion with microfinance institutions in Fiji and also through a review of the literature found that of the microlending services offered in Fiji, none had a direct link to climate change adaptation within their lending criteria.

4.3 THE FIJI LOCALLY MANAGED MARINE AREA (FLMMA)

Throughout Viti-Levi one can see people living off the land. The rivers and sea provides proteins, whilst the land provides medicines, fruits and vegetables. The vast majority of the population do grow and catch a proportion of their own food (Thornton, 2009). If development, environmental degradation and climate change threatens the ability of people to continue to do so, then solutions must be sought. With strong subsistence livelihoods and seemingly successful individual microfinance models, it would seem that merging environmental conditionality along with microloans could further secure existing livelihoods against the pressures of climate change. Whilst such initiatives are lacking in Fiji, other inspiring models have risen.

The most widespread and successful initiative has been the Fiji Locally Managed Marine Area (FLMMA). The FLMMA, established in the early 1990s, arose through local villagers taking charge of restoring the depleted resources within their Qoli qoli (traditional fishing grounds including reef, marine and lagoon areas) that are woven into their culture and traditions. The villagers soon expanded and formed a network through which knowledge, information and resources could be shared. They merged their local practices (such as establishing core 'no-fish' zones) with scientific monitoring and data collection. This data was then presented to relevant policy makers who then went on to provide the network with credibility and weighting through policy development (Veityaki et al, 2008). In Fiji, as in much of Micronesia, people's identity comes from the land and sea. The cultural norm may therefore be strongly in favour of protecting these resources.

The FLMMA is an example of collective management of a commons through community based conservation. Sano (2008) shows that Ostrom's (1990) design principles are evident in the establishment of the Locally Managed Marine Protected Areas (LMMAs). Each area is defined by customary fishing right areas (or qoli qoli's) and tabu (or restricted) areas which form the core Marine Protected Area. When Fiji gained independence in the 1970, a dual ownership system was established with coastal waters and resources becoming State owned with traditional owners retaining exclusive rights within their qoli qoli's. This has provided the LMMAs with legitimacy, with governmental support for its establishment and management (design principle 7). One issue that arises through such an arrangement is that the non-indigenous population does not have rights to access the qoqliqoli's. This means that they are excluded from the FLMMAs. Regardless, this parcelling intro traditional areas has led to well defined and understood boundary areas which are more easily managed due to their size (design principle 1).

Ostrom's (1990) second design principle of clear harvesting conditions and congruence between rules and local traditions, is evident in the concept of Tabu. Traditionally Tabu areas were set up within a qoli qoli following the death of a chief forbidding resource extraction as a sign of respect. The Tabu would last for a 100 days, and following a memorial feast would reopen for harvesting (Sano, 2008). The current practice of setting Tabu areas borrows from and extends this traditional practice and remains successful as it fully utilises culturally acceptable practices for collective resource management. The third design principle of active participation in rule formation by resource users is met with community inputs being welcomed, however final rule decisions come from the chief which is the cultural norm however it does not always mean total compliance. Sano (2008) found that compliance requires whole community involvement in the decision making stages and well defined boundaries. The fourth design principle of monitoring is facilitated by NGOs such as WWF who train and assign residents as wardens. Wardens and villagers can issue graduated sanctions (design principle 5), which can be verbal warning, physical punishment, and police action. Local authorities and chiefs are in hand for conflict resolution; strong social norms necessary for group living also provides a deterrent for situations of conflict or rule breaking (design principle 6). Finally NGOs with their mobility and financial capability have enabled the growth of LMMA from a localised phenomenon to a national one, forming the FLMMA (design principle 8).

The FLMMA network has gone on to win numerous awards, for instance the 2002 Equator Prize. It has grown to include communities within six districts covering an impressive 25 percent of Fiji's inshore marine area (World Resource Institute, 2008). The success of the FLMMA network is stated to lie within its participatory and collaborative focus, ensuring local communities are central to the functioning of the network, providing them with a sense of ownership, empowerment, cultural and livelihood security (Halverson & McNeil , 2008). Such a method can broadly be envisaged as the participatory management of protected areas, the establishment and maintenance of buffer zones, compensating or enabling viable substitutes to local people and promoting local and social development through novel methods such as eco-tourism and sustainable harvesting to name a few (Peters, 1998; Damania et al, 2008).

Whilst collective management has had some positive impact on the health of marine resources, and as such improved the subsistence livelihoods of resource-owning units (members within a qoli qoli), it has not improved household income. Alternative mechanisms need to be sought to invigorate income generation, such as the development of alternative sustainable marine-based occupations (Lawson-Remer, 2013). This is where microloans again become an attractive prospect as it could be used to invigorate livelihoods.

Whilst the FLMMA is indeed a step in the right direction, the fact remains that Fiji's marine areas are under stress for the following reasons: LMMA lack the resources to monitor and pursue illegal poaches within their qoli qoli; over-fishing in near and deep water fisheries is prevalent and species numbers have drastically declined or are now extinct (such as nesting turtles for the former and two species of giant clams for the latter); Fiji lacks a government imposed quota for in-shore fisheries (Lees, 2007); and lastly as was mentioned earlier, rather than the more traditional permanent closures characteristic of protected areas which prohibits resource extraction, FLMMA's can be seen as fisheries regeneration with establishment of conditional closures which still enable people to harvest marine resources (Mills, et al, 2011).

As the pressures placed by climate change increase it may be that some damage to the reef ecosystems in particular will be unavoidable. Increasing temperatures would take a toll on the fragile marine ecosystems and livelihoods. Coral bleaching would negatively impact upon the life-cycle and behaviour of marine species. Climate change adaptation can however present opportunities for people to enter into alternative livelihoods which focus on conservation. Coral plantations, mangrove reforestation, small scale sustainable farming and fishing can yield big results in the long-term.

Of course differing capacities to cope, recover, and to instigate adaptive measures determines the vulnerability of societies to climate variability. In Fiji the implementation of climate change adaptation is hindered by the prevailing weak socioeconomic conditions and issues such as a lack of capacity (human, financial and technical) and the lack of consistency in the practice of good governance at national and local levels. As such adaptation should not be pursued in isolation but incorporated into development, security and overall biodiversity conservation agendas (Fujikura & Kawanishi, 2011). Microloans with environmental criteria can be a novel method through which to sustainably finance adaptive measures, invigorate livelihoods, and conservation behaviour.

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5 THE RESEARCH JOURNEY – A PERSONAL ACCOUNT OF THE RESEARCH PROCESS


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[79] Namatomoto Village

This thesis started off as every PhD does with a research proposal. The initial area of focus was microfinance and water – and specifically the efficacy of small loans on potable water in India. The conception of this research proposal commenced before I had decided on pursuing a PhD. It was an area I was extremely passionate about as water availability would only become more of concern with climate change, border conflicts, and growing populations and economies. It always disturbed me to know that I could open a tap and, without any effort, get access to something so integral to life whilst 783 million people remained without access to safe drinking water. Novel solutions to finance access would have been a value-added area of research.

I came across water.org and its use of microfinance to enable access to safe drinking water and sanitation. As we often find with such programmes you can find many good news stories but the critical exploration of efficacy is generally missing. Water.org seemed like an ideal institution to partner with for my research. They were utilising microloans in a novel way and were showing this application to be highly successful. To scale up the concept and reach a wider population of those without access to water a detailed impact assessment would have been of value. Indeed another benefit would have been of benefit for development practitioners and the organisation alike. Having approached them for a potential collaboration, I was pleased with the response and was asked to submit a proposal that outlined the methodology I would follow and the benefits of this research to the organisation. Whilst the organisation was interested in the research they were hesitant to allow it as a component of a PhD. Thus I had to move away from Water.org. The attractiveness of the research topic still remained. But an existing NGO working on microloans with a focus on water are few and far between. So the remit of the study was extended to environmental protection and biodiversity conservation.

My area of interest was the Sundarbans and the vast and biodiversity rich mangrove forests which are increasingly threatened by encroachment. I found several small organisations that showed interest in working with me. The most promising was an Indigenous group who worked on catchment management in a remote area of the Sundarbans. As we progressed with our discussions unfortunately funding for the organisation was cut and they were forced to close operations. This was a rough time for many organisations, in the early days following the financial crisis.

Using my networks, I made contact with several other organisations outside of the Sundarbans. I finally found promise in one, The Association for Rivers and Coastal-Ecosystems Conservation. This organisation worked on addressing abject poverty of the Chenchus, the indigenous people of the Nallamala forests of the Krishna River Valley. My contact, John Nagella, is the head of the organisation, and remains a passionate advocate of the Chenchus and in the conservation of the natural ecosystems which provides for them.

The isolated nature of the Chenchus meant that they were often bypassed by microlending bodies. John was keen to get microbanking services to the population and found promise in its connection with conservation. Having shared several case studies with him, we begun to assess the feasibility of a research project that could also have practical benefit for the people of the Nallamala forests. I proposed two options:

Option 1: A survey experiment which could be used to assess the feasibility of microloan in the Nallamala forests and be used as a basis through which to develop proposals to setup a microbanking facility in the region.

Option 2: A randomized impact evaluation which would require partnership with a microlending body

Both options were explored. We searched for microbanking organisations which would be interested in the project whilst also developing the concept of the survey experiment. Concurrently funding was sought. Unfortunately after endless rejections it soon became apparent that the project would not go through and at that stage the cost was one I could not bear.

John and I are still in contact however and hopefully we can use this research to instigate a project in the future.

So next, on my supervisor's advice, I tried looking at the Bale Ecoregion in Ethiopia but again was constrained by finance. I went through other regions and had similar issues with financing. It felt like I was spending the majority of my time seeking funding, so I had to make the conscious decision to fund part of all of the research myself.

By the end of 2011 I finally found an organisation that seemed perfect. Microsfere was a non-profit based in Lyon, France. Its objective was to assist the fringe communities living around protected areas in Ghana by combining rural development with biodiversity conservation. They would aim to improve biodiversity conservation by supporting fringe communities in their pursuit of better livelihoods, as such reducing the pressure on natural resources in their areas. This is achieved through the creation of micro-enterprises facilitated through microcredit. The organisation worked in The Kakum Conservation Area in the Central Region of Ghana and the Amansuri Wetland Area in the Western Region. I would have to cover travel, accommodation and some research costs, but the organisation would have covered most other costs as the research would have functioned as an impact assessment to meet its 2013 project monitoring needs.

I had received initial data, project reports, and developed a detailed research plan. Microsfere had already conducted baseline impact assessments in 2011, at which stage they would have been operating for two years already. They had conducted a total of 106 interviews in Amansuri looking at four communities, whilst 195 interviews were completed in Kakum looking at eight communities. The interviews collected baseline data on the socio-economic conditions of the participants as well as on natural resource issues. The expectation was that Microsfere would repeat data collection every two years, in order to have a mid-term first evaluation of the project's impact on people's livelihoods and on the protection of the natural resources by 2013. One community each from Kakum and Amansuri that did not receive microcredits from the organization was also selected and treated as controls – but the total sample size for these was just 21.

The initial collection had some issues. For example: impact indicators of the microfinance intervention as related to the Amansuri Wetlands included alternative sources for extracting wood fuel than from wetlands and mangrove forests, change in dependence on wood fuel, change in local perception about the importance of the Wetland, observance of sustainable fishing methods, local support in protecting mangrove, wetland and coastal forests, changes in turtle egg consumption, and number of catch and releases of sea turtles. However, most of these indicators were not captured in the interview and where attempts were made the responses were not always reliable, with questions pertaining to illegal poaching of turtle eggs especially being vague.

This initial assessment however provided the basis for a longitudinal study particularly for beneficiaries of the scheme. With my research planned, and a comprehensive outline of costs and research expectations completed, I bought my ticket to Ghana, found a homestay and transport options, and was set to depart in May 2012. Unfortunately a few months before leaving Microsfere could no longer carry out the research as they had run into issues with financing. As a consequence they would have to halt activities till more funding came through.

By this stage something had to change in how I would collect my data. I decided to shift my focus for a final time to Small Island States and use the survey experiment method I had developed for The Association for Rivers and Coastal-Ecosystems Conservation. Small Island Developing States (SIDS) and especially Fiji is an area I had wanted to look at for a long time. Not only is it my home, but as with other SIDS, it is particularly vulnerable to the impacts of climate change. I have seen Fiji change; I have seen lush mangroves and the Colo-i-Suva reserve where we used to play slowly recede. In the latter squatter settlements have risen up, whilst the former has been redeveloped to build opulent resorts. I remember trying to spot flying foxes and waiting patiently for lizards. I remember how the cyclone would come and we would need to shore up wooden defences and camp out in the basement. I remember not having water, and having to run after water trucks to collect a rationed bucket. I remember when the floods came and the poverty that ensued. Smallholders suffered the most. Crops wiped out, no infrastructure to get help – these things would only get worse as climate change took hold. In Viti-Levu, the forests and mangroves that surrounded the poorest communities would be assets against climate change. The communities would need help to adapt their practices to become resilient as seasons and weather patterns changed. So I made contact with the Sugar Cane Growers Council, sought out help from the University of the South Pacific, and the Fiji National University for research assistance. The Fiji Sugar Cane Grower's Council provided me with an office and support to start with, I also recruited two research assistants from them. A further two from the Fiji National University and one from the University of the South Pacific.

I would have to entirely fund the research on my own. This would be a stretch as I was also already paying for the substantial portion of my fees not covered by studentships, and was under the limitations of a student work visa. The total cost came to a little under £5000. This included three months research, accommodation, the cost of flights and travel, research assistants, survey material, fees for loan repayments, transport, and a buffer in case of emergency.

The aim was for each research assistant and myself to collect data from 85 respondents to have a total of 510 surveys. The reality was much different from my expectations.

To start I commenced the study on my own by going to local markets and talking to producers. I had identified the Nadi, Suva, Nausori, and Lautoka markets as producers come from various locations either further inland or from coastal regions to sell their produce and would have allowed for a random sample of smallholders. I started off at the Nadi and Lautoka markets, using a simple random sampling via a random number table. After a grand total of five surveys, three in Nadi and two in Lautoka, I found that this strategy was going to be problematic. The surveys were taking two hours each to complete, as participants would stop to sell produce and chat to friends. Whilst this could have been managed, market officials halted efforts to select my sample from the market. In both locations officials would not let the research continue unless a substantial payment was made to them on a weekly basis. This would have quickly become unaffordable so instead I selected sample areas and recruited my research assistants according to those areas they could cover.

Training and testing my research assistants were done in pairs where possible and took three days each. We did three test runs with farmers. It was here that it became apparent when conducting the experiment component of the survey, the exchange of money on the successful repayment of a loan would become an issue. When the monetary component was explained to participants, it was found that they would become hesitant to continue with the experiment. This was a blind spot in the experimental design as it did not consider the cultural shyness which bordered on a cultural taboo around the discussion and exchange of money in a village setting, especially with a stranger. So F$5 which would have been given on successful loan repayment instead became a participation reward.

Once I was satisfied with the conduct of my research assistants, I gave them each 90 surveys and other equipment with enough money to cover participation fees for 20 respondents. I also gave them half their payment, and money to cover transport costs. After the completion of 20 surveys they were to return them to me or to a specified location and collect further participation fees and funds to cover transport.

One research assistant, who came highly recommended by the Sugar Cane Grower's Council, and had completed the training and test runs without any issues was given all his portion of surveys, the full participation rewards, a hefty transport allowance, and postage for each set of 20 surveys as he was to collect data from further afield in the Western Division of the Island. The research would have taken four weeks considering transport time and also the very real effect of 'Island time'.

In the first week, I commenced conducting interviews on local perceptions of climate change by once again approaching producers in the markets for a 'chat'. This proved really interesting. People wanted to talk, to share their experience and no officials tried to stop us. In addition, in the first week I focused on getting a feel of the microfinance institutions, revolving funds, and cooperatives that were in Viti-Levu. The idea was to review progress on returned surveys in the first week then shoot off to the Suva region to collect my data.

After the first week, I never saw or heard from two of the research assistants again. The one who went further afield kept saying the surveys were on the way but delayed because of rains. He assured me I was getting good responses, it was very exciting. After two weeks surveys had still not arrived, but we stayed in touch and he kept assuring me all was well. By the third week he returned. He had not bothered to follow the sampling strategy, and had decided to leave half of the surveys and all of the experiment empty. Of the last two, one quit after one week with no surveys completed because it was too hot, and the last fell ill from the heat and could not complete the task. To be fair, it was extremely hot and humid. The people interviewed often expressed concern about the heat and its effect on their health.

In that first week I had finished my interviews and had looked at a variety of microlending groups and organistions. In the second week I tried looking for replacements for my research assistants but could not find any that I felt I could trust with the work. So with days and money wasted, decided to collect the data myself. At this stage I had still counted on 85 surveys coming from the one remaining research assistant in the Western Division. I went ahead and recruited a further two assistants. They would act as translators and support to approach elders and participate in social conventions in Fijian villages when needed (only one would accompany me at a time). In order to gain permission to talk to residents in Fijian villages an offering or sevusevu must be made. This came in the form of Kava root which is pounded and created into a mildly sedating drink which is drunk in a ceremony. So together we set off to collect my data. It was slow going because of the very real effect of '*island time*' where a meeting scheduled for 12pm could take place at three pm instead. Other factors were travel time, having to hike out to remote villages and locations, and lastly the norms that had to be followed at the Fijian villages would also be time consuming. By the end of collection I had 205 surveys. Whilst a small sample, I was advised that this would be sufficient.

Collecting the data by myself was in the end a good experience. I trusted my data, I was happy with the consistent information that was shared to participants. I was very aware of the risk of experimenter bias, this could have been spread out through research assistants but unfortunately this was not the case, as such the risk remains of such bias and must be stated as a weakness. For a young researcher setting out on her own PhD research, some questions and lessons learnt were:

Seek a research studentship if possible, if you can work with a team their support would be pricelss and the experience less lonely

If this is not possible - think realistically about the type of data you can collect

Can you obtain your data online from places like World Bank Data or UN Stats? Can you pay for access to data sources? Will this meet your needs?

If you cannot and must work with an organisation - be realistic about the help they will provide

You should consider an alternative and independent method sof collecting your data

Have people you can trust on the ground

Be prepared for the unexpected, with backup plans if the reality on the ground is different from that which you envisioned

80

80 A young boy at Sawani Village

6.1 SURVEY-BASED EXPERIMENT

Framed lab and field experiments utilising behavioural and computational game theory have attempted to unpack microfinance mechanisms and the underlying strategies that are utilised by the actors in this environment. For example, Gine et al (2010) ran an experimental economics laboratory in Lima, Peru where participants were recruited to undergo various microfinance experiments (in a 'game' format) that looked at aspects of risk behaviour and group lending. The experiments involved simulated microloans whereby players were able to choose between risky and safe investments and were required to manage the risk of default. As is typical with microfinance, dynamic incentives were in place to moderate the rate of default. They found that group based lending did induce moral hazard but could be mitigated by allowing borrowers to form their own groups; however they also found that this led to very little risk-taking.

Breza, Chandrasekhar and Larreguy (2011) utilised framed field experiments to understand how different contracting environments affected joint investment opportunities. They used a sample of 1080 subjects drawn from 45 villages in Karnataka, India. Building on a two-party sender and receiver trust experiment with the introduction of a third party judge in some treatments, they were able to explore how social network characteristics impact investment decisions. They found that social proximity could overcome weak institutions and achieve better investment levels whilst social distance had weaker investment levels. The introduction of a third party judge led to collusion in cases of proximity whilst socially distant judges facilitated better investments. In the aforementioned study the proximity of social networks provides the social incentives to uptake efficient investment behaviour.

Influenced by the aforementioned experimental designs, we conceived of a framed field experiment which could be administered with limited time and resources. The experiment was designed so participants would receive a F$5 if they were successfully able to repay their loan, if they were unable to do so then they would not receive the fee. But as was expressed earlier, this monetary component did not work culturally.

As no money was exchanged the research design can been described as a survey-based experiment. Lab and field experiments both have their advantages and disadvantages. The use of standardised procedures makes it easier to replicate lab experiments whilst the highly controlled setting enables causal inference. However the artificial lab setting is not an accurate reflection of reality and thus leads to low ecological validity. Generalising findings to real life settings can be compromised. Field experiments on the other hand are more likely to reflect real life as it is conducted in natural settings but as real life is complicated, it is difficult to control extraneous variables which may affect results and compromise replicability. The survey-based experiment does not necessarily distinguish it itself from lab and field experiments. Many experiments already involve survey methods. However it can be a highly flexible population-based experimental design. This method draws on a representative sample and randomly assigns them to conditions by the researcher. An advantage of such a method is that the representative sample does not have to show up to a location – but can complete the experiment in a natural field setting. This can enable the researcher to reach more of the population of interest especially if they live in hard to reach areas.

Whilst there are tremendous benefits to experimentation, the traditional laboratory context is not always suitable for all types of research questions. Mutz (2011) argues that the emphasis on experimental versus survey methods reflects a field's emphasis on internal versus external validity. However Mutz (2011) continues that population-based survey experiments challenge us to expand our methodological repertoire. Survey based experiments have gained value amongst researchers as they maximize the internal validity of an experiment, thus overcoming some of the obstacles that conventional survey data presents in terms of drawing causal inference. In it enables researchers to establish external validity by administering the experiment to a representative population sample. As Harrison and List (2004) note however such artefactual experiments can be logistically difficult, as was found in this study. In addition it is difficult to conceal experimenter effects.

The type of survey-based experiment that was employed in this Thesis can be described as a choice experiment. Choice experiments make use of stated preference data. Here respondents are asked to choose between different options with are identified by their attributes. Through the repetition of choices and varying attribute levels some of the things that researchers can identify are which attributes significantly influence choice, and the implied ranking of attributes (Hanley, Wright, & Adamowicz, 1998). However the choice experiment method has also be scrutinized, with one concern being that of incentive compatibility. This relates to the ability of the survey-based experiment to elicit truthful responses from the respondent. When not enforced it can lead to hypothetical bias which is a weakness of in stated preference studies.

One way that incentive compatibility can be addressed is by the addition of statements that stress the meaningfulness and real impact of the results of the survey. For instance respondents can be told that the choices they make will help inform policy and/or will be made available to decision makers. This can give greater weighting to their responses, making the hypothetical nature of the choice a real world value (McCartney & Cleland, 2010)

In addition there are a broader set of questions which arise with such choice experiments. For instance respondents when presented with choices may elicit extremeness aversion (Simonson & Tversky, 1992). Extremeness aversion runs counter to the assumption of independence of irrelevant alternatives, a core assumption in multinomial logit models, which states that the preference between choices are no dependent on the presence or absence of other options (Chernev, 2004). Here respondents may compromise on a choice they perceive to be less extreme. Furthermore economic theory assumes an attribute of a good or service has an inherent value which will not vary with context and an individual's established preferences. However status quo bias tells us that when presented with a choice, people may prefer what they already know even if the attributes of the new alternative are better (Kahneman, Knetsh, & Thanler, 1991; Samuelson & Zeckhauser, 1988).

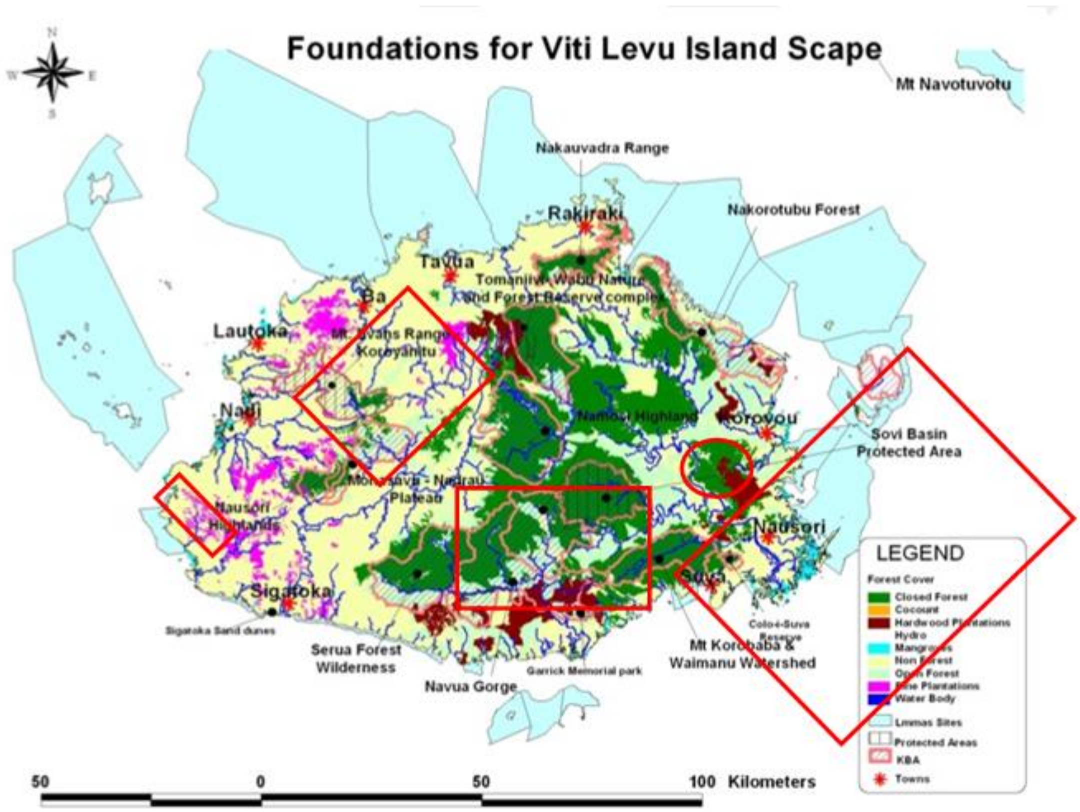
6.2 SAMPLING STRATEGY AND PSYCHOLOGICAL CONSTRUCTS SURVEY CONSTRUCTION

6.2.1 SAMPLING STRATEGY

The survey and framed field experiment was collected between November 2012 and January 2013 in 5 different locations in Viti-Levu. As we saw in the previous section, Viti-Levu is the main island system in Fiji and the most densely populated. It houses some of the countries more encroached upon protected areas and has had the greater human impact from climate variability in recent years. The sample (n=205) was collected by the author with help from two research assistants. Respondents were incentivised with a F$5 participation reward. As the research is focused on advancing knowledge of vulnerable communities in the developing world, the choice of sampling strategy to correctly represent these communities was very important.

The target population consisted of those living by forests, rivers, mangroves and coastal areas. Commencing with a simple random sample the author approached producers in the main markets of Nadi, Lautoka, Nausori and Suva. Producers selling their wares in these markets generally come down from the highlands or the coastal regions to sell their goods. This would have enabled a broader and more representative sample. It was found however that each survey would take upwards of two hours to complete in the market as stall holders would stop the survey to sell their produce and to chat to friends. In addition market authorities became increasingly problematic, seeking money to allow the research to continue. As such the sampling strategy was adjusted to stratified sampling with the population being divided into geographical groups consisting of villages close to or within fragile ecosystems (Figure 6.1). The specified areas were Koroyanitu protected area and highlands, Coral Coast marine protected area, Navua, Nausori, the Rewa delta and Colo-i-Suva reserve. Within each strata respondents were randomly selected with a random number sheet. The author was accompanied by one of two research assistants to gain permission to talk to residents in Fijian villages. Permission was sought through a sevusevu (offering) of Piper Methysticum root, locally known as Kava root, which was presented to the village head. In addition the research assistant acted as a translator when necessary.

FIGURE 6-1:VITI-LEVU ISLAND-SCAPE MAP - (BERGEN, 2010)



6.2.2 SURVEY – PSYCHOLOGICAL CONSTRUCTS

The survey collected information on household social characteristic, health information, land ownership, crop production, marine activities, and dependencies on the natural systems, income sources, expenditure, microcredit activities and loan characteristics.

It also collected information on perceptions of social, economic and environmental problems facing the country, attitudes, subjective norms, perceived behavioural control and behavioural intention regarding conservation behaviour. The survey can be found in Appendix A.

The psychological constructs of Attitudes Towards Conservation, Subjective Norms, Perceived Behavioural Control and Behavioural Intention, were informed by the theory of planned behaviour (Ajzen, 1991). The final scales omitting those items removed for internal consistency and reliability, consisted of a 9-item Attitudes Towards Conservation scale, a 9-item Subjective Norms scale, a 5-item Perceived Behavioural Control scale, and a 3-item Behavioural Intention Scale (α=.90). Each item was measured on a 5-point Likert scale.

The decision to utilise a 5-point scale was based on findings from a pilot study of the survey and experiment with 10 respondents. It was found that Respondents struggled with items that included a 7-point scale compared to a 5-point scale. As each question was posed to respondents verbally it was found that they had greater difficulty in recalling the measurement attributes of the 7-point scale. As such all scales were converted to the 5-point format.

According to Ajzen (1991) attitudes towards a behaviour consists of an individual's favourable or unfavourable evaluation or appraisal of the behaviour in question. Ajzen (1991) suggests an expectancy-value model of attitudes. Here, attitudes take the form of:

EQUATION 6-1

$$A\alpha \sum b_i e_i$$

where attitudes are proportional to the summative value of the strength of a salient belief multiplied by the subjective evaluation of the belief. This method requires focus groups and extensive piloting to determine each item to be included within the scale. However with budgetary and time constraints this was not possible in the current study. The pilot study of 10 respondents was deemed as an insufficient sample size to determine beliefs of the total population of interest.

Instead it was decided to extend the basis of existing scales to reflect attitudes towards environmental conservation rather than adding a wholly novel attitude measurement scale to an already saturated field of enquiry. For instance, Dunlap and Jones (2002) estimated over a decade ago that there were between 700 to 1000 published studies which measure various aspects of environmental attitudes, but a large proportion of these did not employ pre-existing measures of environmental attitudes. This has resulted in a saturation of measurements which perhaps conceptualise the environment quite differently (Corbett, 2006). In addition, having such a volume of measures reflects theoretical uncertainty in regards to the concept of environmental concern (Stern, 1992).

Considering this, a scale was created based on value orientations. Through his review of the literature, Stern (1992) identified four broad value orientations reflected within the various measurement instruments utilised in the study of environmental attitudes. These orientations need not be mutually exclusive and rather may be operating simultaneously. The first reflects a new way of thinking which arguably replaces the common anthropocentric conception of people's relationship with nature. This value orientation is represented in the "New Environmental Paradigm" (NEP). Developed by Dunlap and Van Liere (1978) the NEP introduces a new world view where cultural and societal processes act as the fundamental factor of peoples concern for the environment. The ensuing NEP Scale was designed to measure people's endorsement of this new worldview.

The NEP challenges the Dominant Social Paradigm which forms the second value orientation. The Dominant Social Paradigm involves anthropocentric altruism. In this orientation, the driving factor for people's concern for the environment is their belief that environmental degradation threatens the health and well-being of people (Taylor, 2000). The third orientation can be defined as egoistic concern. Here, concern is guided by perceived personal threats posed by environmental deterioration. The last orientation identified by Stern (1992) is that of religious or ideological concern. In this orientation, concern is a function of deeper religious or cultural values which boarder on our metaphysical understanding of the world (Nickerson, 2012). Later, Gardner and Stern (1996) added a fifth orientation which they labeled 'ecocentric' in which environmental concern is for the sake of the ecosystem. This orientation however has not been shown to be distinct from that of anthropocentrism (Stern, Kalof , Dietz & Guagnano, 1995).

Bearing this in mind the Attitudes towards Conservation scale was created by borrowing items from an existing NEP where appropriate and including items to reflect the Dominant Social Paradigm, egoistic concern and religious concern. Each item was directed towards the behaviour of interest – environmental conservation. The items were as follows:

A1 The forest/river is sacred

A2 Taking care of the forest/river is important for future generations

A3 The forest/river should be used by men as they see fit

A4 The forest/river does not belong to men – Omitted for internal consistency

A5 It is my duty to protect the forest/river

A6 I will not harm the forest/river species because they are protected

A7 I would stop others from hunting/poaching the forest/river species

The NEP items included were as follows:

A8 The balance of nature is very delicate and easily upset

A9 The earth is like a ship floating in space with only limited room and resources

A10 There are limits to economic growth even for developed countries

The scale had good internal consistency as measured by Cronbach's alpha (α=0.73).

TABLE 6-1: ATTITUDES TOWARDS CONSERVATION - DESCRIPTIVES

Attitudes Towards Conservation	Mean	Sd
A1	3.240	1.069
A2	4.340	0.886
A3	2.770	1.062
A5	4.160	0.872
A6	3.730	0.935
A7	3.460	0.921
A8	3.320	1.073
A9	3.350	1.104
A10	3.270	1.010

TABLE 6-2: ATTITUDES TOWARDS CONSERVATION - MATRIX OF CORRELATIONS

Attitudes Towards Conservation	A1	A2	A3	A5	A6	A7	A8	A9	A10
A1	1.000								
A2	0.255	1.000							
A3	-0.072	-0.187	1.000						
A5	0.265	0.419	-0.199	1.000					
A6	0.118	0.307	-0.196	0.503	1.000				
A7	0.192	0.222	-0.022	0.350	0.434	1.000			
A8	0.339	0.333	-0.012	0.313	0.170	0.396	1.000		
A9	0.348	0.363	-0.102	0.223	0.192	0.121	0.355	1.000	
A10	0.140	0.226	-0.102	0.253	0.139	0.125	0.291	0.407	1.000

The Subjective Norm scale is more straightforward. It assesses an individual's perception of the social pressure to perform a certain behaviour. The items in this scale were as follows:

S1 My family finds it important to protect the forest/river

S2 My community finds it important to protect the forest/river

S3 Our neighboring communities find it important to protect the forest/river

S4 The authorities (government) find it important to protect the forest/river

S5 Our elders find it important to protect the forest/river

S6 The young find it important to protect the forest/river

S7 My family's approval of my treatment of the forest/river is important to me

S8 My communities approval of my treatment of the forest/river is important to me

S9 The opinion of others outside my family/community on my use of the forest/river is important to me

The scale show good internal consistency according to Cronbach's Alpha (α=0.87)

TABLE 6-3: SUBJECTIVE NORMS - DESCRIPTIVES

Subjective Norms	Mean	Sd
S1	4.020	0.910
S2	3.840	0.931
S3	3.710	0.956
S4	3.740	1.102
S5	4.090	1.055
S6	3.410	1.275
S7	3.710	0.925
S8	3.620	0.908
S9	3.460	0.957

TABLE 6-4: SUBJECTIVE NORMS - MATRIX OF CORRELATIONS

Subjective Norms	S1	S2	S3	S4	S5	S6	S7	S8	S9
S1	1.000								
S2	0.699	1.000							
S3	0.431	0.587	1.000						
S4	0.451	0.413	0.583	1.000					
S5	0.335	0.474	0.319	0.190	1.000				
S6	0.502	0.463	0.369	0.608	0.223	1.000			
S7	0.609	0.709	0.490	0.501	0.455	0.507	1.000		
S8	0.480	0.481	0.681	0.601	0.231	0.521	0.610	1.000	
S9	0.330	0.328	0.549	0.408	0.171	0.382	0.379	0.668	1.000

The Perceived Behavioural Control scale includes efficacy to perform the specified behaviour and the amount of control one has over the behaviour. The scale items were as follows:

P1 I feel I can control the upkeep of the forest/river

P2 I do not feel like I have any control over how to use the forest/river positively – Omitted for internal consistency

P3 It is easy to live in a way that does not hurt the forest/river

P4 I do not feel that I have the ability to protect the forest/river

P5 It is easy for me to look after the forest/river

P6 It is too great a task to survive and care for the forest/river.

The scale showed adequate internal consistency (α=0.61).

TABLE 6-5: PERCEIVED BEHAVIOURAL CONTROL - DESCRIPTIVES

Perceived Behavioural Control	Mean	Sd
P1	3.320	1.016
P3	3.170	1.031
P5	3.040	1.009
P4	3.107	1.004
P6	2.700	0.942

TABLE 6-6: PERCEIVED BEHAVIOURAL CONTROL - MATRIX OF CORRELATIONS

Perceived Behavioural Control	P1	P3	P4	P5	P6
P1	1.000				
P2	0.144	1.000			
P3	-0.020	-0.269	1.000		
P5	0.241	0.394	-0.299	1.000	
P6	-0.278	-0.255	0.117	-0.199	1.000

Behavioural Intention measures the motivational factors influencing the uptake of a particular behaviour. It indicates the amount of effort one is willing to put into the adoption of a behaviour. The items followed the structure suggested by Jillian and colleagues (2004) which displayed strong internal consistency. The items were:

B1 I expect to respect and sustainably use the forest/river

B2 I want to respect and sustainably use the forest/river

B3 I intend to respect and sustainably use the forest/river

The resulting scale showed excellent internal consistency (α=0.90).

TABLE 6-7: BEHAVIOURAL INTENTION - DESCRIPTIVES

Behavioural Intention	Mean	Sd
B1	4.02	.852
B2	4.07	.798
B3	3.98	.888

TABLE 6-8: BEHAVIOURAL INTENTION - MATRIX OF CORRELATIONS

Behavioural Intention	B1	B2	B3
B1	1.000		
B2	0.770	1.000	
B3	0.701	0.750	1.000

To summarize, the final scales omitting those items removed for internal consistency and reliability, consisted of a 9-item ATC scale (α=.73), a 9-item SN scale (α=.87) a 5-item PBC scale (α=.61) and a 3-item BI Scale (BI; α=.90). Each item was measured on a 5-point Likert scale. The scales items were reverse coded where appropriate and aggregated to create a summative scale.

In the following chapters you will find that the scales have been treated differently. In chapter 3 the individual measures are used to inform appropriate latent variables. This is to done to see whether the use of the summative scale is appropriate for subsequent analysis. In chapters 3 through 6 the items are aggregated to create a summative scale which has then been coded into a categorical variable.

When summated, the Attitudes towards Conservation Summative Scale resulted in scores which ranged from 17-44. Scores between 17-26 indicated negative attitudes towards conservation, 27-35 indicated neither strongly negative nor strongly positive attitudes towards conservation, and scores between 36-44 indicated strongly positive attitudes towards conservation. These scores were coded to create a categorical variable with three categories:

1. Negative attitudes towards conservation,
2. Neither strongly negative nor strongly positive attitudes towards conservation,
3. Strongly positive attitudes towards conservation

The Subjective Norm scale assessed an individual's perception of relevant others expectations for them to perform certain adaptive behaviours. The scores ranged from 12-45 with scores between 12-23 indicating low subjective norms, 24-34 indicating moderate levels of subjective norms, and scores between 35-45 indicating strong presence of subjective norms. These scores were coded to create a categorical variable with three categories:

1. Low subjective norms (not influenced by others expectations)
2. Moderate levels of subject norms
3. Strong subjective norms (highly influenced by others expectations)

The Perceived Behavioural Control scale included items assessing self-efficacy to behave adaptively and one's perceptions of control over the behaviour. Scores ranged between 7-20. Low levels of perceived behavioural control were indicated by scores between 7-11, medium levels of perceived behavioural control were indicated by scores between 12-15, and high levels of perceived behavioural control were indicated by scores between 16-20. As with the other constructs, these scores were coded to create a categorical variable with three categories.

1. Weak perception of behavioural control
2. Medium levels of perceived behavioural control
3. High levels of perceived of behavioural control

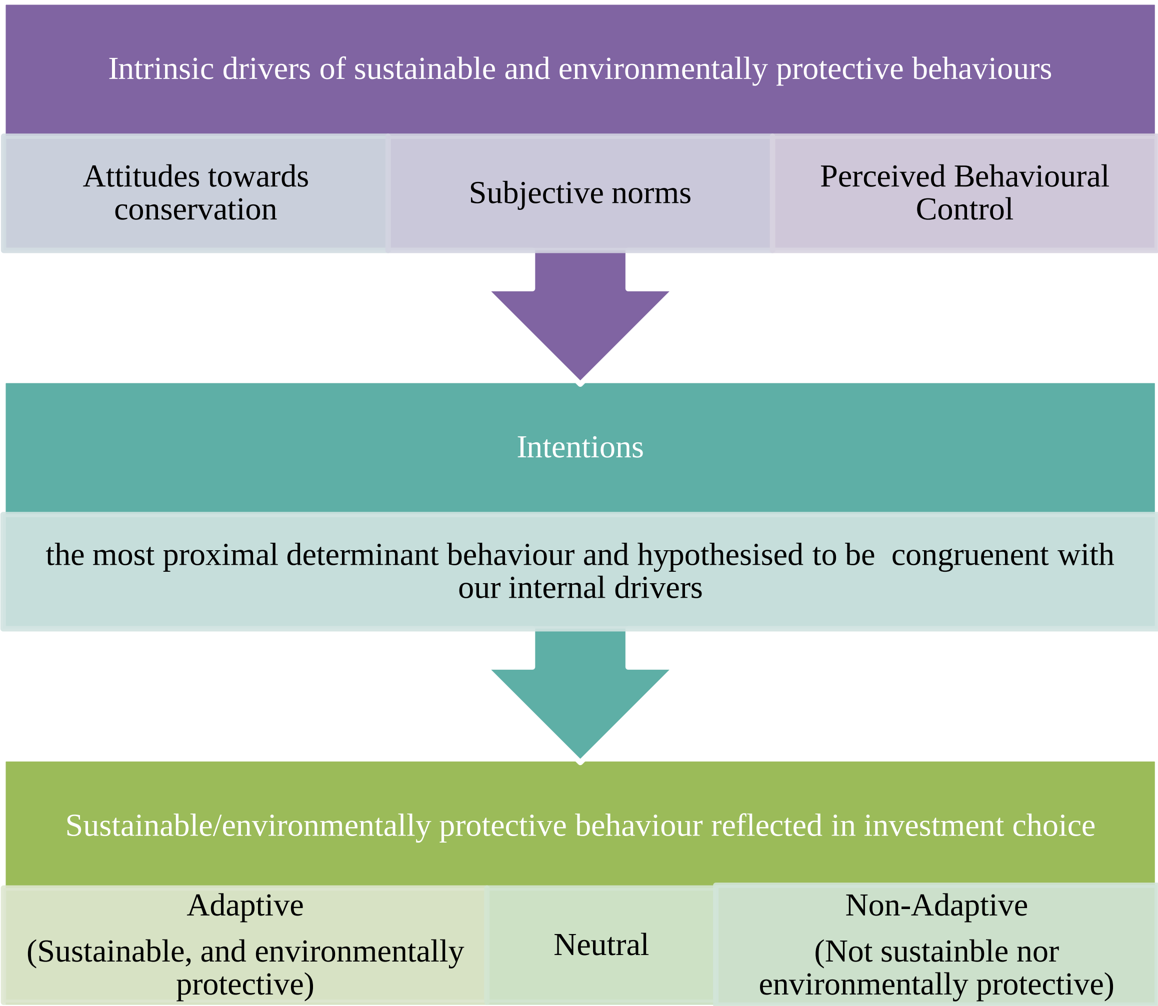
Behavioural Intention, one of the core concepts within the TPB measures the motivational factors influencing the uptake of a climate adaptive behaviour. It indicates the amount of effort one is willing to put into the adoption of a behaviour. Behavioural intention scores had a range of 3-15 and indicated intention to engage in subsequent climate change adaptation and conservation behaviour. Low intention scores were represented by values between 3-7, medium intention was indicated by scores between 8-11 and high intention to engage in the behaviour was indicated by scores between 12-15. The intention scale was converted into a categorical variable with three categories:

1. Weak intention
2. Medium intention
3. Strong intention

The items were constructed to ascertain peoples protective beliefs, norms, and intentions regarding the environment. They were used to ascertain people's internal motives - to take up investments that were not only adaptive but also protective of natural ecosystems. The sustainable use of natural resources which the survey questions assess may be seen as divergent from the specificity argument of the Theory of Planned Behaviour – where we measure attitudes et al. towards a specific behaviour.

However we argue that is exactly what we are doing in the ensuing experiment. Firstly, asking respondents about their attitudes towards investment behaviour would have been quite abstract. The different investment choices which will be introduced in the next section would each have an impact on the environment, with some being more sustainable then others. Thus investment choice acts as a proxy to the 'end' behaviour - the sustainable use and protection of the forest/river ecosystems. These were the natural ecosystems that were in proximity to the sampled population. In addition, this allowed us to control for response and acquiescence bias to a certain degree. If we asked questions relating to the intended use of the microloan for sustainable investments then during the choice experiment we risk diluting actual stated preference by artificially leading respondents to a choice.

We can break down the process of measuring stated behaviour as follows:



6.3 SURVEY-BASED EXPERIMENT

The survey-based experiment was carried out following the administration of the surveys. The experiment was designed to collect data on environmentally protective investment preferences. Specifically how these preferences were affected when faced with different microloan incentive structures which did or did not impose environmental conditions. The experiment is depicted in Figure 6.2 and can be found in Appendix D.

FIGURE 6-2: FRAMED FIELD EXPERIMENT HIGH LEVEL SUMMARY

Experiment - High level summary

Note: the summary diagram below does not detail the concept of ecosystem effect

Incentive Type *There are two lending periods under each incentive type, thus respondents play two rounds of the experiment for each Incentive Type*	**Investment Choice** *Respondents selects an Investment choice for each of the two lending periods*	**Loan Conditions** *Determined by and incentive type and investment choice*
No Incentive	Adaptive	• Interest (“i”) = 20%
	Mixed	• Loan maturity (“M”) = 8 months
	Non-Adaptive	• Required principal repayment (“P”) =100%
Dynamic Incentive *i.e. missed payment ceases current loan so that further returns on the investment cannot be accrued for that loan period.*	Adaptive	• i = 20%
	Mixed	• M = 8 months
	Non-Adaptive	• P = 100% or $300
Green Incentive *Ecosystem effect impacts interest rate depending on Investment Choice (see column Loan Conditions)*	Adaptive	• i = 0% • M = 8 months • P = 90%
	Mixed	• i =24% • M = 8 months • P = 100%
	Non-Adaptive	• i = 25% • M = 6 months • P = 100%

Respondents were randomly assigned into a control group and a treatment group. The treatment group consisted of talking respondents through a climate change information leaflet which is displayed in Appendix B, whilst the control group received no such information.

The experiment consisted of two “lending models”. These were: a) individual liability loans where the respondent was solely responsible for their loans followed by b) joint liability loans with mutual responsibility of outcomes. The joint liability scenarios were played out with the researcher who mimicked the loan choice of the respondent in the individual liability scenario.

The joint liability scenario was initially to be played out between participants rather than with the researcher however we found this difficult to implement. In Fijian communities in particular, it is culturally frowned upon to talk about money, thus there was a reluctance of people to conduct the experiment together. The solution at the time was for the researcher to play the role of the second borrower, mimicking the participant’s investment choice from the individual liability scenario. However this was argued to be a shortsighted and ultimately flawed solution as it would be hard to look past the issue of response bias and observer bias. The participants could be playing off the researchers expectations, and the researcher in turn could be influencing the direction of the response. As such the joint liability scenario was omitted from the study.

The experiment started by setting the scene. Respondents were asked to imagine themselves as a smallholder farmer with their plot being near the closest forest/river ecosystem in the region. They would be offered a microloan to invest in their farm.

Respondents started the experiment with a hypothetical loan of F$300 with a flat interest rate of 20% on the principal. This loan could be used to invest in one of three agricultural strategies which are determined by their investment choice and was explained to them with the help of the information cards and mangrove and vertiver hedge leaflets in Appendix C. Investment choices are outlined in Figure 6.3.

The experiment was conducted three times with three different incentive types. The incentive types determine the loan conditions; these were: no incentive, dynamic incentive, and green incentives. Under each incentive type there were two lending periods – so respondents could borrow twice under each incentive. The reason for having two periods was to see whether there would be congruence between choices across periods.

Investment choice differed in riskiness of the returns, sustainability, and impact on ecosystems. The choices were:

FIGURE 6-3: INVESTMENT CHOICE

Investment Choice			
	Adaptive	**Mixed**	**Non-Adaptive**
Investment components	• Vertiver hedges • Organic fertilizer • Resilient seedlings • Mangrove seedlings for compulsory mangrove restoration	• Chemical fertilizer • Resilient seedlings • Mangrove seedlings for mangrove restoration	• Chemical fertilizer • Chemical pesticides • Resilient seedlings
Returns on Investment - Determined by Die Roll			
Good Season	120	225	300
Bad Season	120	75	0
Ecosystem Effects			
	6 (Good)	3 (Neutral)	0 (Bad)

The method in which returns would be calculated would be affected by the incentive type and random climate attributes. The latter was divided into good and bad seasons and was determined by a die roll. A roll of 1, 2 or 3 represented a good season (for instance: good soil fertility from appropriate rainfall and optimal temperature for crop production). A roll of 4, 5 or 6 represented a bad season (for instance: extreme climate events such as erratic rainfall, drought, and increased severity of flooding). So for example, the respondent chooses a non-adaptive investment. They roll the die and it falls on a 2. This tells them that it was a good season and they had a fruitful harvest which yielded them F$300 return on their investment.

A number value was assigned to translate the impact that the investment choice will have on the ecosystem. A high value was a positive impact and a low value was a negative impact. The impact that investments would have on the ecosystem would inform the interest rate only under the green incentive condition. The information people were provided was limited to the information cards in Appendix C.

The experiments were carried out on a decision sheet which was filled out by the researcher. An example for each different incentive type was carried out by the researcher to aid their understanding of the experiment. The respondents were presented with a calculator so as to decrease mental burden and to enable them to decide on the best investment strategy and calculate repayments however these proved to be difficult for respondents as such the researcher and research assistants would state returns.

The different incentives types were as follows:

1. A control, **No Incentive** condition which imposed no restrictions on the borrower. Borrowers can take out a loan of F$300, with a flat interest rate of 20% on the principal with monthly repayments and a term of 8 months.
2. A **Dynamic Incentive** condition where defaulting on any repayments during any collection period would cease the loan at that point. Traditionally dynamic incentives would limit future loans if a borrower were to default or via progressive lending increase/decrease the principal for future loans. As we were still interested in the subsequent investment choice, the method employed within this experimental model explores how people may react when they are faced with a potential loss of future income.
3. A **Green Incentive** condition where the characteristic of your investment was taken into consideration. Steeper losses are attached to the mixed and non-adaptive investments when compared to the adaptive. In addition the adaptive investment introduces rewards in the form of partial funding of the principal. We want to test whether monetary incentives,

as present in environmental mortgages and PES, could in fact crowd-out intrinsic motivation. The selection of the adaptive investment would result in a partially funded, interest free loan of which borrowers only have to pay back 90% of their principal amount (F$270). This funding is available to them for the services rendered in maintaining the ecosystem through sustainable agriculture practices and rehabilitating mangrove forests.

The mixed and non-adaptive strategies would result in an increased interest rate and shorter repayment term depending on the ecosystem effect of the chosen investment. It is explained that this is because of the inherent risk in these investments and their potential effect on future productivity and is used as a way to show the consequence on the wider environment of the respondents chosen investment. The ecosystem effect was given the values 0 for negative effect, 3 for neither good nor bad, and 6 for good effect. The ecosystem effect would determine the borrowers interest rate (i) and repayment duration:

If ecosystem effect=3 (mixed investment), i=24%, Repayment Term= 8 months

If ecosystem effect<3 (non-adaptive investment), i=25%, Repayment Term=6 months

The following script informed respondents of why the interest rate would differ according to the impact of investments on ecosystems:

Script

Vertiver hedges, mangroves and organic fertilisers are good for the ecosystem. They do not harm the forest/river but instead protect and regenerate it. They will also allow you to have longer term security and returns by for example helping the soil, and protecting against cyclones. Because of the protective nature of these elements in the adaptive investment, and your role in the upkeep of mangroves you are awarded a partial grant.

Chemical fertilizers and pesticides may increase yield in the short term but they can also contaminate water, and reduce soil health. It can also be dangerous for local flora and fauna and is riskier for your future returns during a bad season. Therefore interest rates are higher for those investments which use ‘chemical elements’ as they are ultimately riskier.

6.3.1 OUTCOME VARIABLE CODING

The subsequent outcome variable for analysis was coded from 1 to 5, which combined the investment choices across the two collection periods. This coding represented all the possible combination of investments the respondent could have chosen. Below is a breakdown of what the coding meant:

TABLE 6-9: MATRIX OF INVESTMENT CHOICES ACROSS THE TWO COLLECTION PERIODS

	Adaptive	Mixed	Non Adaptive
Adaptive	1, 1	1, 2	1, 3
Mixed	2, 1	2, 2	2, 3
Non Adaptive	3, 1	3, 2	3, 3

FIGURE 6-4: POSSIBLE INVESTMENT PORTFOLIOS

Adaptive portfolio	• Score equivalent = 1 • Composition of investment: Adaptive + Adaptive investment choice
Moderately adaptive portfolio	• Score equivalent = 2 • Composition of investment: Adaptive + Mixed investment choice
Mixed portfolio	• Score equivalent = 3 • Composition of investment: Mixed + Mixed OR Adaptive + Non-Adaptive investment choice
Moderately non-adaptive portfolio	• Score equivalent = 4 • Composition of investment: Mixed + Non-adaptive investment choice
Non-adaptive portfolio	• Score equivalent = 5 • Composition of investment: Non-adaptive + Non-adaptive investment choice

6.4 DESCRIPTIVE STATISTICS

The survey and survey-based experiment was composed of a total of 205 residents living in or near six fragile ecosystems in Viti-Levu. 17 villages were sampled. The sample population consisted of 75.1% Fijians, 24.9% Indo-Fijians, 42.4% females and 57.6% males. The average respondent was 41.6 years old with a range with 19 and 83 years of age. On average, they lived in households consisting of five people and generally were the head of the household (50.7%). The main occupation was farming (45.9%), followed by fishing (31.7%) and the remainder (22.4%) of respondents were in other forms of employment. 35.61% of respondents earned between F$0 and less than F$10 a day. 50.2% earned between F$11 and F$20 a day and the remaining 14.1% earned over $21 a day. In terms of education, 2.9% of the sampled population had no schooling, 18.5% went through some primary school, 16.1% completed primary school, 31.7% went through some secondary schooling, 24.9% completed secondary school, 2% went through a literacy campaign and the remaining 3.9% were in or had completed tertiary education.

Regarding access to microcredit, 20.49% of respondents had no access to microcredit. 39.51% of respondents were microcredit participants. Only 14% of people sampled had access to insurance, whilst 45.36% had access to savings.

TABLE 6-10: DESCRIPTIVES OF DEMOGRAPHIC AND CONTEXTUAL VARIABLES

					Frequency		
	Mean	Sd	Min	Max	0	1	
Access to Credit	0.717	0.444	0	1	124	81	0.395
Current Microloan	0.200	0.405	0	1	163	42	0.205
Access to Insurance	0.140	0.349	0	1	176	29	0.141
Access to Savings	0.450	0.499	0	1	112	93	0.454
Female	0.424	0.495	0	1	118	87	0.424
FarmFish	0.776	0.418	0	1	46	159	0.776
Fijian	0.751	0.433	0	1	51	154	0.751
Chief	0.073	0.261	0	1	190	15	0.073
Y<F$10	0.356	0.480	0	1	132	73	0.356
Household Size	5.200	2.265	1	13			
Age	41.600	13.186	19	83			
Size of loan	159.024	574.374	0	5000			

People were on average spending the most on food and personal social obligations each month. However, the reluctance of people to talk about their monthly expenditure questions the validity of the expenditure data collected.

TABLE 6-11: EXPENDITURE PER MONTH

Expenditure/Month	Mean	sd	Min	Max
Food	81.268	70.858	0	300
Housing maintenance/building	25.161	64.310	0	500
Personal social obligations	49.424	86.502	0	600
Non-religious social obligations	27.468	46.393	0	350
Religious obligations	37.244	46.833	0	228
Farm/marine investments	29.068	38.777	0	250

Of the 108 people who disclosed how prior and current loans were spent, the majority was on maintaining current livelihoods followed by consumption spending.

TABLE 6-12: USE OF LOANS

	What was loan used for?	Percent
Social	9	4.390
Infrastructure (water, toilets, etc)	15	7.317
Alternative livelihoods	6	2.927
Maintaining current livelihood	25	12.195
Buying food	2	0.976
Medical care	5	2.439
Personal spending (clothes, household items etc.)	18	8.780
Education	11	5.366
Repaying other loans	17	8.293
Not disclosed/No loan	97	47.300
Total	205	100

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[81]

[81] Smallholder in Nausori

7.1 ABSTRACT

Through guided interviews (*N*=50) of market stall holders in Viti-Levu, Fiji, this study asked:

What are the local perceptions of climate change in Fiji?

The results indicated that the majority of those interviewed linked climate change to changes in weather patterns (such as rising temperatures, and heavier rains). In addition they generally attributed it to men made causes and for the most part did not know how to cope with the consequences of climate change.

7.2 PERCEPTIONS

In chapter _ I had the opportunity to talk to small farmers in the Caribbean about climate change in 2015. The region was in the grips of a terrible drought and small farmers were struggling. In fact they were finding that each year it became more difficult to farm their lands and maintain their livelihoods. We had organised a meeting over skype which included different parties of interest. We had academics, policy makers, NGOs, and a group of small farmers. Some of the gaps I had identified in my own research were being repeated by the farmers and the policy makers.

The farmers stated that there was a lack of awareness on the issue. Whilst the changes in the climate were evident the concept of climate change was little understood. The frustration was that when an informed farmer tried to instigate a measure to conserve water to adapt and their neighbour or other non-smallholders carried on like business as usual, it negatively impacted the informed farmer’s activity and also deterred them from future actions. They also mentioned that all the great research and ideas of how to adapt to the climate change were often not reaching the farmers. Policymakers also identified that there was a need to understand local perceptions and attitudes towards climate change and also on developing strategies to distribute adaptation measures beyond relying on external experts or aide. A value add of the current research is that it complements and enlarges the small body of existing research on climate change adaptation perceptions in SIDS by asking:

What are the local perceptions of climate change in Fiji?

- Islanders are used to climate variability. In Fiji climate has always been very variable but the severity of extreme events has been increasing in the last decade. As such we would expect that people are aware of changes in weather but perhaps link it to natural rather than anthropogenic processes.

7.3 MENTAL MODELS

In order to investigate barriers to behaviour it is important to also look at the perceptions of local people to climate change. Subjective perceptions of climate change are important in shaping our responses, thus a significant barrier to climate change adaptation is how we perceive the problem (Oskamp, 2000). If we hold erroneous mental models of what causes climate change then the responses we shape will be formulated to address that erroneous belief set. The concept of mental models was first put forth by Craik (1943), who postulated that we develop small scale representations of the world. It is suggested that these models exist in both long-term and working memory, with the latter drawing on the former to support reasoning, and to solve problems (Nersessian, 2002).

Cognitive systems create models of the problem space and these mental models are used to interpret external realities whilst external social mechanisms in the form of social rules, are used to structure and order the environment –guiding choice and shaping political, economic and social systems. External social mechanisms align mental models such that people with shared cultural backgrounds will have convergent mental models. As such whilst lack of awareness is an impediment to adaptive behaviour, other cultural factors which shape our perceptions can also be detrimental (Denazau & North, 1994). For instance, in Fiji short-term planning perspectives prevail, this hinders the adoption of adaptive behaviours which generally have long-term outcomes (Lata & Nunn, 2012).

Within natural resource management, mental model mapping techniques have become popular as it reveals how stakeholders perceive natural resource systems to function and those things which they find important within the system (Jones et al, 2000). In Fiji, climate change is by no means an ignored subject. There are regular public service announcements on the radio talking of climate change, and encouraging adaptation. Fijian village signs are emblazoned with their disaster preparedness status whilst billboards extol the virtues of conservation and the dangers of burning garbage (an extremely widespread and regular activity even in the main centre of Suva). However whether such messages have an effect is not clear. As the socio-cultural aspects of SIDS can influence the understanding of and subsequent actions relating to climate change (Basher, 2000), for those designing climate-related policies and communications, understanding subjective perceptions to climate change is important.

7.4 METHOD

7.4.1 GENERAL INTERVIEW GUIDE APPROACH

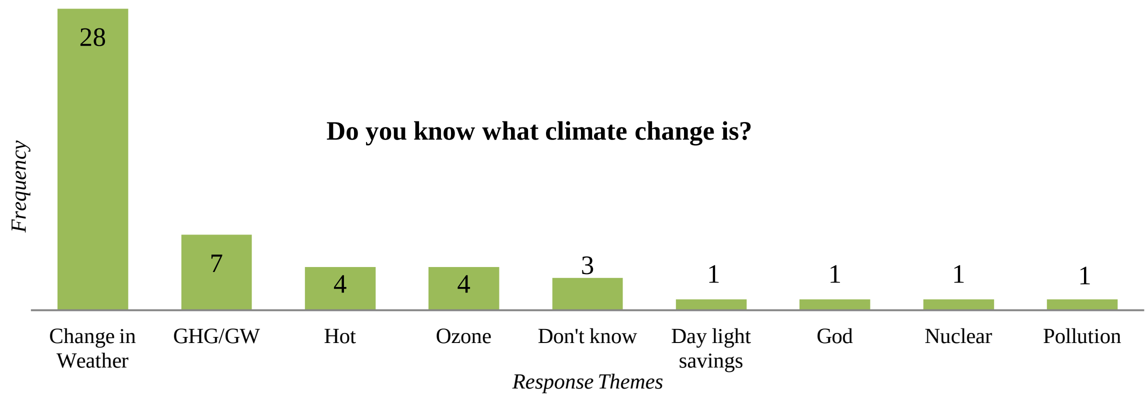
Interviews were conducted in English and Hindi. The guided questions were as follows: 1) Do you know what climate change is? 2) What do you think is its cause? 3) How does it affect you? 4) What can we do? 5) What help do you need? 6) Can you tell me a bit about changes you are seeing in the forests and the sea? For the majority, interviews lasted between 20 to 30 minutes. The interviews were recorded through the collection of detailed notes during and immediately after each interview. It was decided against using a tape recorder as it was evident that it made informants uncomfortable.

The sample was composed of a total of 50 market stall holders. The markets were: Namaka market in Nadi (*N*=5), Nadi Market (*N*=15), Suva Municipal Market (*N*=15), and Nausori Market (*N*=15). Respondents were selected by random sampling which was generated through excel. The sample consisted of 23 (46%) Fijians, 21 (42%) Indo-Fijians and 6 (12%) other Pacific Islanders. Informants had an average age of 41.02 with a range between 17 and 74. The majority of informants were female, 28 (56%). Informants came from different provinces, with Yasawa's and Nausori (10, 20% each) being most represented followed by Nadi and Suva (7, 14% each), and Lautoka and Ba (5, 10% each). Notes from each interview was collated in excel and dominant themes were coded. Frequency and percentage tables were created to assess the most dominant themes for each question. Frequency distributions and percentages for each conservation point do not sum to the total number of informants as multiple themes could arise for each conversation point.

When asked whether informants knew what climate change was (Figure 7.1), the dominant response was: a change in weather (28, 56%) with one informant commenting:

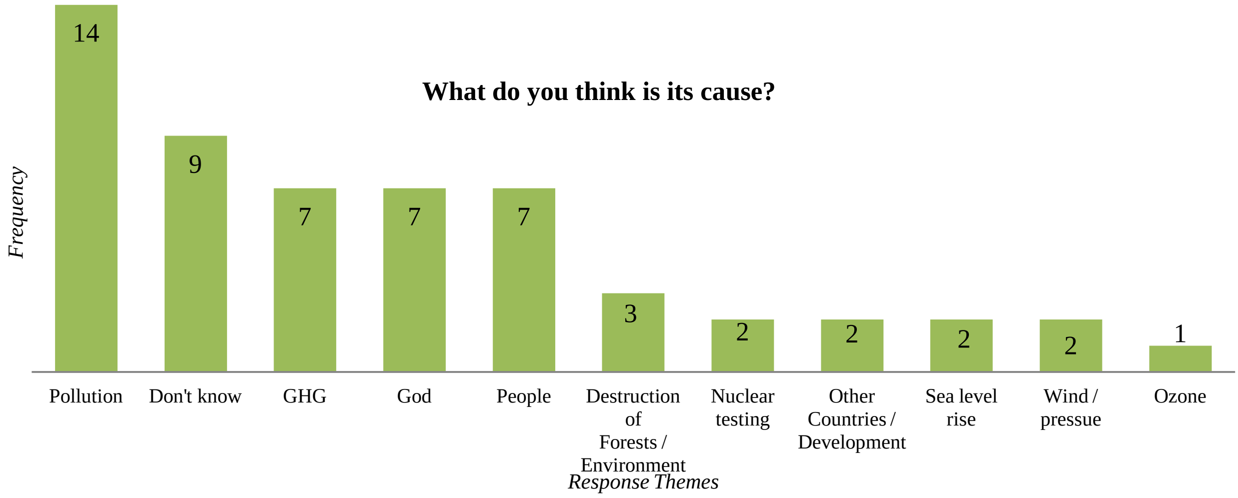
"lots of rain and then no rain", and another answering: "change in weather, more floods now, more drought. And cyclone!" This was followed by greenhouse gases and global warming (7, 14%) with one informant responding: "GHG. It's all chemistry...chemical reactions in the sky". The third most common theme was the concept of ozone (4, 8%), and heat (4, 8%) with informants responding: "It's very hot, makes people lazy", "Ozone and not enough water - sunlight absorbs lots of water and the weather is not suitable for crops". Only three (6%) informants were unsure of what climate change was and would not hazard a guess.

FIGURE 7-1: THEMES RELATING TO KNOWLEDGE OF CLIMATE CHANGE



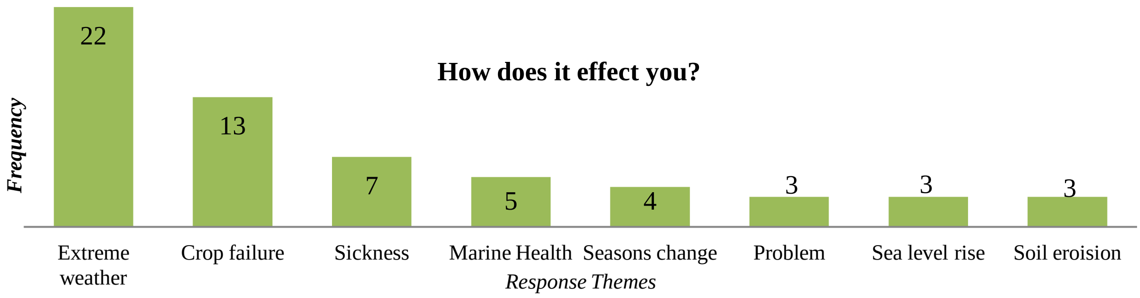
The main theme that arose when asked the cause of climate change (Figure 7.2) was pollution (14, 28%; "Pollution, too much rubbish in the sea...you see it all comes in with the tide. All sorts of things!"). This was followed by not knowing the cause (9, 18%) and in equal levels: GHG ("Carbon and the other GHG"), God ("God because we are in Kalyug {Hindu cosmic developmental stage}, everything is bad") and people ("People... people don't care. They've forgotten how to live with the land. It's not everyone but especially in the cities. You see. {Gestures around} They build all this then forget."; 7, 14% each).

FIGURE 7-2: THEMES RELATING TO SOURCE OF CLIMATE CHANGE



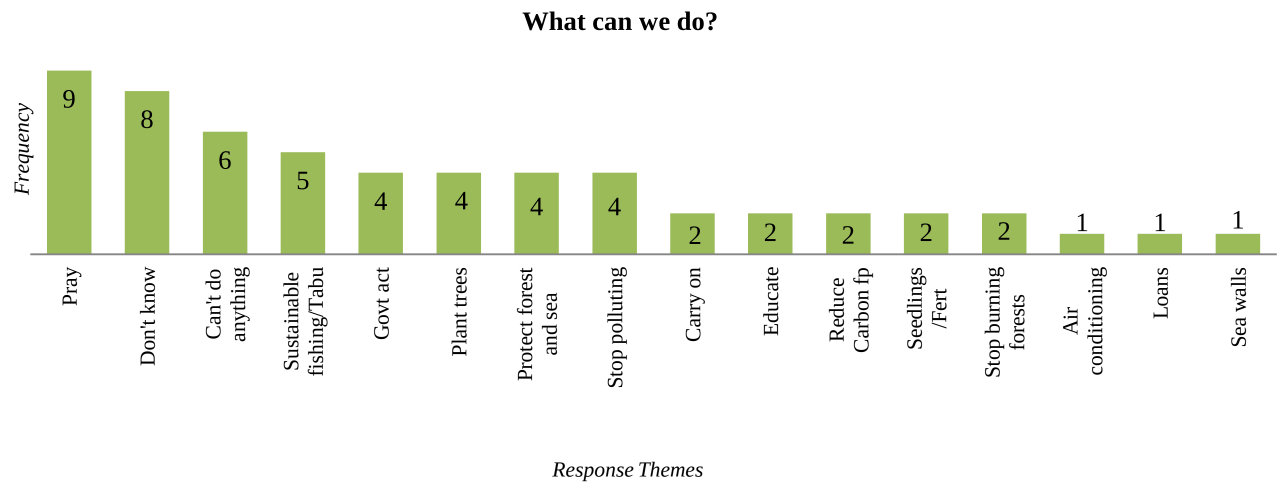
The main theme arising when asked of the effect climate change had (Figure 7.3) was extreme weather (22, 44%) and crop failure (13, 26%) as demonstrated by one informant: "Big problem! Sugarcane is too wet. We have less [produce]. Things don't grow as well, Cassava didn't grow because of floods". This was followed by sickness (7, 14%; "crops and animals getting sick.", though human illness was attributed to climate change too, "disease...cancer") and marine health (5, 10%; "fish catch is small, very hard").

FIGURE 7-3: EFFECT OF CLIMATE CHANGE ON INDIVIDUALS



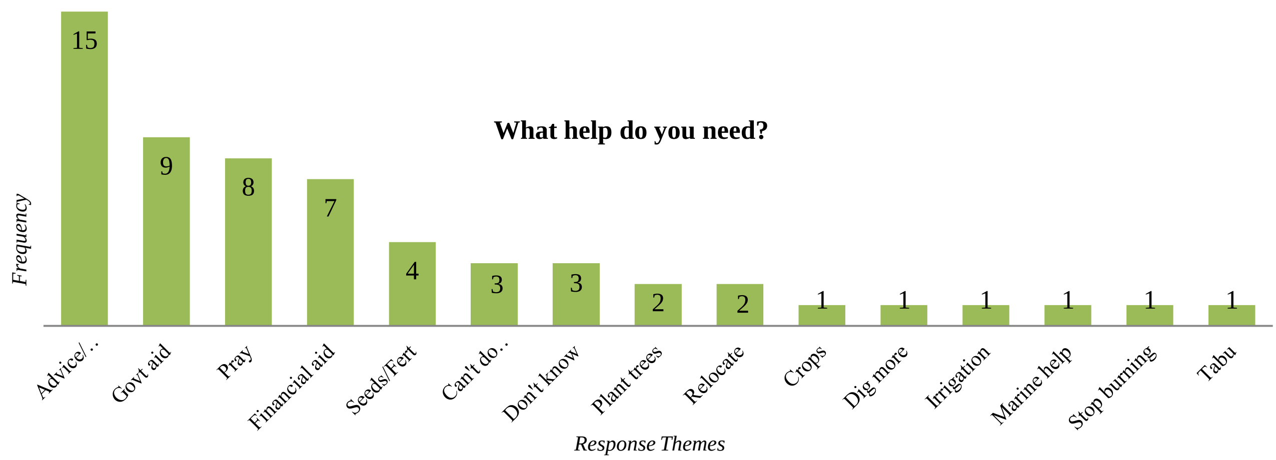
When asked what actions could be taken to counteract these effects (Figure 7.4) the main theme was to pray (9, 18%; "Pray"), followed by uncertainty (8, 16%; "Don't know!"), and resignation (6, 12% "What are you going to do? Other countries should look after smaller ones. Love is most important", "Can't do anything").

FIGURE 7-4:ACTIONS TO COUNTERACT NEGATIVE EFFECTS OF CLIMATE CHANGE



Finally, advice, education, and awareness (15, 30%; "education should be ongoing, not limited to schools") were the dominant themes that arose when asked what help could be provided to face the challenges of climate change (Figure 7.5). Followed by government aid (9,18%; "Government aid for agriculture, need seeds and fertiliser"), praying (8, 16%; "Just pray") and financial aid (7, 14%; "Advice, financial help for better nets and boats").

FIGURE 7-5: RESOURCES NEEDED TO TAKE ACTION



7.5 DISCUSSION

For island ecosystems climate variability is normal, and this is particularly true in the South Pacific. The effects of El Niño and La Niña results in high levels of natural variability in climate related phenomena in this region. Natural climate change is thus a common occurrence. Adaptation to such variability is evident in the rich tapestry of traditional ecological knowledge within the region (McNamara & Prasad, 2014). As such anthropogenic climate change would have been expected to be perceived as a fact of life in the islands. What we found was that the majority of those interviewed related climate change to a change in weather and for the most part attributed it to men made causes. The concept of a change in weather was linked to their direct experiences with more volatile and extreme weather events in Fiji and the effect it had on their livelihoods. This is not dissimilar to perceptions held by other Pacific Island communities (Australian Bureau of Meteorology and CSIRO, 2011; Rasmussen et al, 2009).

That informants for the most part attributed climate change to anthropogenic causes is indication that climate variability was seen to deviate from the natural climatic oscillations. This deviation was shown to affect the ability of informants to adapt to climate change. For instance, when asked what actions could be taken to ameliorate the impacts of climate change, major themes which emerged were a sense of helplessness and uncertainty. Prayer in particular was cited predominantly by those who saw climate change as caused by God. As such one can argue that prayer can be seen as a logical coping strategy and a common one for people who share similar beliefs regarding the origin of climate change (King, Snipper & Tawhai, 2008; Kaundjua, Angula & Angombe, 2012). In a study looking at perceptions towards climate change around the world, Wolf and Moser (2011) found that Fijian's and Indo-Fijian's alike had a greater tendency to attribute climate change to their religious beliefs.

It could be that when faced with anthropogenic climate change, informant's coping appraisal of their ability to engage in adaptive behaviour was constrained by response options. This is reflected in the main themes which arose when asked about the type of assistance they would require to adapt. Constructive assistance in the form of education, government and financial aid, new seedlings and better fertilisers were often cited. Education, advice and awareness in particular arose as the dominant themes and as such the lack thereof can be seen as a barrier to engaging in climate adaptive behaviours. In terms of policy, when people are unable to understand the basis of proposed policies as it conflicts with their held mental models, then support for and adoption of policies will be limited. If however policies and initiative are tailored to work around shared mental models then you have greater chance of success (Sterman, 2008). The study revealed that mental models of climate change did suffer some misconceptions. These flawed mental models would restrict the ability to elicit effective coping strategies.

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8 COGNITIVE DRIVERS, AND THE EFFECT OF INFORMATION ON STATED CLIMATE CHANGE ADAPTIVE INVESTMENT BEHAVIOUR


[82]

[82] Dalo and Kumara vendor at 'Nadi Central' market.

8.1 ABSTRACT

Using a survey and survey-based experiment (*N*=205), this study asked: a)What are the cognitive antecedents of stated climate change adaptive microloan investment behaviour for people living in or near fragile ecosystems through the framework of the Theory of Planned Behaviour (TPB); b) What is the effect of information on stated adaptive investment behaviour. Using path analysis and Structural Equation Modelling, we found support for the Theory of Planned Behaviour. Attitudes, subjective norms, and perceived behavioural control moderated intention which in turn mediated behaviour. The difference in investment choice between those who did and those who did not receive climate change and conservation information was not significantly different however we found that the correlation between intention and behaviour was only found to be significant in the presence of information. In addition for those in receipt of information, intention accounted for a greater amount of variance than in the absence of information. The interaction between information and the antecedents of behaviour does lend to interesting discussion.

8.2 INTRODUCTION

Small island states represent areas with the highest vulnerability and lowest adaptive capacity to climate change (Nance et al, 2014). These nations, built on fragile ecosystems, account for less than 1% of global GHG emissions and yet they must suffer the full brunt of the consequences elicited by anthropogenic climate change. There is an array of Small Island Developing States (SIDS) resting in the most threatened of the World's 34 biodiversity hotspots (Brooks et al, 2002; Watling, 2011). Fiji compromises one of these SIDS. Fiji and other SIDS are facing an uphill battle against the impact of climate change (Australian Bureau of Meteorology & CSIRO, 2011).[83] In Fiji, for Viti Levu alone, it is estimated that climate related disasters can incur a cost equivalent to between two and four percent of Fiji's GDP by 2050, whilst for other SIDS the costs are far greater (Bettencourt, 2011).

[83] As we saw in the previous chapter, Fiji's ecosystems are also faced with the anthropogenic threats of over-harvesting, pollution and conversion to alternative uses which largely relate to agriculture and tourism. Between 1992 and 2007 alone Fiji had lost 70,000 hectares of forest cover (Lees, 2007). Loss of mangroves, corals and natural forests would not just impact its main industries of tourism and agriculture but through the loss of biodiversity, the archipelago's overall health is threatened and with it people's livelihoods (Pelling & Uitto, 2001).

Accordingly, SIDS are urgently in need of cost-effective and novel solutions to engage its communities to take up climate adaptive behaviours.

This chapter aims to analyze the broader set of motives that shape people's adaptive investment decision under a novel microlending context. It does so through a survey-based choice experiment which was preceded by a survey of psychological measures. The study attempted to broaden the notion of the rational economic agent by employing one of the most used socio-psychological theories in the study of behaviour, the Theory of Planned Behaviour (TPB). The survey-based experiment randomly assigned people living in or near fragile ecosystems in the island of Viti-Levu in Fiji into a treatment and control group and presented them with a microloan to invest in a choice of smallholder farming practices which varied in its level of adaptation. The treatment group was designed to test whether the provision of climate change information was a determining factor in the uptake of adaptive investments. It consisted of the provision of an information leaflet on the cause, local effects, and adaptive solutions to climate change. By focusing on motivations behind stated behaviour through the framework of the established Theory of Planned Behaviour, this paper offers a new perspective on microlending to finance climate adaptive behaviours. This can be of great utility to the development of new initiatives which hope to instigate behavioural change. Climate change adaptation in smallholders is a policy challenge, and one that will only be resolved by persuading people to change their behaviour. Indeed Sanderson (2002) has argued that for sound policy making a theory-based evaluation is essential. Examining the motivations behind behaviour, enables us to understand the processes which may subsequently influence behaviour.

For example, say you want to encourage people in SIDS to grow and eat local foods to enhance food security and curb high food import bills. How do you shift people away from export diets? If you knew what people's attitudes were towards local foods, whether referent others influenced their choice of food, whether they felt like they had any control of what they ate (because they do not cook or food prices are high) then you could understand what sorts of initiatives need to be designed to persuade people to grow and eat local foods.

Information provision has been a tool used by policy makers to persuade people to adapt their behaviour but why is it important to see how information may interact with intrinsic motivations? According to Nickerson (1998) people tend to seek information that they consider supportive of favoured hypotheses or existing beliefs. They interpret the receipt of information in ways that are biased to those hypotheses or beliefs. He also finds that people will steer away from seeking, perhaps even avoiding, information that would be considered counterindicative to their held beliefs, and may even look for information that is instead supportive of alternative possibilities. To illustrate, let us imagine a climate change denier. He has a wealth of scientific and highly verified information on the fact of anthropogenic climate change, but he holds a mental model which is not congruent to this belief, and thus seeks evidence to the contrary to support his hypothesis. So if you have a climate change adaptation strategy that involves the dissemination of information – it would be useful to not only ascertain whether it will have an impact on people, but also whether it is correlated with our intrinsic set of motives.

We argue that by better understanding those factors which determine the behavioural outcomes under scrutiny, there is potential for the research to inform the more technocratic side of policy formation through informing targeted policy instruments. So by examining how certain behaviours can be achieved research such as this can contribute to closing that gap between the theory and practice of policy making (Nye Jr, 2008).

As we have seen, novel financing methods are being developed to bridge capital from microloans to the local and global value of intact environmental resources to facilitate environmental stewardship. Methods include Wetland Internationals' Bio-Rights model which effectively collateralizes intact ecosystems (van Eijk, & Kumar, 2009), integrated conservation and development programmes (Herrold-Menzies, 2006), integrated microfinance and Payments for Ecosystem Services projects (Forcella, 2011), and microloans for green technologies such as renewable energy (Wimmer, 2014). Considering that climate change adaptation and environmental conservation are underfunded (Gichira, Agwata & Muigua, 2014; Le Saout et al, 2013) cost effective initiatives such as the provision of information alongside the tools to engage in adaptive behaviour through microloans could potentially enable positive behavioural change. Depending on the type of information provided, it can aid in building adaptive capacity (Neil Adger, Arnell & Tompkins, 2005). According to Knowledge-deficit theory an increase in knowledge will lead to a change in behaviour (Shultz, 2002). Di Falco, Veronesi and Yesuf (2011), in a study that looked at the impact of climatic variables on a farmer's decision to adapt found, and other variables that influence adaptive decisions – these variables included information from various sources and access to credit amongst others. They found that better informed farmers in the Nile Basin of Ethiopia had a greater probability to adapt to climate change as they placed less value on the option to postpone adaptation. In addition, they also found that farm households with access to credit had a greater probability to take up climate adaptive strategies. This effect of information and credit access on farmers adaption decisions has been supported by others as well (Deressa, et al, 2009; Nhemachena & Hassan, 2007; Apata, Samuel, & Adeola, 2009). These studies hint that information, and microloans can be useful instruments to enable more prolific adoption of adaptation measures.

Prompting environmental stewardship through such tools can greatly benefit from psychological perspectives of behaviour. Such a perspective can inform best practice and induce greater behavioural adoption by better visualising the drivers of behaviour. To the best of the author's knowledge, previous research has not examined the cognitive drivers of climate adaptive microloan investment behaviours nor what role information plays in such decisions. Accordingly, we apply the conceptual framework of the theory of planned behaviour to explore the implications of cognitive characteristics on people's decisions to adapt to climate change using a novel survey-based experiment. To the best of the author's knowledge this is the first study employing an experimental procedure to assess the effect of information on the adoption of adaptive investments, and the first experimental study specifically looking at the cognitive drivers of microloan investment choice.

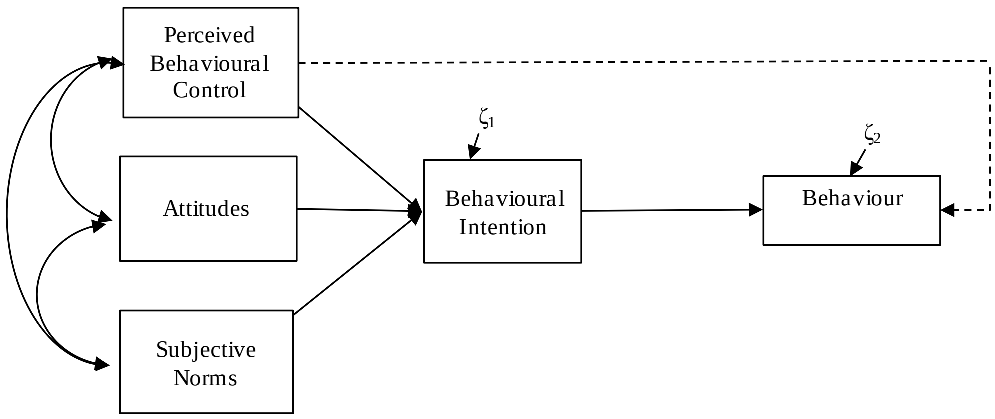
8.3 CONCEPTUAL FRAMEWORK

Bénabou and Tirole (2006) model individual choice through intrinsic, extrinsic and reputational motivations. Experimental games and empirical studies have demonstrated individual's propensity to behave in a pro-social and fair manner (Kahneman, Knetsch & Thaler, 1986; Gowdy, 2008), a shift away from the classical notion of behaviour as governed by purely selfish motivations and a step into Homo reciprocans or reciprocal fairness reasoning (Bowles et al, 1997).

Bénabou and Tirole (2003a) note that people face significant uncertainty regarding the costs and payoffs associated with their actions. The decision to engage in behaviour hinges on the individual's self-confidence in her ability to engage in the action. Imperfect-information regarding one's own ability is thus a factor in deciding whether to pursue a task with short-term costs and long-run payoffs. This holds particular poignancy when looking at climate change adaptation and more specifically when looking at the investment options presented by the microloan scheme in this paper as there is uncertainty around pay-offs. In their motivation-based theory they present a two person framework with an agent, and a principal who benefits from the agents performance. It is in the interest of the principal (in our case the lending organisation) to encourage self-confidence in the agent. The reason for this is because self-confidence in one's ability will enhance the perceived expected return from effort (Bénabou & Tirole, 2003a). They note that in the absence of objective information on deep preferences (such as loyalty or faith) people can be affected by manipulations of salience such as reminders of personal responsibility, or information cues. They also note though that our self-knowledge is history dependent – when we are in a novel situation we look back at our prior actions in similar scenarios and obtain confidence from them (Bénabou & Tirole, 2006). This also depends on our disposition. For instance, over confident individuals with time inconsistent preferences have more at stake when they face the decision of learning the truth about themselves than more pessimistic agents, and as such they may avoid information which is detrimental to their self-belief (Zambrano, 2011).

Bénabou and Tirole borrow from psychology to broaden the 'Homo Economicus' paradigm (Bénabou & Tirole, 2003a). Theories such as the Theory of Planned Behaviour (TPB) can be of be additive to the understanding of motivations behind behaviour, by enabling us to understand peoples held belief structures. The TPB (Figure 8.1) is a rational choice-based model wherein one's decisions are assumed to be grounded in subjective utility and cost-benefit rationality (Hübner & Kaiser, 2006). The TPB provides a model of human action and predicts the occurrence of a specific behaviour provided that it is intentional. It states that the constructs of attitudes towards the behaviour, subjective norms and perceived behavioural control will lead to intention to perform the said behaviour. Behavioural intention is in turn seen as the primary antecedent of volitional behaviour. This has been supported in meta-analytical reviews (Armitage & Conner, 2001; Ajzen, 2002).

FIGURE 8-1: THE THEORY OF PLANNED BEHAVIOUR



Within the TPB, attitudes refer to the positive or negative evaluation of the behaviour in question (Ajzen, 1991). Attitudes are determined by the total set of accessible behavioural beliefs linking the behaviour to various outcomes and internal accord. Subjective norms refer to the perceived social pressure to perform or avoid a particular behaviour. It includes normative beliefs which concern the perceived probability that important referent individuals or groups will approve or reject a given behaviour and one's motivation to comply to referent others. Perceived behavioural control refers to the perceived ease or difficulty of performing the behaviour in question and is similar to the concept of self efficacy. It reflects past experiences and future impediments to behaviour. The model requires the constructs within it to adhere to the principle of compatibility, wherein each construct is measured at the same level of specificity (for instance in looking at conservation behaviour one would need to assess attitudes, control perceptions, and subjective norms regarding the particular conservation behaviour of interest).

The importance of the various constructs of the TPB has been shown to differ when looking at different target variables. For instance in a study looking at transferium (i.e. park and ride) use, De Groot and Steg (2007), found attitudes were the best predictor of intention, followed by perceived behavioural control and subjective norms. In contrast Godin and Kok (1996), in a review of the application of the TPB to health related behaviours, found that attitudes and perceived behavioural control were most often the best predictors of behavioural intention. They also found support for intention being the most proximal determinate of behaviour whilst half the studies in their sample also showed that perceived behavioural control directly influenced behaviour. In a study looking at household recycling, Terry, Hogg, and White (1999) found that people who identified less with a group (in this case their neighbourhood community), had a stronger relationship between perceived behavioural control and intention. Whilst for people who identified strongly with a group, subjective norms were a greater predictor of behavioural intention.

One of the draws of the TPB in regards to environmental behaviour is in the incorporation of influences beyond one's control. This assumes: 1) the predicted behaviour must partly be beyond volitional control and 2) how one perceives control should reflect actual behavioural control. Whilst the latter assumption has been contested as a flaw within the theory, the former fits well within the ecological domain (Kaiser, Wolfing & Fuhrer, 1999). The theory has been applied widely to specific environmental behaviours such as recycling (Tonglet, Philips & Read, 2004; Nigbur, Lyons & Uzzell, 2010; Cheung, Chan &

Wong, 1999) conservation technology adoption (Lynne, Franklin Casey, Hodges & Rahmani, 1995; Lam, 2006) and environmental activism (Fielding, McDonald, & Louis, 2008) – these studies have had mixed results when considering the strength of the moderating variables however generally it is found that intention is a strong predictor of behaviour. The TPB has had some limited application in the Global South, where it has been used to probe the use of health protective behaviours such as condom use (Schaalma et al, 2009; Molla, Astrom & Brehane, 2007, Bryan, Kagee, & Broaddus, 2006).

Recently studies have applied the TPB to various aspects of micro-banking. For instance Nance (2013) looked at microfinance tourism, whereby tourists invest in micro-entrepreneurs or microfinance organisations. She applied the TPB to understand the investor's perspective in continued investment following the end of their vacation. She found perceived behavioural control and attitudes to be strong predictors of investment intention. Jebarajakirthy and Lobo (2014) applied the TPB to youth's intentions of seeking microloans in post-conflict zones in Sri-Lanka. They found that whilst positive attitudes and subjective norms improved behavioural intention, perceived behavioural control and knowledge of microloans did not. Ferdous & Polonsky (2013) on the other hand applied the TPB to understand ethical selling intention of financial salespeople in Bangladesh. They found that attitudes, subjective norms and perceived behavioural control influenced intention which in turn predicted behaviours; however perceived behavioural control did not directly influence behaviour. To the best of the authors' knowledge no study has yet applied the TPB to investigate climate adaptive investment behaviour. For such a prolific development tool, relatively little is understood about the cognitive drivers behind microloan investment behaviours. So here we try to rectify that by asking two things:

What are the antecedents of stated adaptive investment behaviour?

- According to the Theory of Planned Behaviour, positive subjective norms, attitudes and perceived behavioural control will lead to positive intention to perform a behaviour.
- As such we hypothesis that positive set of intrinsic motives would be reflected in positive intentions to conserve and protect natural ecosystems.
- As intention is the most proximal determinant of behaviour – we hypothesis that positive intentions will increase the probability of choosing adaptive over non-adaptive investments.

What is the effect of information on stated climate change adaptative investment Behaviour?

- According to knowledge deficit theory access to information will allow people to make better informed choices - therefore providing information on the benefits of adaptive behaviour should be reflected in more adaptive stated behaviour. Thus our hypothesis is that infromation will increase the probability of choosing adaptive investments.

8.4 RESEARCH DESIGN

The research used the methodology described in the methods section. Here we only looked at the no incentive lending condition, the summated and coded psychological constructs of attitudes towards conservation, subjective norms, perceived behavioural control, and behavioural intention as well as the individual indicators for each of the summated variables.

8.5 EMPIRICAL METHOD

The analysis method consisted of two subsets of Structural Equation Modelling (SEM). Such modelling utilises a series of statistical methods (such as Analysis of Variance, regression, and factor analysis) to investigate complex relationships between multivariate data. This type of modelling has two components, a structural model and a measurement model. The measurement model is a Confirmatory Factor Analysis which estimates a continuous latent variable based on observed indicator variables. Once the factorial structure of the underlying constructs is validated the relationships between latent variables and other factors is examined. This forms the structural component.

One of the main features of SEM is to compare the model to empirical data (Nachtigall et al, 2003). The ensuing comparison results in fit-statistics which enables as to assess how well the model and data match. An acceptable fit statistic tells us that the assumed relationships between latent and observed variables – which form the measurement model – and those between the various latent variables – which form the structural model - are supported by the data. The fit statistics are often the main component that is reported in the interpretation of results. In addition SEM is generally represented graphically rather than through equations.

The first method used in this study is path analysis. In SEM, the causal relationships among unobserved latent variables are defined by a set of equations. In path analysis causal relationships amongst observed variable are defined instead. The second method was a full SEM. This latter was employed to assess whether the use of composite scores is appropriate. With the small sample size as models became more complex in subsequent chapters, the use of more complex methods in the SEM toolkit would suffer the same constraints of more typical analysis methods such as Multinomial logistic regression – namely the rule of 10 – which recommends 10 cases per variable (Westland, 2010; Starkweather & Moske, 2011).

The software used was MPlus version 6 software (Muthen & Muthen, 2011) as it is one of the few packages that can handle categorical data in Structural Equation Modeling. The main assumptions of such models are: a theoretical basis for model specification, a reasonable sample size (N=200), complete data, continuous and normally distributed endogenous variables. However with categorical data MPlus uses the Means and Variances Weighted Least Square Estimator (WLSMV) which does not make any distributional assumption regarding the independent variable vectors and can handle correlated errors (Muthen, 1983). It has been shown to be a robust estimator for categorical data (Brown, 2006).

This kind of analysis is popular in the social sciences. It can model complex and multivariate relationships simultaneously, and fit two or more groups. It is the only linear analysis method that allows us to for the complete and simultaneous test of all relationships. It is important to remember though that this type of analysis is a confirmatory technique to test theory. It does not imply causality.

However it has been argued that it can be hard to interpret (Nachtigall et al, 2003). In the case of categorical data, when using the WLSMV estimator categorical outcomes are probit coefficients and the sign and significance is reported. However predicted probabilities can be calculated for probit probabilities and is shown in equation 2 and 4.

For this study, to test the hypothesis that intentions are more likely to be enacted if they have been supplemented with climate change adaptation and conservation information, a simultaneous multigroup analysis with clustering at the village level, was specified for the path model and the SEM. The antecedents of behaviour were examined through the theoretical framework of the Theory of Planned Behaviour. As with the study of any behaviour, by dissecting the antecedents to behaviour one can ultimately design better initiatives to facilitate behavioural change.

The equations for the Path Analysis can be written as follows:

EQUATION 8-1

$$\begin{aligned} &Behavioural\ Intention \\ &\qquad = \alpha + \beta Attitudes + \beta Subjective\ Norms \\ &\qquad + \beta_{11} Perceived\ Behavioural\ Control + \zeta_1 \end{aligned}$$

$$\begin{aligned} &Investment\ Choice \\ &\qquad = \alpha + \beta Behavioural\ Intention + \beta_{21} Perceived\ Behavioural\ Control \\ &\qquad + \zeta_2 \end{aligned}$$

Predicted probabilities can be calculated by the following equation:

EQUATION 8-2

$$Pr(Investment\ Choice \ = 1|x_i) = \Phi(\tau_1 - b_1x_2 - b_2x_2 \dots)$$

$$Pr(Investment\ Choice \ = 2|x_i) = \Phi(\tau_2 - b_1x_2 - b_2x_2 \dots) - \Phi(\tau_1 - b_1x_2 - b_2x_2 \dots)$$

$$Pr(Investment\ Choice \ = 3|x_i) = \Phi(\tau_3 - b_1x_2 - b_2x_2 \dots) - \Phi(\tau_2 - b_1x_2 - b_2x_2 \dots)$$

$$Pr(Investment\ Choice \ = 4|x_i) = \Phi(\tau_4 - b_1x_2 - b_2x_2 \dots) - \Phi(\tau_3 - b_1x_2 - b_2x_2 \dots)$$

$$Pr(Investment\ Choice \ = 5|x_i) = \Phi(-\tau_4 + b_1x_2 + b_2x_2 \dots)$$

Where

$$Investment\ Choice \ = \left\{\begin{matrix} 1 & Adaptive \\ 2 & Moderately\ Adaptive \\ 3 & Mixed \\ 4 & Moderately\ Non-Adaptive \\ 5 & Non-Adaptive \end{matrix}\right\}$$

EQUATION 8-3

The Structural Equation Model is represented by the following equation:

$$u_{ij}^{*} = \beta_j \eta_i + \beta_j \xi_i + \varepsilon_{ij}, j = 1,2 \dots q$$

$$\eta_i = \alpha + \mathrm{B}\eta_i + \Gamma\gamma_i + \zeta_i$$

$$y_i = v + \Lambda\eta_i + \epsilon_i$$

$$x_i = \nu + \Lambda\xi_i + \delta_i$$

Where η is a vector of endogenous latent variables, y is the endogenous indicators, x is the exogenous manifest variables, u is the outcome variable, v is a vector of measurement intercepts, Λ is a matrix of factor loadings, α is a vector of latent intercepts, B is a matrix of the latent variable coefficients, Γ is a matrix of exogenous variable regression coefficients, γ is the exogenous latent variable regression coefficients, ξ is a vector of exogenous latent variables, β is the regression coefficients for the exogenous and endogenous latent variables on the outcome variable and ε, δ, ϵ, and ζ are error terms .

Thus:

EQUATION 8-4

$$Investment\ choice_{ij}^{*} = \beta_j \eta_i + \beta_j \xi_i + \varepsilon_{ij}$$

$$\eta_{Behavioural\ Intention} = \alpha + \mathrm{B}\eta_1 + \Gamma\gamma_i + \zeta_i$$

$$y_{B1-3} = v + \Lambda\eta_{Behavioural\ Intention} + \epsilon$$

$$x_{A1-10} = \nu + \Lambda\xi_{Attitudes} + \delta$$

$$x_{S1-9} = \nu + \Lambda\xi_{Subjective\ Norms} + \delta$$

$$x_{P1-6} = \nu + \Lambda\xi_{Perceived\ Behavioural\ Control} + \delta$$

Where B_{1-3}, A_{1-10}, S_{1-9}, P_{1-6} are the scale items described in chapter 6 for the latent constructs.

The conditional probability of u=1 response given the factor η_i and the covariate is given by:

EQUATION 8-5

$$P(u_{ij} = 1 | \eta_i, x_i) = 1 - \phi[(\tau_j - \beta_j \eta_i - \beta_j \xi_{Perceived\ Behavioural\ Control})\theta_{jj}{}^{-1/2}]$$

8.6 RESULTS

8.6.1 DESCRIPTIVE STATISTICS

To allow for more direct comparison with the data, scale items were coded 1-3, with 1 being negative, 2 moderate, and 3 being positive. Looking at the descriptive statistics we see that people generally had moderate attitudes (*M*=2.102, *SD*=0.637), whilst subjective norms (*M*=2.439, *SD*=0.620) and behavioural intention (*M*=2.771, *SD*=0.455) tended towards positive. Perceived behavioural intention (*M*=1.776, *SD*=0.601) was found to be negative to moderate. The item correlations was weak for subjective norms and perceived behavioural control and moderate between the remaining variables.

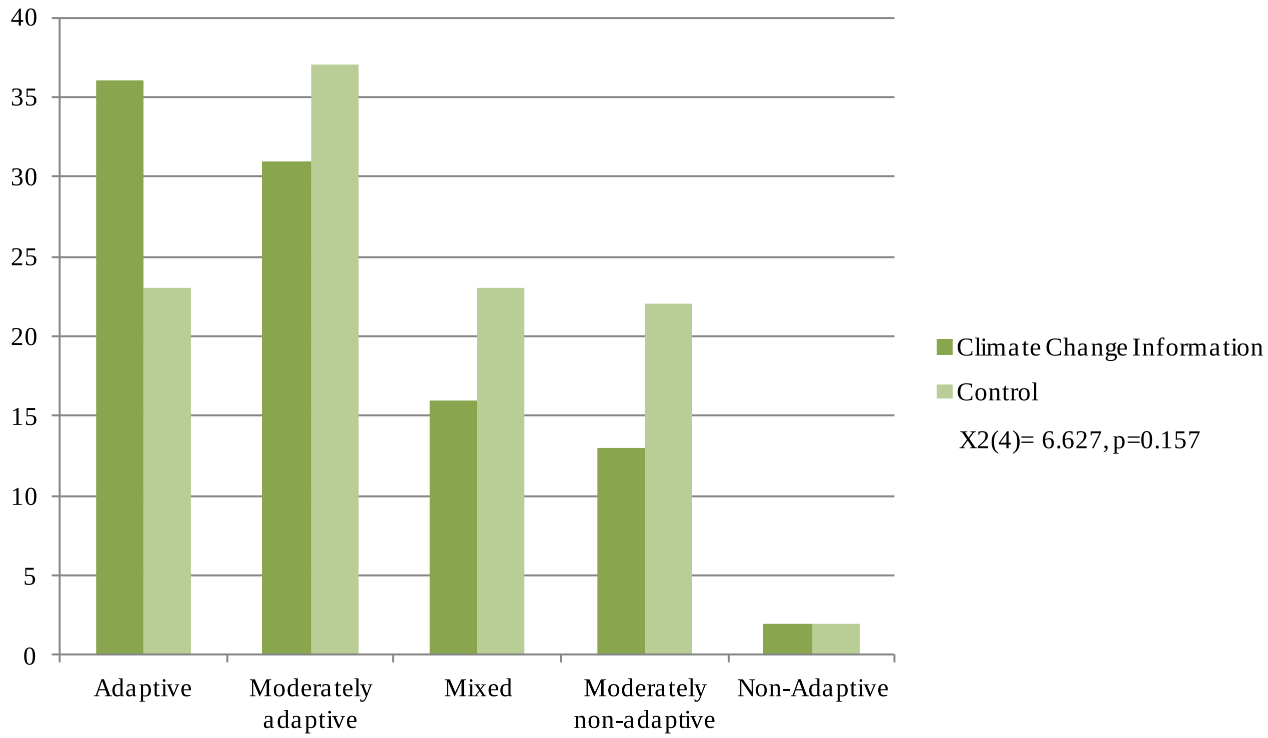
TABLE 8-1: DESCRIPTIVE STATISTICS AND CORRELATIONS

					Frequency		
Variable	Mean	SD	Min	Max	1	2	3
Attitudes Towards Conservation	2.102	0.637	1	3	32	120	53
Subjective Norms	2.439	0.620	1	3	14	87	104
Perceived Behavioural Control	1.776	0.601	1	3	65	121	19
Behavioural Intention	2.771	0.455	1	3	3	41	161

Variable	Attitudes Towards Conservation	Subjective Norms	Perceived Behavioural Control	Behavioural Intention
Attitudes Towards Conservation	1.000			
Subjective Norms	0.332	1.000		
Perceived Behavioural Control	0.355	0.082	1.000	
Behavioural Intention	0.318	0.341	0.295	1.000

Looking at the difference in investment choice between the control and treatment groups, the likelihood ratio Chi Square (χ^2 (4, N=205) =6.27, p=0.148) revealed that the treatment and control group was not significantly different from each other in the no incentive condition which was examined here. However in the subsequent analysis we see that two groups do differ in regards to behavioural intention.

FIGURE 8-2: FREQUENCY DISTRIBUTION OF INVESTMENT CHOICE



8.6.2 MULTI-GROUP PATH ANALYSIS WITH WLSMV ESTIMATOR

Analysis across groups was run simultaneously. The path diagram for the treatment and control groups are represented in figures 8.3, and 8.4 respectively. Model fit indexes were selected according to Hu and Bentler's (1999) two-index presentation strategy. We have included the Root Mean Square Error of Approximation (RMSEA), an absolute measure of fit which tells us how well the model, with unknown but optimally chosen parameter estimates would fit the population's covariance matrix – thus it tests a null hypothesis of poor fit. The second is an incremental fit index, the Comparative Fit Index (CFI). The CFI assumes that all latent variables are uncorrelated, comparing the sample covariance matrix with this null model. It tells us the percentage of covariation in the data that can be explained by the specified model. According to Hooper, Coughlan & Mullen (2008) a CFI greater than 0.95, and a RMSEA less than 0.06 would provide good fit.

Without constraining the direct effect of perceived behavioural control to behaviour the model resulted in very poor fit (Path Model: RMSEA=0.122; CFI=0.636. As such a linear constrain was added so that perceived behavioural control equalled 0.

The ensuing overall path model showed excellent fit indicating that the data supported the theoretical model (RMSEA=0.044, CFI=1).

We see across both models and groups that the constructs of the TPB were upheld. Positive attitudes, subjective norms, and perceived behavioural control were correlated with positive behavioural intention. Intention, which is hypothesized to be the most proximal determinate of behaviour, only significantly predicted subsequent stated behaviour in the group that received climate change information, with the predicted probability of choosing adaptive investments being 0.502 (Table 8.2) compared to 0.226 in the control group (Table 8.3) when behavioural intention was positive. The difference between choosing adaptive and non-adaptive loans was greater in the treatment group (diff=0.435) then the control (diff=0.952).

With positive behavioural intention the probability of choosing the moderately adaptive or mixed portfolios was 0.827 and 0.728 respectively in the control group and 0.804 and 0.716 respectively in the treatment group. The probability of choosing the moderately non-adaptive portfolio was 0.908 in the control group and 0.857 in the treatment group. We also found that intention accounted for more variance in the group that received information then not (R_2=0.498; R_2=0.402 respectively).

FIGURE 8-3: PATH MODEL FOR THE GROUP IN RECEIPT OF CLIMATE CHANGE INFORMATION

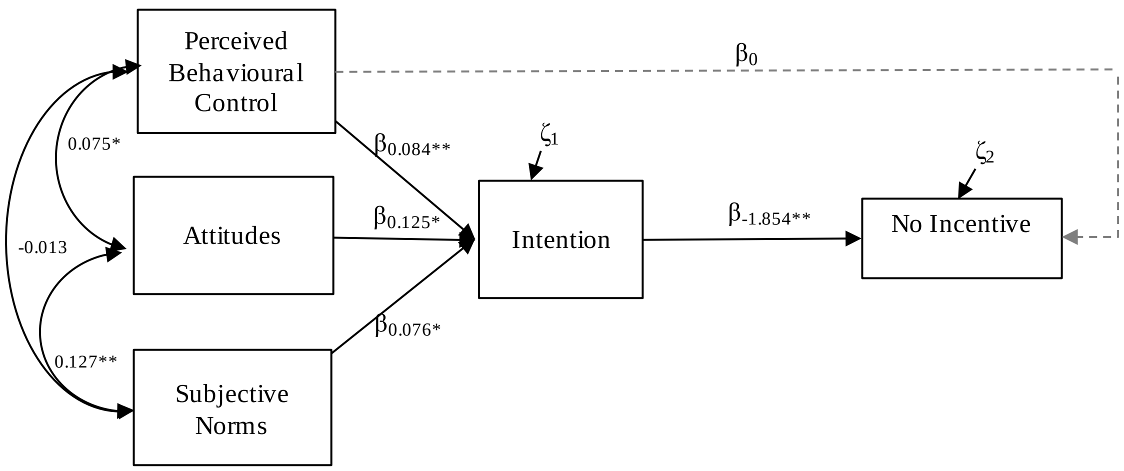


TABLE 8-2: PATH COEFFICIENTS AND PROBABILITIES FOR GROUP IN RECEIPT OF CLIMATE CHANGE INFORMATION

Group: Climate			β	S.E.	p	
Behavioural Intention	→	Attitudes Towards Conservation	0.125	0.060	0.036	**
		Subjective Norms	0.076	0.029	0.010	**
		Perceived Behavioural Control	0.084	0.040	0.035	**
No Incentive	→	Behavioural Intention	-1.854	0.798	0.020	**
		Perceived Behavioural Control	0	-	-	
Attitudes Towards Conservation	↔	Perceived Behavioural Control	0.075	0.039	0.051	*
		Subjective Norms	0.127	0.064	0.049	**
Subjective Norms	↔	Perceived Behavioural Control	-0.013	0.043	0.761	

Predicted Probability of Investment Portfolios if Behavioural Intention is Positive				
Adaptive	Moderately Adaptive	Mixed	Moderately Non-Adaptive	Non-Adaptive
0.502	0.804	0.716	0.857	0.067
R_2 Behavioural Intention=0.498; *p<0.1, **p<0.05, ***p<0.001				

FIGURE 8-4: PATH MODEL FOR THE CONTROL GROUP

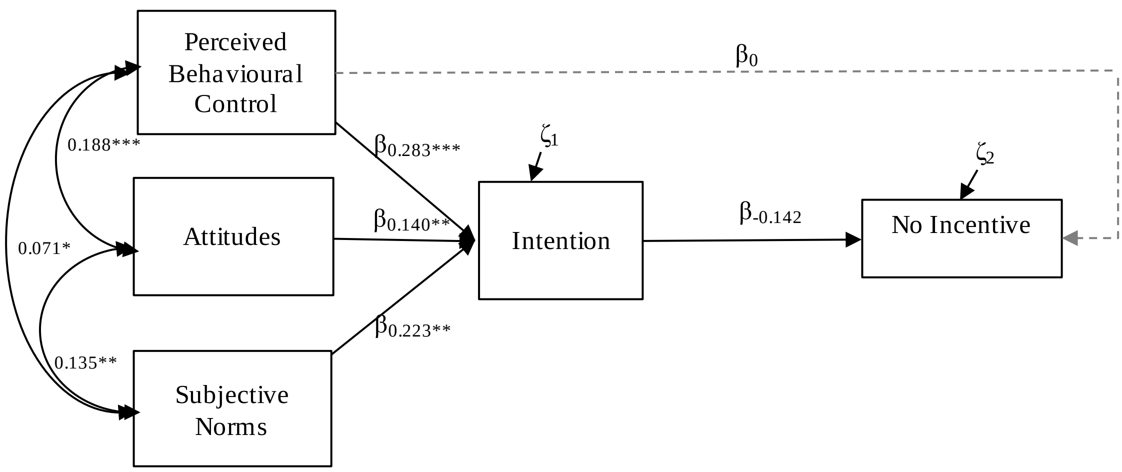


TABLE 8-3: PATH COEFFICIENTS AND PROBABILITIES FOR THE CONTROL GROUP

Group: Control			B	S.E.	p	
Behavioural Intention	→	Attitudes Towards Conservation	0.140	0.050	0.005	**
		Subjective Norms	0.223	0.044	0.000	***
		Perceived Behavioural Control	0.283	0.053	0.000	***
No Incentive	→	Behavioural Intention	-0.142	0.207	0.493	
		Perceived Behavioural Control	0	-	-	
Attitudes Towards Conservation	↔	Perceived Behavioural Control	0.188	0.040	0.000	***
		Subjective Norms	0.135	0.067	0.044	**
Subjective Norms	↔	Perceived Behavioural Control	0.071	0.026	0.007	**

Predicted Probability of Investment Portfolios if Behavioural Intention is Positive				
Adaptive	Moderately Adaptive	Mixed	Moderately Non-Adaptive	Non-Adaptive
0.226	0.827	0.728	0.908	0.131

R_2 Behavioural Intention=0.402; *p<0.1, **p<0.05, ***p<0.001

8.6.3 MULTI-GROUP SEM MODEL

The SEM had the same issue as the path analysis in regards to examining the direct effect of perceived behavioural control on stated behaviour. Without constraining this path, the resulting model displayed poor fit (RMSEA=0.061, CFI=0.776). For the constrained model, the RMSEA showed adequate fit (RMSEA=0.058), however the CFI did not (CFI=0.707). Thus the path Analysis was a better fitting model. The results of the two types of analysis however were similar.

The measurement model showed that the measured variables accurately reflected the desired latent constructs. The measurement model coefficients is displayed in Appendix E The probability of choosing the adaptive investment portfolio in the treatment group was 0.597 compared to 0.055 for non-adaptive investments. Whilst intention did not significantly mediate behaviour in the control group, the probability of choosing the adaptive portfolio was only 0.159. The difference in variance explained intention on subsequent stated behaviour in the treatment and control groups was also greater (R^2=0.616, R^2=0.434 respectively). The

Control group differed from the path analysis in that perceived behavioural control was not a significant moderator of intention (B=-0.033, p=0.896).

FIGURE 8-5: SEM FOR THE GROUP IN RECEIPT OF CLIMATE CHANGE INFORMATION

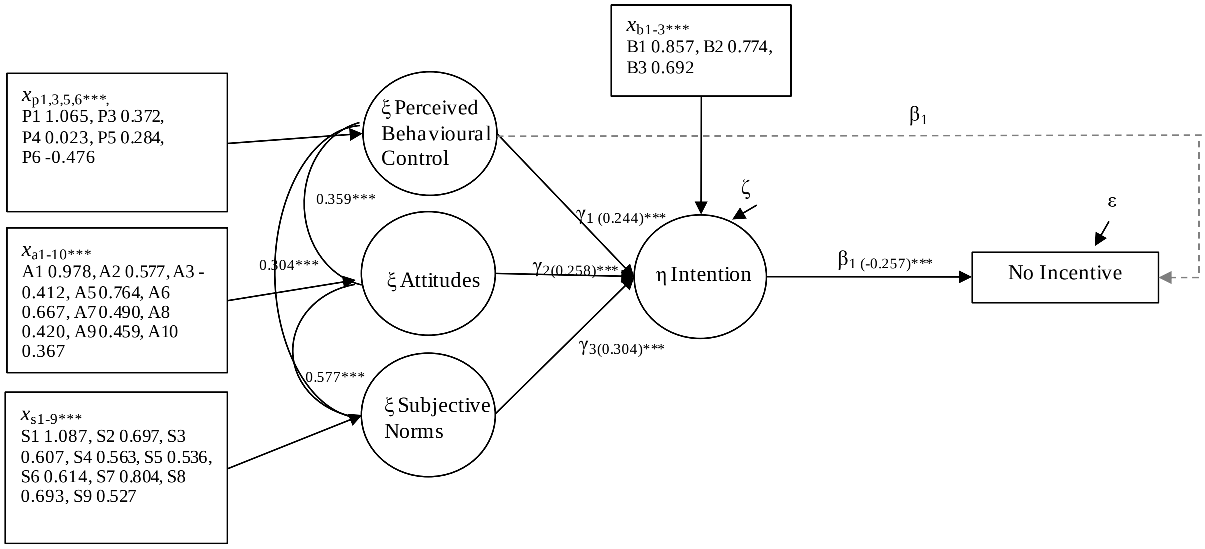


TABLE 8-4: SEM COEFFICIENTS AND PROBABILITIES FOR GROUP IN RECEIPT OF CLIMATE CHANGE INFORMATION

Climate			β	S.E	p	
Behavioural Intention	←	Attitudes Towards Conservation	0.258	0.076	0.001	***
		Subjective Norms	0.337	0.083	0.000	***
		Perceived Behavioural Control	0.244	0.067	0.000	***
No Incentive	←	Behavioural Intention	-0.257	0.050	0.000	***
		Perceived Behavioural Control	0.000	-	-	
Attitudes Towards Conservation	↔	Perceived Behavioural Control	0.359	0.076	0.000	***
		Subjective Norms	0.577	0.054	0.000	***
Subjective Norms	↔	Perceived Behavioural Control	0.304	0.087	0.001	***

Predicted Probability of Investment Portfolios if Behavioural Intention is Positive				
Adaptive	Moderately Adaptive	Mixed	Moderately Non-Adaptive	Non-Adaptive
0.597	0.909	0.881	0.927	0.055

Behavioural Intention R2= 0.616; *p<0.1, **p<0.05, ***p<0.001

FIGURE 8-6: SEM FOR THE CONTROL GROUP

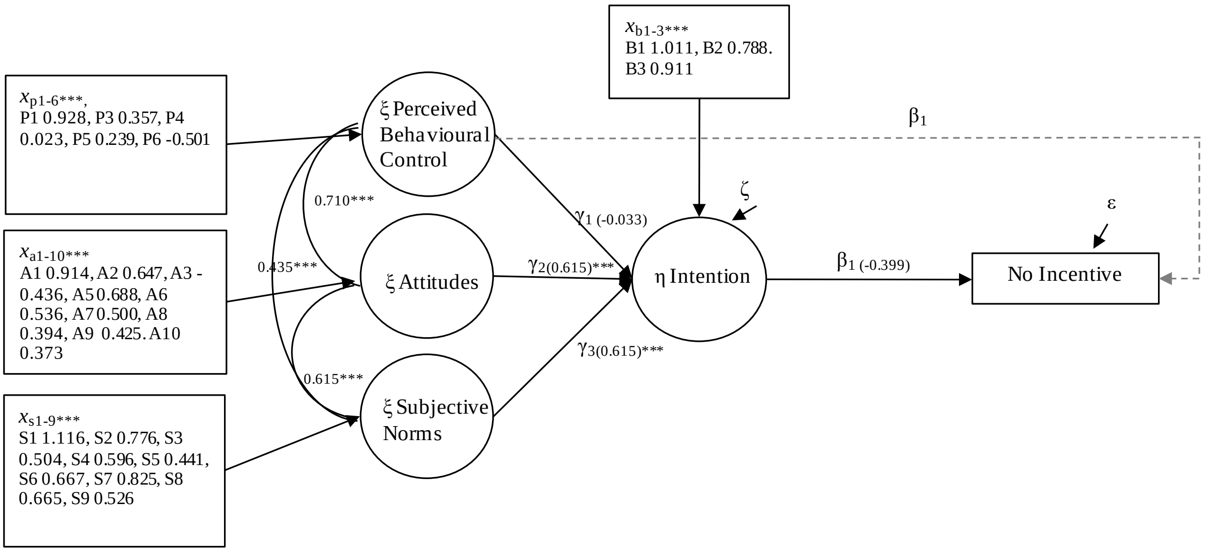


TABLE 8-5: SEM COEFFICIENTS AND PROBABILITIES FOR THE CONTROL GROUP

Climate			B	S.E	p	
Behavioural Intention	←	Attitudes Towards Conservation	0.615	0.237	0.010	**
		Subjective Norms	0.323	0.079	0.000	***
		Perceived Behavioural Control	-0.033	0.250	0.896	
No Incentive	←	Behavioural Intention	-0.399	0.137	0.678	
		Perceived Behavioural Control	0.000	-	-	
Attitudes Towards Conservation	↔	Perceived Behavioural Control	0.710	0.116	0.000	***
		Subjective Norms	0.615	0.094	0.000	***
Subjective Norms	↔	Perceived Behavioural Control	0.435	0.082	0.000	***

Predicted Probability of Investment Portfolios if Behavioural Intention is Positive				
Adaptive	Moderately Adaptive	Mixed	Moderately Non-Adaptive	Non-Adaptive
0.159	0.981	0.937	0.996	0.000

Behavioural Intention R2= 0.616; *p<0.1, **p<0.05, ***p<0.001

How we construct a behavioural response may thus be impacted by access to information. To query this, we asked whether the provision of basic information on climate change could sway the uptake of adaptive investments through a path analysis and a Structural Equation Model (SEM) across groups. We found that both our models fit the theoretical framework of the theory of planned behaviour.

As theorized, subjective norms, attitudes and perceived behavioural control were positively correlated to behavioural intention which in turn mediated behaviour. For the groups that received information on climate change, we did see a correlation between intention and behaviour. Whilst in the control group, in the absence of information, intention was not a significant moderator of subsequent behaviour. We found that intention accounted for a greater amount of variance in the treatment group compared to the control, and as hypothesised increased the probability of choosing adaptive over non-adaptive investments compared to the control group. In the previous chapter the notion of mental models was presented, if we applied that here than it could suggest that exposure to information could manipulate such models. If we thought of a mental model as a schema, representing a knowledge structure in memory, and a set of cognitive processes that allows for the manipulation and modification of the knowledge structures within the schema (Merrill, 2002) then it could be possible that where the schema is vague (as we saw with respondents understanding of climate change), information can fill gaps in the model.

In the treatment group and control groups, the addition of a direct effect of perceived behavioural control on stated behaviour led to a poor fitting model, as such in subsequent analysis this direct effect was constrained. Perceived behavioural control has been shown to be a somewhat problematic construct within the TPB. For instance Bamberg and Moser (2007), in a meta-analytical review of 57 datasets found that the effect of perceived behavioural control was weaker on actual behaviour then on intention. In addition, the collective action nature of biodiversity conservation and climate change could mean that individual action is seen as futile or insignificant (Gifford, 2011; Oskamp, 2000). This is supported in the interviews, where informants made comments such as “what can we do?” and “can’t do anything”. Comments such as these indicate that people believed that they had little behavioural control over the outcome.

Interestingly in the control group, when people were not exposed to information regarding climate change adaptation and conservation, perceived behavioural control deviated further from the theoretical model. Firstly in the SEM ml we found that there was a negative relationship between perceived behavioural control and intention in the control group (B=-0.033, p=0.896), whilst this was not the case in the presence of information (B=0.244, p<0.001). Whilst in the path analysis we found that it did not positively covary with subjective norms in the information treatment (B=-0.013, p=0.761) which differed from the control group (B=0.061, p=0.007).

In the control group, absence of information removed the significant effect of perceived behavioural control on intention. Hogwarth, Waterson and McDonald (2010) looked at whether information could influence travel behaviour in the UK. They found that perceived behavioural barriers were surmounted through the provision of well crafted information.

The finding that the probability of choosing climate adaptive over non-adaptive investments was greater when climate change information was presented provides support for the knowledge-deficit theory, whereby an increase in knowledge will lead to a change in behaviour (Shultz, 2002). That the tools to engage in adaptive behaviour were then made readily available via microloans with adaptive investment options would have lifted barriers to behavioural adoption and could have lead to better informed and more effective decision making. Information followed the survey instrument so we cannot make any causal links but hazard to conjecture that it did perhaps strengthen cognitive motivations.

Grothmann and Patt (2005) note that when looking at climate change adaptation behaviour, it is important to distinguish between intention and actual adaptive behaviour because of a lack of objective adaptive capacity when intention perceptions are formed. Objective adaptive capacity includes things like time, money, knowledge, and support. Consequently there may be a disconnect between when adaptive intentions were conceived and subsequent adaptive behaviour. Accordingly, when comparing the control and treatment groups, we may say that the absence of information was detrimental to ensuing adaptive investment behaviour.

Overall it was found that the TPB was a useful investigative tool through which to reveal the behavioural antecedents of microloan investment choice in poor communities in SIDS. We found that attitudes and subjective norms were positively related to behavioural intentions regardless of treatment. Stronger attitudes towards conservation and subjective norms were associated with greater intention to behave in a manner that was protective of the forests and rivers.

In order to increase communities resilience against climate change impacts, a holistic approach is required which considers weaknesses in the cognitive antecedents of behaviour. The effect of information is encouraging as it shows that it was sufficient in encouraging people to take up adaptive investments. The findings suggests a holistic microloans approach would challenge negative environmental attitudes, strengthen community perceptions and importantly inform of the risks and benefits of conservation and climate change adaptation behaviour in order to encourage people to take up environmentally responsible investments.

Microloans which provide adaptive investment options and educate the borrower of climate change and the benefits of adaptation could remove barriers to action. By removing these barriers such microloans can strengthen objective adaptive capacity. In addition such microloans, when structured correctly, can be an effective response to the request for support by informants against the impacts of climate change. These included the need for advice, awareness, financial, and government aid. Considering this and the results of the survey-based experiment, it would seem that microloans with adaptive investment options does show promise in meeting the triple bottom line of sound economic, social and environmental impact.

The study has its limitations and these are shared throughout the thesis. Firstly the administration of the survey instrument came before the experiment which could have primed people to a certain response. The validity of self-reported data is also a concern. In addition, the small sample size does limit statements of generalisability. Lastly, as a true experimental method was not employed, we cannot infer causality.

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9 MICROLOANS FOR CLIMATE CHANGE ADAPTATION – INCENTIVISING ADAPTIVE INVESTMENTS

[87]

[87] Transporting coconut palm seedlings.

9.1 ABSTRACT

This study reports on the motives that drive smallholders in their stated climate adaptive investment behaviour when borrowing under novel microloan incentives. The incentive conditions consisted of: a green incentive, where returns were contingent on the chosen investments impact on the environment; dynamic incentive where returns were contingent on repayment; and a control, no incentive condition. Through a survey and survey-based experiment conducted in Fiji, a path analysis informed by the Theory of Planned behaviour was specified. Our model fit the data extremely well (RMSEA=0.03; CFI=0.966). It was found that a positive set of intrinsic beliefs positively influenced the intention to behave in an environmentally protective manner. Intentions in turn mediated behaviour in the green incentive condition with the probability of choosing an adaptive investment being greatest in this condition (0.346) then in the absence of incentives (0.057), or under dynamic incentives (0.051). This could indicate that the green incentive condition crowded-in intrinsic motivations. Demographic factors of ethnicity, occupation, participation in and access to credit also influenced the exogenous cognitive and endogenous behavioural constructs to varying degrees.

9.2 INTRODUCTION

As we have seen in the preceding chapters, the importance of acting on climate change cannot be overstated. The consequences will be far reaching, transcending borders, species and economies. The impacts have already proven to be life-changing with some small, low lying island nations in the Pacific facing displacement (Yamamoto & Esteban , 2014), their communal and individual identities threatened, for the most part, by the activities of others in distant lands. The recognition of climate change impacts is increasing the sense of urgency for societal adaptation, most urgently in the developing world where it poses a very real threat to development with the ability to reverse current progress in eliminating extreme poverty and exacerbating economic, political, and humanitarian stresses (Watkins, 2007). As such development initiatives must focus on environmental dimensions alongside the economic and social.

We have discussed how microfinance has the potential to meet the triple bottom line of sound economic, social, and environmental development; microinsurance and microsavings can reduce vulnerability to climate related risks for smallholder farmers, whilst microloans can help people to diversify incomes and invest in climate resilient technologies.

However there seems to be little literature on how microloans can be used to incentivise uptake of climate adaptive behaviour. In the preceding chapter we began nudging at this concept. Through the application of the Theory of Planned Behaviour (TPB) we were able to assess the antecedents of behaviour and the role of information in driving behavioural change. This chapter builds on the findings of the previous chapter by extending a modified model of the TPB (which omits the direct relationship of perceived behavioural control to behaviour) to assess behavioural responses to incentives.

The notion of incentivising behaviour has come under scrutiny in recent decades. Economists have questioned human motivation and the effects of incentives thereupon through a framework grounded in rationality. More recently however, non-pecuniary motives have been found to be powerful motivators of behaviour. In fact, monetary incentives have been found, at times, to be detrimental to inducing the desired for behaviour. How we then attach incentives to climate change adaptation measures requires careful consideration if we hope for long-term adoption. Whilst incentivising environmentally protective behaviour is not a new concept in microlending, no study has to date looked at the deeper motivating factors which are engaged in the face of incentives induced by environmentally conscious microloans.

Specifically, in this thesis, extrinsic incentives are represented by hypothetical pecuniary reinforcements. We measure intrinsic drivers by looking at peoples' attitudes subjective norms, perceptions of behavioural control, and intentions towards environmentally responsible behaviours. If people have positive intrinsic inclinations then according to the theory of planned behaviour this should translate to congruent actions. However we are uncertain whether incentives will impact our internal drivers.

As such, this chapter aims to provide input on how to integrate climate adaptation measures into microloans such that it can induce the uptake of climate change adaptation behaviours. It does so by examining the role of incentives on stated climate change adaptive investment behaviour. We ask:

What are the behavioural drivers of climate adaptive investments under different microloan incentive conditions

- According to the theory of planned behaviour, behavioural intentions are the most proximal determinant of behaviour. Intention in turn is influenced by activity specific attitudes, subjective norms, and perceived behavioural control. As such we hypothesis that : a) regardless of incentive condition behavioural intention should mediate investment choice. b) attitudes, subjective norms and perceived behavioural control should moderate behavioural intention.

Can environmental conditionality on loans induce uptake of climate adaptive investment behaviour?

- We hypothesis that green incentives, if congruent with internal drivers of behaviour will crowd-in internal motivations - aligning intentions with subsequent stated adaptive investment behaviour.
- Green incentives will thus increase the probability of adaptive investments especially if people are already that way inclined.

Do demographic and contextual factors impact stated behaviour?

- We hypothesis that the demographic variables of ethnicity and gender would influence stated behaviour. Specifically, for Fijians, their cultural and spiritual connection to Vanua, the land and sea, is hypothesized to lead to the choice of more adaptive investment portfolios. In addition it is hypothesized that this will also be reflected in the antecedents of behaviour, with Fijians being inclined to positive attitudes, subjective norms particularly.
- Studies have shown that women are more inclined to environmentally protective behaviours. As such we hypothesis women to choose more adaptive portfolios over men.
- Income and access to microcredit have also been shown as facilitators of adaptive behaviour. As such we hypothesis that higher incomes, access to credit and having a current microloan would be correlated with greater uptake of stated adaptive investments.

To the best of the author's knowledge, this is the first study to dissect the behavioural antecedents of climate adaptive behaviour using microloan based incentives. This research contributes to our knowledge of the efficacy of monetary and non-pecuniary incentives on inducing the uptake of climate change adaptive investments for small holder farmers in particular. In addition it suggests a novel climate adaptive incentive mechanism based on the incentive and motivation based theories. Lastly the novel experimental design contributes to knowledge of survey-based experiments in the global south.

We build our investigation by borrowing from Bénabou and Tirole's motivation based theory of prosocial behaviour, Kahnman and Tversky's prospect theory and Ajzen and Fishbein's Theory of planned behaviour. We argue that microloans attached with environmental conditionality as an incentive mechanism can guide people towards making adaptive investments over the more maladaptive. We commence by looking at microloans and its application in conservation and adaptation before moving on to the conceptual framework.

9.2.1 MICROCREDIT

In the preceding chapters we have seen that microfinance has been linked to conservation and development projects. Novel financing methods to foster adaptation and conservation have also been developed by Payment for Ecosystem Services (PES) practitioners linking the basis of microloans with PES. Such initiatives take on an ecosystem-based approach to environmental management and development, safeguarding livelihoods and the needs of local people whilst also conserving biodiversity (Ounsted & Stolk, 2009). The ecosystem-based approach to conservation has been promoted by the Convention on Biological Diversity as it upholds its tenets of conservation, sustainable use and the fair and equitable sharing of benefits arising from the utilisation of genetic resources. The notion is that well managed ecosystems can instigate poverty reduction.

An example of PES linked with microcredit can be seen in Cranford and Mourato's (2014) choice experiment in the Intag river zone in Northern Ecuador. They draw on modern incentive theory to examine whether microcredit for ecosystem services (or Credit-Based (CB) PES) is a more viable tool then direct payments as experienced in PES. This works on the notion that credit-based incentives are supportive rather than controlling and as such would lead to crowding-in of intrinsic motivations. They constructed a novel choice experiment to understand whether people preferred loans with or without environmental conditions. The environmental condition was to convert one hectare of land to agro-forestry. If people chose this option then they would enjoy a lower interest rate, however if they failed to meet the condition of the loan then normal interest rates would apply. They found that around 50% of respondents were willing to take loans with environmental conditions. They also found that the loss or gain of carrying out the environmental condition, and the magnitude of the incentive, influenced respondents choice. Specifically, at lower interest rates people were more likely to accept CB-PES. Cranford and Mourato (2014) note that whilst such a pairing of PES and Microcredit through conditional lending is gaining interest, there remains little application on the ground, and little empirical research on the topic.

The usefulness of microcredit as an adaptive strategy has been recognized by certain environmental NGO's such as WWF and CARE who have been implementing schemes whereby loans are attached with environmental conditionality through lending criteria. The criteria for securing loans vary widely, some for instance impose strict conditions prohibiting certain income generating activities such as charcoal production or wood cutting for sale (Wild, Millinga, Robinson, 2008) whilst others have modified the microfinance model to effectively collateralize environmental assets in order to create strong environmental incentives for conservation (Kaiser, Hübner, & Bogner 2005). The latter refers to the hybrid method, introduced in chapter 1, termed 'Bio-rights'. The Bio-rights method was developed by Wetlands International and incorporates aspects of microloans along with payment for ecosystem services (Kaiser, Hübner, & Bogner 2005). The model relies on a community-ecosystem approach and is driven by the hypothesis that by gaining income from conserving protected areas, vulnerable communities can enter into sustainable rural development. The whole community is engaged in initiatives and their position as stakeholders is validated through their active participation in evaluating and validating projects. The model distributes microloans at the group level to establish a sense of community, to buffer against default and enhance cooperation amongst group members. Microloans are used to move people away from unsustainable practices to more ecologically sound activities. The recipients receive active support in the form of technical training, participatory workshops and study visits. The microloan with interest is repaid by members actively conserving the environment.

Whilst promising, the Bio-rights model has limited applicability due to a lack of enforceable property rights and contractual laws, which can present challenges when trying to influence conservation outcomes in local communities (van Eijk & Kumar, 2009). In addition the nature of property rights in developing communities may preclude some women from being active Bio-rights member. It remains that gender differentials in regards to property rights is widespread in the Global South, and whilst women tend to have usufruct rights these too are often mediated by men (Moghadam, 2007). Furthermore, as with PES, sustained funding is required from the global community.

In addition the deeper cognitive motivations which PES and Bio-rights engage within resource users are still little understood. How intrinsic motivations may be enabled by such models can be useful in the design of such initiatives. For instance, looking at a case study of community-based conservation in Peru, Cranford and Mourato (2011), found that through a mix of structural (which included providing alternative to degrading activities) and cognitive (which included the provision of information, and creating strong social norms of conservation) was able to create a culture of conservation. They suggest that market-based mechanisms such as PES can be introduced as a second-order incentive to reinforce the culture of conservation.

9.3 CONCEPTUAL FRAMEWORK

9.3.1 INCENTIVES

The role of incentives in positively and negatively reinforcing behaviours has long been a fascination of psychologists. An early example is that of Pavlov (1906) who used incentives to condition a salivation response in dogs. Relatively recent insights from the cognitive neuropsychological studies have been able to map the neural circuitry which is activated in incentive-driven behaviour. Such studies have shown that negative and positive incentives did result in slightly different activation pathways (Knutson, Westdorp, Kaiser & Hommer, 2000). It was Deci (1971) who first introduced the notion that monetary incentives may backfire. To test the effect of external incentives on internal motivations, he devised an experiment which consisted of three sessions and a control and treatment group. The task was to solve a puzzle with distractions in the form of magazines being present. For the treatment group, during the second session, a monetary reward was given for each puzzle solved. He found that after the monetary incentive, those in the treatment group spent less time solving puzzles then those within the control. It was as though they had lost interest in the task. Deci’s humble findings would go on to shake the foundations of the study of incentives and motivations.

Since Deci, it has become evident that a complex and often non-additive relationship exists between material and psychological incentives (Miller & Prentice, 2012). Gardner and

Stern (1996) for instance found that there is a possibility that creating large incentives could be detrimental to behavioural change in the long-run by undermining people's intrinsic motives for action. Such incentives could potentially lead to a conditioned dependency on immediate rewards which may inhibit sustained and voluntary behavioural restraint when the reward schema is removed.

Contextual inference theory also attempts to explain incentive anomalies. Contextual inference suggests that people take cues from their surrounding environment as to what the appropriate response should be when faced with uncertain stimuli – essentially converting environmental cues into heuristics for action (Kahneman, 2011; Kamenica, 2012). For instance if you can have a choice to purchase a water filter or a sturdy bucket to carry water in and are offered an incentive for the former, you may think the filter has some issues with it and therefore stick with your bucket (Bénabou & Tirole, 2003a). Of course this is not always the case as has been displayed by Cohen and Dupas (2010). They found that cost-sharing reduced demand of insecticide treated bed nets by 75% compared to the free distribution scheme.

Considering contextual inference, Kamenica (2012) suggests that less money and fewer options should be considered in incentive design (Kamenica, 2012). Smaller and simpler choice sets are more attractive to individuals then excessive choice sets because you can easily identify the utility of a decision. By offering too great a monetary incentive you may crowd-out intrinsic motivation as people become suspicious or complacent of the reward (Kamenica, 2008). In a green microloan example, if you offer to write off any loan repayment obligations in exchange for protecting the environment, this may come off as suspect and people therefore may not participate. However if you offer to reduce the interest rate this may prove more attractive. In addition, by offering people a limited and simple set of investment options could lead to greater adoption of adaptive measures.

In their motivations based theory, Bénabou and Tirole (2006) show how intrinsic incentives (motivations) can be crowded-out by extrinsic incentives (such as monetary rewards). Three different types of motivations are present in their utility function. These are: intrinsic, extrinsic and reputational motivations. Intrinsic motivations can be explained as our internal drive to perform an activity or task. Intrinsic motivations are reflective of our internal beliefs and its study has been related to cognitive dissonance theory which suggests from that people have an inner need to ensure that their beliefs and behaviors are consistent. Inconsistent or conflicting beliefs leads to disharmony, which people strive to avoid (Festinger, 1962) Intrinsic motivation does not depend on the rate of external rewards and punishments (incentives) but are driven by our own belief systems. Extrinsic motivation on the other hand comes from influences outside of the individual.

Both intrinsic and extrinsic motivations vary independently of each other; hence it is possible for extrinsic motivation to crowd-out intrinsic motivation. This is called the over-justification effect which refers to the observation that an expected external incentive can decrease a person's intrinsic motivation to perform a task. Markowitz and Shariff (2012) show why this effect is important when looking at climate change adaptation. In a review of the literature regarding climate change and moral judgment, they found that an important barrier to public action on climate change may be that it often fails to activate our moral intuitions which are important in forming relevant actions. They note that in using economic incentives as a mechanism to motivate behaviour, you can create conflict between two values, namely: materialism and environmentalism which are shown to be negatively related. They warn that the focus by policy makers on the framing of responses to climate change in economically beneficialy terms can actively inhibit individuals from developing intrinsic, non-materialist motives (for example, being true to their values and beliefs, virtue, and affiliation) to respond to the problem.

Imagine, to stop the over extraction of turtle eggs a community is given a pecuniary reward to instead sustainably harvest them. Consistent reliance on extrinsic incentives to stop over harvesting can crowd out pre-existing intrinsic drivers of that behaviour which are formed by the agents held beliefs. If and when the extrinsic incentive is removed, there is no longer any motivation to continue performing that behaviour for its own sake. Thus, as economic incentives and benefits for climate adaptive behaviour changes over time, the focus on extrinsic motivators for individuals may be counterproductive in the long-run. So the worry here is that incentives may not be a sustainable solution for long-run climate change adaptive and environmentally protective behaviour.

The final type if motivation in Bénabou and Tirole’s (2006) utility function is that of reputational motivation which refers to concern for one’s reputation. Reputational motivation varies with the public visibility of one’s behaviour. If the behaviour is invisible to others then it is assumed that reputational motivation is lacking. Their two player principle-agent game shows that the information the principle holds regarding the agent’s ability or regarding the task at hand does have an effect on the efficacy of the extrinsic reward. Using Cooley’s (and preceding him, Adam Smith’s) concept of the ‘looking glass self’, the agent uses the principal’s perspective in order to learn about his or her ability. They show that successful incentives would provide the agent with hidden information about themselves that increases their confidence or perceived ability to perform a task (Bénabou & Tirole, 2006).

By introducing extrinsic incentives (such as monetary rewards) we alter the motivation sphere in such a way that it can change the meaning attached to a behaviour. For an intrinsically motivated person extrinsic incentives thus may conflict with the intrinsic in such a way that it negatively affects one's desire to engage in the behaviour. The framing of the incentive in the private or public domain could in addition impact on one's moral reputation which further influences behaviour. Bénabou and Tirole (2002) show that when an individual lacks self confidence in their own ability to perform a task, then offering an economic reward can be counterfactual. His perception of his own ability may be further lowered by the incentive. Thus the likelihood of undertaking the task, when a person displays self doubt, is compromised by a monetary reward.

We could argue that the Grameen microfinance model has traditionally relied on the reputational aspect as an incentive against defaulting (McDonnell, 1999) . In green iterations of microcredit the interplay between the aforementioned motivators is complex. When targeting groups who are dependent on the land and sea for livelihoods, but do not have the resources to carry out adaptive behaviours, are incentives even necessary or would the loan suffice? If these groups have strongly positive intrinsic motivations then according to Ajzen's TPB (1985), this should lead to a greater intention to behave in a manner that is environmentally protective. Constructive incentives, such as a loan, could then positively influence one's perception of their own ability to behave in an environmentally protective way.

It is also important to consider the framing of the incentive. Framing incentives with losses in mind can be interpreted very differently depending on one's socioeconomic status. How the poor weigh losses is understandably distinct from that of the better off as their baseline position or reference points from which they can judge a loss, is unlike that of the wealthier. For the poor all existing choices are between losses. Ultimately the least costly loss is that which is the most likely to be chosen. Loss aversion can be seen as an innate desire to avoid situations which threaten our physical and mental wellbeing.

The concept of loss aversion is modelled in Kahneman and Tversky's (1986) prospect theory which tries to explain decision making under risk. The theory consists of a framing and valuation phase. Within the framing phase a representation of those elements (acts, contingencies and outcomes) which are of importance to the decision is constructed. In the valuation phase, values are assigned to each prospect and a choice made. The four key aspects to the theory are: 1) reference dependence, 2) loss aversion, 3) diminishing sensitivity, and 4) probability weighting. There are two versions of the theory, original (OPT) and cumulative (CPT). With reference dependence, we measure utility of gains and losses from a neutral starting point that is not entirely governed by wealth. Such a reference point takes into consideration our propensity to perceive and value changes in the attributes over absolute magnitudes (Barberis, 2012).

The second component we have already discussed, basically loss aversion states that people are more responsive to losses then to gains. Loss aversion is influenced by decision weights which are in turn influenced by further cognitive aspects such as the certainty and possibility effects and the temporality of events. The latter refers to the propensity of decision makers to amplify present outcomes over future ones (Keren & Roelofsma, 1995). The possibility effect denotes the tendency of overestimating the importance or weight of low probability events whilst the certainty effect is the tendency to overweight certain outcomes over probable ones (Tversky & Kahneman, 1992). Possible neural substrates of the possibility and certainty effect may indicate that the two types of effects are bound by different cognitive processes thus framing of outcomes can elicit distinctly different cognitive pathways (Carter, Meyer & Huettel, 2010; Kahneman, 2011; Weber & Huettel, 2008; Zeng et al, 2013).

The third component of diminishing sensitivity is that gains have a concave value function and the opposite for losses. Lastly, probability weighting refers to persons attitudes towards outcome probabilities in general such that the probability for each separate outcome is transformed into a decision weight (OPT). Alternatively it refers to a person's attitudes towards the different probabilities for a gain or a loss (CPT) such that de-cumulative (losses) and cumulative (gains) probabilities are weighted as a function of consecutive losses or gains (Fennema & Wakker, 1997).

In OPT, loss aversion is seen as a tendency towards the utility curve for losses to be steeper than the utility curve for gains when starting from a neutral reference point. This is the first element of Kahneman and Tversky's theory, the second assumes a nonlinear transformation of the probability scale so that their weighting function is most sensitive to changes in probability closer to the ends of the curve at 0 and 1 and less sensitive to changes in the middle. Small probabilities are overweighed whilst the inverse is true for large probabilities (& Tversky & Kahneman, 1992). In their original model, separable decision weights led to a violation in stochastic dominance. Here we would expect that as probability magnitude changes from bad outcomes to better outcomes, one's prospect would improve. To manage this, CPT was developed. Here the value of an outcome is multiplied by a decision weight rather than an additive probability (Tversky & Kahneman, 1992). This allows the theory to be extended to prospects with a larger number of outcomes.

When viewed in conjunction with hyperbolic time discounting – or the scalar decrease in negative and positive utility across time – prospect theory and specifically loss aversion becomes a significant consideration in environmental conservation where utility often is realised in the future. In evolutionary terms, loss aversion has been seen as an important adaptive strategy with Li and colleagues (2012) finding that men and women became more loss-averse when self-protective motives were primed. Their study is interesting as it shows that perhaps loss aversion is domain specific, and therefore not applicable to all decision scenarios. If loss aversion is indeed domain specific to protective motives then it could lead to useful insights regarding climate change adaptation programme design. For instance looking at Small Island Developing States (SIDS) for whom climate change threatens their cultural identity, framing adaptation as a way to protect one's history, people and culture can be a powerful motivator to adopt adaptive behaviours. Kahneman and Tversky (1986) show how loss aversion can be modified through creative framing of problem scenarios. Simply through the use of emotive words one can evoke a desired for reaction.

We can find evidence for the neural substrates of decisions under risk through cognitive neuropsychology. For instance, Weber and Huettel (2008) used functional Magnetic Resonance Imaging (fMRI) to explore probabilistic and intertermporal decision making. They presented subjects with a decision making task consisting of a series of choices between pairs of real monetary rewards. The rewards differed either in their relative risk or their relative delay. It was found that risky choices evoked greater activation in the posterior parietal (associated with: free will, planned physical movements and pain perception) and lateral prefrontal cortices (associated with: executive behaviour control), whilst choices involving delay evoked greater activation in the posterior cingulate cortex (associated with: human awareness although very little is known of this region) and the striatum (associated with: novel decision making and working memory). Importantly, they found that regions associated with reward evaluation predicted risky choices whilst those regions implicated in control decisions were implicated in the less risky and more delayed decisions. This indicates that risky and intertemporal choices elicit different cognitive processes. As such framing risk modules will impact the way in which we process it. Again, this highlights the importance of the framing of incentives to elicit behaviour change as the incentive structure can produce different outcomes with regards to the relative weights placed on behavioural choices.

When applying prospect theory to climate change adaption decisions, the location of our reference point will impact outcome evaluations. Loss aversions would state that the position of this reference point in the domain of gains or losses will impact subsequent responses. If outcomes of climate change are framed in the domain of losses then we would anticipate net benefits to be more attractive to the decision maker (Osberghaus, 2013). So for example imagine a subsistence farmer for whom climate change will increase the probability of losses in crop yield thus negatively impacting subsistence needs. This farmer starts from the reference point of losses. The farmer is offered the opportunity to invest in either a non-adaptive or adaptive basket of agricultural tools. The adaptive will yield steady returns in the future whilst the non-adaptive has the potential to rapidly increase gains now but will certainly be detrimental to future yields. Under prospect theory and considering the certainty effect and temporality, it is reasonable to assume that the more attractive option to this farmer will be the non-adaptive basket where potential of loss is rapidly minimised in the immediate future. If however we reframed the baskets, so that the adaptive will increase yield indefinitely and minimise losses now, whilst the non-adaptive may increase yield but may also increase losses in the future then the adaptive investment becomes most attractive as it offers a certainty to minimise losses. It is intriguing that such decisions will probably employ different cognitive pathways depending on risk and control evaluations.

How we conceive people should behave in order to lead better, more fulfilled lives has been debated over the centuries. For economists, the rationality of human beings is a primary and valid assumption. This assumption, divorced from psychological insights and framed by logical reasoning has been the base of many a normative model of decision making and risk. Behavioural economists, in moving away from this idealised conception of a model decision maker to one that is more realistic to the complex and messy nature of human thought processes, have opened a new window into the design of initiatives to ameliorate the lot of the poor. Ecosystem-based adaptation strategies can benefit from new insights offered by behavioural economics especially in the design of incentives structures.

9.3.2 BEHAVIOURAL ANTECEDENTS

It is evident that the nature of incentives in eliciting the sought after behaviour tends to draw upon complex cognitive functioning's. The salience of the incentive must be properly conceived of in order for it to be seen as a desirable reward structure thus provoking the crowding out of the undesirable behaviour and the uptake of that which is sought after. This indicates the importance of teasing apart the antecedents of behaviour in order to better understand the efficacy of incentive structures. Powerful imaging tools such as fMRI can be of great utility in understanding how behavioural responses are formed, alas the use of such technologies in assessing particular behaviours in the Global South is expensive and, unfortunately, unrealistic at the moment.

Thus a natural starting point to behavioural antecedents is one's beliefs and attitudes. The assumption here is that people behave in ways that are consistent to the beliefs and attitudes they hold (Nickerson, 2012). As with the assumption of rationality, humans have shown that they are more complicated then this assumption would tend to show. Indeed studies have shown that the nature of the relationship between attitudes, beliefs and behaviour is a cloudy one at best. For instance, Gardner and Stern (1996) show that in cultures where the prevailing religious ideologies have explicit pro-environmental teachings, the ensuing pro-environmental beliefs and attitudes do not seem to affect pro-environmental behaviour. However it has been shown that by measuring attitudes and behaviours on the same level of specificity and by addressing constraints and facilities on behaviour beyond one's control (Kaiser, Wolfing &Fuhrer, 1999) does increase the attitudes predictive power.

The Theory of Planned Behaviour (TPB) takes this into consideration. It states that the constructs of Attitudes towards the behaviour (A_B), Subjective Norms (SN; which are significant others approval or disapproval to perform the behaviour) and Perceived Behavioural Control (PBC; which is the appraisal of one's own ability to perform a behaviour) will lead to intention to perform said behaviour. Intention in turn is hypothesized to be the most immediate predictor of behaviour (Ajzen, 2002). Attitudes, subjective norms and perceived behavioural control can be seen as intrinsic motivators. Subjective norms can also be regarded as a reputational motivator as it indicates our reputational concerns through the importance placed in referent others. A formulaic representation can be conceived of as follows:

$$\mathrm{BI} = \mathrm{A_B}(\mathrm{W_1}) + \mathrm{SN}(\mathrm{W_2}) + \mathrm{PBC}(\mathrm{W_3})$$

The TPB has provided useful insights into conservation and pro-environmental behaviour in the West particularly. For instance, Lynne, Casey, Hodges, and Rahmani, (1995) compared the theories of Reasoned Action, Planned Behaviour, and Derived Demand to explain the adoption of water conservation technology by Florida strawberry farmers. Whilst they found support for the TPB, they also state that the incorporation of financial variables to express actual behavioural control could increase the models explanatory power. For the case of water conservation technology adoption, Lynne et al (1995) suggest that low PBC could in fact crowd-out behaviour. As such governments need to balance control with incentives and moral suasion.

Other studies have successfully applied the TPB to look at sustainable agricultural practices (Beedell & Rehman, 1999), curb-side recycling (Tonglet, Phillips & Read, 2004), the adoption of sustainable business practices by executives and managers (Mancha, Muniz & Yoder, 2014), and environmental behaviours in the workplace (Greaves, Zibarras & Stride, 2013). The success of this model and its parallels with Bénabou and Tirole's motivation based theory made it an attractive option to test the cognitive drivers of microloan investment behaviour under differing incentive structures. In addition, considering its relative obscurity in explaining conservation behaviour in the South, the application of the model in this context can aide in understanding its utility in developing countries.

It has been shown that when used in conjunction with lab and field experiments, the TPB can be a useful predictor of behaviours. For instance Bamberg (2002) utilized field experiments to assess how intentions are translated to behaviour. The behaviour in question was buying organic food. Bamberg (2002) introduced differing levels of monetary incentives for purchasing organic food and found that higher incentives did in fact translate to action within the TPB paradigm.

9.3.3 DEMOGRAPHIC AND CONTEXTUAL FACTORS

In this research, to better understand the determinants of stated adaptive investment behaviours and its antecedents, several demographic and contextual factors were included in the TPB model. These include gender, Status as chief, ethnicity, income, prior and current microcredit participation.

Demographic and contextual factors which may influence behaviour and which have been explored in the TPB framework are attributes such as age, gender, religion, and income to name a few. For instance, in a study looking at environmental behaviour in youths, gender, income, education and religious beliefs did not make a considerable impact on their environmental attitudes, behavioural intentions, actual behaviour (Niaura, 2013). However beyond the domains of the TPB, there has been much research to support the hypothesis that women are more inclined to environmentally protective behaviours. It has been argued that women have a special relationship with nature, and are particularly altruistic and caring in their environmental management (Jackson, 1993). Indeed in the Global South women a distinct role in: the management of plants and animals in forests, drylands, wetlands and agriculture; in collecting water, fuel and fodder for domestic use and income generation; and in overseeing land and water resources. The extensive experience of women in the sustainable use of resources has included them in the climate change, and environmental conservation agenda as key actors of positive change (Meena, 1992; Pearson, 2000; Dankelman, 2002; Merchant, 2014; Vernooy, 2015)

Similarly indigenous communities are often in possession of rich cultural heritages and traditional ecological knowledge that has been passed down from generation to generation on the sustainable use of resources (Cairns, 2015). In the pacific this is evident in the traditional practices around marine conservation. The use of tabu (or restricted) areas are commonplace as a traditional, and more sustainable harvesting and gathering methods (for instance through the use of line fishing, hand nets, bare handed catching, and vono (a method of fishing through the creation of an inshore trap) (Kittinger, 2013).

Decisions affecting the management of the qoli qoli (traditionally defined fishing areas) and vanua (land-sea estate) are led by the clan chief. The clan chief in Fiji is seen as the supreme guardian of the village’s parcel of land, waters, resources and resident indigenous people (Mühlig-Hofmann, 2007). It is this status as steward and guardian that makes us hypothesize that chiefs may be more inclined to make decisions which are environmentally protective.

In addition we look at income, access to credit and current microloans as factors that influence behaviour. Semenza et al (2008) showed that lower income people had greater concern regarding climate change. This could be because of the additional risk that climate change poses on their livelihoods. Whilst Grothmann (Grothmann & Patt, 2005) found that the level of income had no significant explanatory power for adaption behavior. Other studies that investigate the impact of income on the adoption of climate change adaptive behaviours have found a positive correlation between income and adoption (Franzel, 1999). It could be that higher income farmers may be less risk averse, have better information access, and a longer term planning horizon (Deressa et al, 2009). In addition, we include access to credit and current microcredit participation as factors which may positively predict subsequent adaptive stated investment behaviour as studies have shown that access to microcredit removes barriers to climate change adaptation in farmers (Bryan et al, 2006; Hassan et al, 2008; Below et al, 2012). It has also been argued that microfinance services can create livelihood asset base through direct income effects, indirect income effects (from education and training), and non-pecuniary effects (for instance from stronger social networks and increased confidence) which can make them more resilient to shocks and enable their capability to take on adaptive behaviours (Hammill, Matthew, & McCarter, 2008).

Lastly we include the treatment and control groups - which related to the presence or absence of information - from the previous chapter as a dummy variable as advised by Muthen and Muthen (2007) with small samples and more complex models.

9.4 RESEARCH DESIGN AND EMPIRICAL METHOD

A multi-stage sampling strategy was adopted. The first stage consisted of stratified sampling. Each strata indicated a geographic region defined as being close to or within fragile ecosystems in Viti-Levu. The second stage consisted of simple random sampling within each strata. Sampling strategy is described in detail in Chapter 6. The resulting sample consisted of 205 respondents. The same experimental methodology described in Chapter 6 was employed here. Unlike the previous chapter, here our empirical analysis looks across all the incentive conditions – namely no incentive, dynamic incentive, and green incentive. In addition the following demographic variables were included:

FIGURE 9-1: DEMOGRAPHIC AND CONTEXTUAL VARIABLES

Description/Scale	
Ethnicity	0=Other 1=Fijian
Gender	0=Male, 1=Female
Occupation	0=Other, 1=Farmer/Fisher
Status	0=Other, 1=Chief
Income	0=Y>F\$10, 1= Y<F\$10
Access to Credit	0=No, 1=Yes
Credit Participant	0=No, 1=Yes
Control (No information offered)	0=Yes, 1= No

The survey preceded the survey-based experiment and explored cognitive drivers and collected demographic information. The framed field experiment introduced a ‘green’ incentive condition, the design of which was influenced by incentive theory, in particular looking at aspects of framing, contextual inference, and prospect theory. The ensuing green incentive condition offered simpler and fewer choice sets with a small pecuniary reward. It also had a mandatory mangrove rehabilitation component to encourage biodiversity conservation. We also take note that the absolute subjective value of decisions under loss are greater than those under gain (Kahneman, Knetsh & Thaler, 1991). Thus non-adaptive investments carry monetary penalties so that they elicit greater losses then the adaptive options.

The empirical method employed was that of Path analysis as described in the previous chapter. As before, the path analysis was clustered at the village level and specified using Mplus Version 6 software (Muthen & Muthen, 2011). Using a Weighted Means and Variance Estimator (WLSMV), Mplus estimates probit and linear regression coefficients, with the former being estimated for categorical outcomes. The WLSMV estimator is a robust method for categorical data. It uses a diagonal weight matrix, robust standard errors and mean and variance adjusted χ^2 test statistic (Finney & DiStefano, 2006). This method has also been shown to be sufficient for medium sized models with sample sizes between 150 and 200 (Brown, 2006) as is the case with the present study.

The Path model can be written as follows:

EQUATION 9-1

$$Y1(Attitudes) = \alpha + \gamma_{11}\, Occupation + \gamma_{12}\, Gender + \gamma_{13}\, Ethnicity + \gamma_{14}\, Income + \epsilon_1$$

$$Y2(Subjective\ Norms) = \alpha + \gamma_{21}\, Occupation + \gamma_{22}\, Gender + \gamma_{23}\, Ethnicity + \gamma_{24}\, Income + \epsilon_3$$

$$Y3(Perceived\ Behavioural\ Control) = \alpha + \gamma_{31}\, Occupation + \gamma_{32}\, Gender + \gamma_{33}\, Ethnicity + \gamma_{34}\, Income + \epsilon_2$$

$$Y4(Behavioural\ Intention) = \alpha + \beta Attitudes + \beta Subjective\ Norms + \beta Perceived\ Behavioural\ Control + \zeta_1$$

$$
\begin{aligned}
U_1(No\ Incentive) &= \alpha + \beta_2 Behavioural\ Intention + \beta_{21} Perceived\ Behavioural\ Control \\
&+ \gamma_{41}\ Control\ (No\ Information) + \ \gamma_{42}\ Occupation + \ \gamma_{43}\ Gender \\
&+ \gamma_{44}\ Ethnicity + \ \gamma_{45}\ Income + \ \gamma_{46}\ Prior\ Microcredit\ Participation \\
&+ \gamma_{47} Current\ Microloan + \zeta_2
\end{aligned}
$$

$$
\begin{aligned}
U_2(Dynamic\ Incentive) &= \alpha + \beta_3 Behavioural\ Intention + \beta_{22} Perceived\ Behavioural\ Control \\
&+ \gamma_{51}\ Control\ (No\ Information) + \ \gamma_{52}\ Occupation + \ \gamma_{53}\ Gender \\
&+ \gamma_{54}\ Ethnicity + \ \gamma_{55}\ Income + \ \gamma_{56}\ Prior\ Microcredit\ Participation \\
&+ \gamma_{57} Current\ Microloan + \ \zeta_3
\end{aligned}
$$

$$
\begin{aligned}
U_3(Green\ Incentive) &= \alpha + \beta_1 Behavioural\ Intention + \beta_{23} Perceived\ Behavioural\ Control \\
&+ \gamma_{61}\ Control\ (No\ Information) + \ \gamma_{62}\ Occupation + \ \gamma_{63}\ Gender \\
&+ \gamma_{64}\ Ethnicity + \ \gamma_{65}\ Income + \ \gamma_{66}\ Prior\ Microcredit\ Participation \\
&+ \gamma_{67} Current\ Microloan + \ \zeta_4
\end{aligned}
$$

The predicted probability of investment choice was given as:

EQUATION 9-2

$$
\begin{aligned}
Pr(U &= 1|x_i) = \Phi(\tau_1 - b_1x_2 - b_2x_2 \dots) \\
Pr(U &= 2|x_i) = \Phi(\tau_2 - b_1x_2 - b_2x_2 \dots) - \ \Phi(\tau_1 - b_1x_2 - b_2x_2 \dots) \\
Pr(U &= 3|x_i) = \Phi(\tau_3 - b_1x_2 - b_2x_2 \dots) - \ \Phi(\tau_2 - b_1x_2 - b_2x_2 \dots) \\
Pr(U &= 4|x_i) = \Phi(\tau_4 - b_1x_2 - b_2x_2 \dots) - \ \Phi(\tau_3 - b_1x_2 - b_2x_2 \dots) \\
Pr(U &= 5|x_i) = \Phi(-\tau_4 + b_1x_2 + b_2x_2 \dots)
\end{aligned}
$$

Where ϕ is the cumulative normal distribution, τ is the threshold which in Mplus is the inverse of the intercept, b is the unstandardised coefficient. And recalling that investment choice was:

1) Adaptive portfolio
2) Moderately adaptive portfolio
3) Mixed portfolio
4) Moderately non-adaptive portfolio
5) Non-Adaptive portfolio

9.5 RESULTS

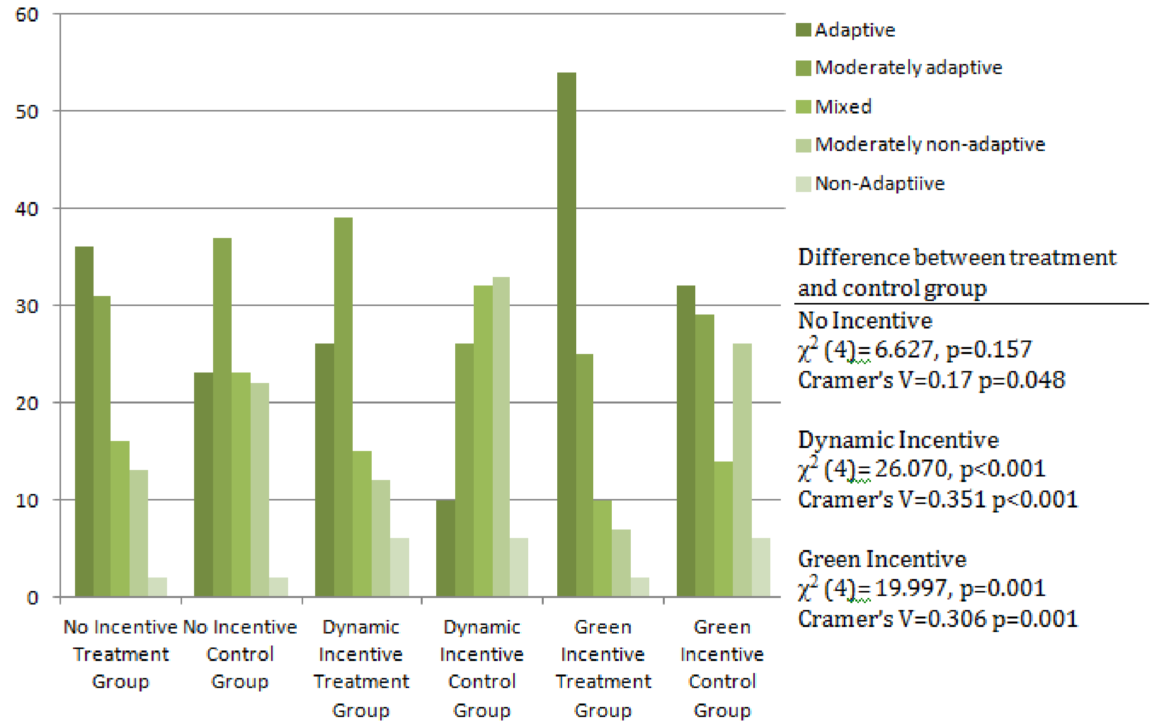
Frequency distribution of investment choice across periods and incentives types revealed that the adaptive investment was the most popular option (Table 9.1). People were opting for the adaptive investments most in the green incentive conditions, followed by the no incentive conditions.

TABLE 9-1: FREQUENCY DISTRIBUTION OF INVESTMENT CHOICE

Incentive Type & Period	Adaptive	%	Mixed	%	Non-Adaptive	%
None Period 1	119	58	69	33.7	17	17
None Period 2	91	44.4	64	31.2	50	24.4
Dynamic Period 1	85	41.5	71	34.6	49	23.9
Dynamic Period 2	84	41.0	69	33.7	52	25.4
Green Period 1	117	57.1	66	32.2	22	10.7
Green Period 2	122	59.5	43	21.0	40	19.5

We also evaluated whether the different conditions significantly differed from each other by way of a likelihood ratio chi square goodness of fit test. The null hypotheses that there was no significant different between conditions was rejected, with moderate association between the conditions (No Incentive*Green Incentive: $\chi^2(16)$ 76.808, p=0.001; Cramer's V=0.338, p=0.001; Green Incentive*Dynamic Incentive: $\chi^2(16)=79.256$, p=0.001; Cramer's V =0.294, p=0.001; Dynamic Incentive*No Incentive: $\chi^2(16)$ 61.545, p=0.001; Cramer's V=0.274, p=0.001). We also saw that the treatment groups who were in receipt of climate change information did significantly differ from the control group in the dynamic and green incentive conditions, with moderate association between the conditions (Figure 9.2).

FIGURE 9-2: INCENTIVE CHOICE ACROSS TREATMENTS AND CONDITIONS

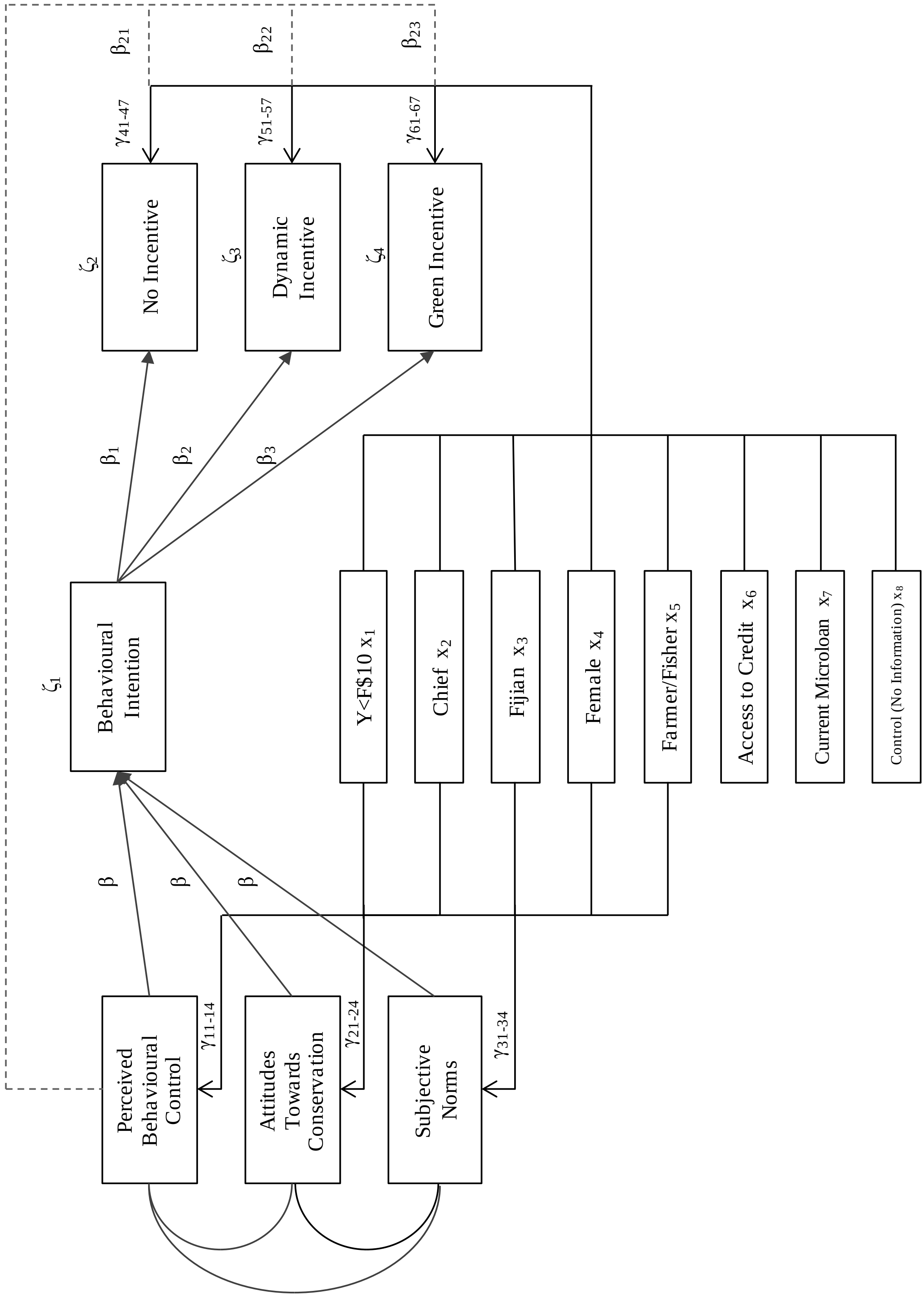


9.5.1 PATH ANALYSIS

As with the previous chapter, the direct effect of perceived behavioural control to stated behaviour was constrained as this led to poor model fit (RMSEA=0.074, CFI=0.886). The constrained model had excellent fit statistics (RMSEA=0.03, CFI=0.966). The RMSEA tells us that we can reject our null hypothesis of a poor fit of the data to the model, whilst the CFI tells us that 96.6% of the covariation in the data can be explained by our model.

The theoretical model as expressed by our path analysis is represented in Figure 9.3. The path coefficients and probabilities are represented in Tables 9.2 to 9.5.

FIGURE 9-3: PATH MODEL



The results were in line with the theoretical model. Intention was significantly and positively predicted by attitudes (B=0.224, p=0.080), subjective norms (B=0.393, p=0.036), and perceived behavioural control (B=0.404, p=0.016). When attitudes were positive and all other predictor variables were held at their mean then probability of moderately positive intentions was 0.952 and positive intentions was 0.991. The same case for positive subjective norms, saw an 0.812 probability of positive intentions, whilst perceived behavioural control saw an .707 probability of moderately positive and an 0.999 probability of positive intentions.

Attitudes, subjective norms and perceived behavioural control were positively and significantly influenced by ethnicity, with Fijians having a 0.630 probability of positive attitudes, a 0.995 probability of positive subjective norms, and a 0.904 probability of positive perceived behavioural control. In addition status as a chief, and being female positively and significantly influenced behavioural control with a probability of positive behavioural control being 0.901 and 0.890 respectively. Income increased the probability of negative (0.408) and neutral (0.959) attitudes.

TABLE 9-2: BEHAVIOURAL ANTECDENTS AND DEMOGRAPHIC MODERATORS

							Predicted Probabilities		
			β	S.E	P		Low	Medium	High
Behavioural Intention	←	Attitudes Towards Conservation	0.224	0.172	0.080	**	0.001	0.952	0.991
		Subjective Norms	0.393	0.264	0.036	**	0.000	0.000	0.813
		Perceived Behavioural Control	0.403	0.229	0.016	**	0.000	0.707	0.999
Attitudes Towards Conservation	←	y<$10	0.015	0.154	0.820		0.408	0.959	0.282
		Chief	0.105	0.352	0.207		0.261	0.822	0.433
		Fijian	0.372	0.145	0.000	***	0.127	0.468	0.630
		Female	0.026	0.148	0.694		0.399	0.955	0.290
		Farmer/Fisher	0.047	0.191	0.515		0.374	0.941	0.313
Subjective Norms	←	y<$10	-0.100	0.184	0.234		0.196	0.978	0.968
		Chief	0.009	0.402	0.925		0.133	0.934	0.983
		Fijian	0.214	0.223	0.021	**	0.056	0.707	0.995
		Female	-0.127	0.186	0.150		0.210	0.983	0.965
		Farmer/Fisher	0.111	0.333	0.405		0.088	0.847	0.991
Perceived Behavioural Control	←	y<$10	0.101	0.218	0.296		0.609	0.222	0.849
		Chief	0.116	0.266	0.070	*	0.509	0.101	0.901
		Fijian	0.199	0.171	0.003	**	0.502	0.095	0.904
		Female	0.192	0.144	0.003	**	0.533	0.125	0.890
		Farmer/Fisher	0.120	0.254	0.220		0.577	0.175	0.868

R2: Attitudes=0.176; Subjective Norms=0.092; Perceived Behavioural Control=0.151; Behavioural Intention=0.543; *p<0.1, **p<0.05, ***p<0.001

So in the *no incentive condition*, holding all other variables constant, we see that Fijians were more likely to choose adaptive portfolios over non-adaptive with a probability difference of 0.291 between an entirely adaptive and an entirely non-adaptive portfolio. Similarly having a current microloan increased the probability of choosing an adaptive portfolio (probability difference of 0.222 between choosing an adaptive over a non-adaptive portfolio).

TABLE 9-3: NO INCENTIVE COEFFICIENTS AND PREDICTED PROBABILITIES

			β	S.E	p		Predicted Probabilities Adaptive	M A	Mixed	M N-A	Non-Adaptive
No Incentive	←	Behavioural Intention	-0.016	0.063	0.845		0.057	0.849	0.770	0.927	0.076
		Perceived Behav Control	0.000	0.000	-		0.037	0.874	0.796	0.906	0.066
		Control	0.108	0.212	0.244		0.031	0.672	0.560	0.807	0.123
		y<F$10	-0.083	0.128	0.123		0.078	0.913	0.856	0.962	0.055
		Chief	-0.045	0.457	0.670		0.120	0.967	0.940	0.988	0.089
		Fijian	-0.482	0.234	0.000	***	0.293	0.999	0.998	1.000	0.002
		Female	0.023	0.131	0.689		0.031	0.679	0.568	0.812	0.062
		Farmer/Fisher	-0.011	0.183	0.874		0.002	0.064	0.035	0.136	0.004
		Access to Credit	0.091	0.224	0.252		0.034	0.710	0.602	0.835	0.139
		Current Microloan	-0.392	0.218	0.000	***	0.232	0.997	0.993	0.999	0.010

No Incentive R2= 0.231; *p<0.1, **p<0.05, ***p<0.001; M A= Moderately Adaptive, M N-A= Moderately Non-Adaptive

In the *dynamic incentive condition*, holding all other variables constant, the probability of adaptive and moderately positive investment choices increased for Fijians (B=-0.045, p=<0.001; Predicted probability of an adaptive portfolio=0.356 compared to 0.002 for non-adaptive) and by having an existing microloan (B=-0.179, p=0.01; predicted probability of adaptive portfolio=0.120 compared to 0.017 for non-adaptive). Farmers and fisher folk also were more inclined towards adaptive (0.473) over non-adaptive investment portfolios (0.001).

The control treatment (B=0.21, p=0.006), income (B=0.062, p=0.019) and access to credit (B=0.0159, p=0.006) significantly increased the probability of choosing more non-adaptive portfolios with the moderately non-adaptive investment portfolio being the most popular choice with a probability of 0.558, 0.838, and 0.567 respectively.

TABLE 9-4: DYNAMIC INCENTIVE COEFFICIENTS AND PREDICTED PROBABILITIES

						Predicted Probabilities				
		β	S.E	p		Adaptive	M A	Mixed	M N-A	Non-Adaptive
Dynamic Incentive	← Behavioural Intention	-0.058	0.039	0.195		0.051	0.926	0.872	0.948	0.048
	Perceived Behav Control	0.000	0.000	-		0.037	0.874	0.796	0.906	0.066
	Control	0.210	0.197	0.006	**	0.011	0.489	0.366	0.558	0.155
	y<F$10	0.062	0.070	0.019	**	0.026	0.792	0.691	0.838	0.090
	Chief	0.016	0.246	0.752		0.008	0.981	0.960	0.987	0.187
	Fijian	-0.532	0.147	0.000	***	0.356	1.000	1.000	1.000	0.002
	Female	-0.027	0.130	0.590		0.037	0.925	0.870	0.947	0.067
	Farmer/Fisher	-0.045	0.154	0.368		0.473	0.041	0.020	0.059	0.001
	Access to Credit	0.159	0.183	0.006	**	0.013	0.498	0.374	0.567	0.142
	Current Microloan	-0.179	0.181	0.010	**	0.120	0.965	0.932	0.976	0.017

Dynamic Incentive R2=0.231; *p<0.1, **p<0.05, ***p<0.001; M A= Moderately Adaptive, M N-A= Moderately Non-Adaptive

In the *green incentive condition*, holding all other variables constant, investment choice was significantly mediated by behavioural intention (B=-0.187, p-0.022), being Fijian (B=-0.525, p=<0.001), the treatment group (B=0.241, p=0.027), and status as chief (B=0.101, p=0.067). Behavioural intention and being Fijian inclined people towards more adaptive portfolios. With positive behavioural intention the predicted probability of a solely adaptive portfolio was 0.346 in contrast to a probability of 0.012 for an entirely non-adaptive portfolio. For Fijians the probability of choosing an adaptive portfolio was 0.573, compared to 0.002 for non-adaptive. As in the dynamic incentive condition, farmers and fisher folk also were more inclined towards adaptive (0.771) over non-adaptive investment portfolios (0).

In contrast, being in the control group, and status as Chief inclined people towards more non-adaptive portfolios. In the control group the probability of choosing an adaptive portfolio was 0.065, whilst it was 0.125 for non-adaptive. Similarly, for chiefs the probability of adaptive loans was lower at 0.061 than for non-adaptive (0.131).

FIGURE 9-4: GREEN INCENTIVE COEFFICIENTS AND PREDICTED PROBABILITIES

							Predicted Probabilities				
			β	S.E	p		Adaptive	M A	Mixed	M N-A	Non-Adaptive
Green Incentive	←	Behavioural Intention	-0.187	0.072	0.022	**	0.346	0.972	0.937	0.986	0.012
		Perceived Behav Control	0.000	0.000	-		0.229	0.731	0.596	0.818	0.027
		Control	0.241	0.283	0.027	**	0.065	0.369	0.239	0.482	0.125
		y<F$10	0.055	0.198	0.447		0.048	0.969	0.933	0.985	0.158
		Chief	0.101	0.276	0.067	*	0.061	0.582	0.434	0.690	0.131
		Fijian	-0.525	0.196	0.000	***	0.573	1.000	1.000	1.000	0.002
		Female	-0.020	0.179	0.764		0.771	0.016	0.006	0.032	0.000
		Farmer/Fisher	-0.038	0.259	0.651		0.235	0.852	0.749	0.909	0.026
		Access to Credit	0.018	0.376	0.880		0.203	0.716	0.578	0.805	0.033
		Current Microloan	-0.155	0.319	0.196		0.296	0.968	0.931	0.984	0.016

Green Incentive R2=0.412; *p<0.1, **p<0.05, ***p<0.001; M A= Moderately Adaptive, M N-A= Moderately Non-Adaptive

We found that the different incentive conditions positively covaried with each other as did the moderating constructs of the Theory of Planned Behaviour.

TABLE 9-5: COVARIANCE COEFFICIENTS

			B	S.E	P	
No Incentive	↔	Dynamic Incentive	0.207	0.091	0.023	**
		Green Incentive	0.361	0.061	0.000	***
Green Incentive	↔	Dynamic Incentive	0.264	0.047	0.000	***
Attitudes Towards Conservation	↔	Subjective Norms	0.354	0.096	0.000	***
		Perceived Behavioural Control	0.381	0.063	0.000	***
Subjective Norms	↔	Perceived Behavioural Control	0.031	0.074	0.670	

*p<0.1, **p<0.05, ***p<0.001

As the investment portfolios were coded with 1 being adaptive and 5 non-adaptive, the negative correlation of the incentive conditions with the constructs of the Theory of Planned Behaviour shows that people were choosing more adaptive investment portfolios.

TABLE 9-6: MATRIC OF CORRELATIONS

		1	2	3	4	5	6	7
1	Attitudes Towards Conservation	1						
2	Subjective Norms	0.403	1					
3	Perceived Behavioural Control	0.453	0.071	1				
4	Behavioural Intention	0.565	0.512	0.532	1			
5	No Incentive	-0.151	-0.079	-0.114	-0.118	1		
6	Dynamic Incentive	-0.251	-0.161	-0.182	-0.22	0.389	1	
7	Green Incentive	-0.288	-0.207	-0.222	-0.321	0.492	0.543	1

9.6 DISCUSSION

In general when looking across the models, we found that a positive intrinsic set of beliefs regarding the environment favourably influenced self-reported behavioural intention. A similar finding on the moderating effect of attitudes, subjective norms and perceived behavioural control on intention to perform environmentally responsible behaviour is shown by Defrancesco and colleagues (2008). They found that a farmer's attitudes, beliefs and relationship with neighbouring farmers and their opinions on environmentally protective behaviours significantly affected adoption of agri-environmental measures. Further support for the moderating affect of attitudes, subjective norms and perceived behavioural control on behavioural intention can be found in studies looking at recycling (Boldero, 1995; Laudenslager, Holt & Lofgren, 2004) and public transport uptake (Heath & Gifford, 2002) amongst others.

Behavioural intention was found increase the probability of choosing more adaptive investments in the green incentive condition. This supports the TPB's assumption that intention, moderated by the aforementioned intrinsic variables, is the most proximal determinant of behaviour. Deviating from our hypothesis, intention did not mediate subsequent stated behaviour under dynamic and no incentive conditions. This could be an indication that the green incentive condition was able to engage people's deeper motivations to undertake adaptive behaviour. Indeed as hypothesized we also found that adaptive investments over non-adaptive was greater under this condition. Thus, by using the framework of the TPB we were able to show that extrinsic incentives to facilitate the uptake of climate adaptive investments did not seem to crowd-out one's environmentally protective intrinsic motivations. As such, this study provides preliminary evidence to support the use of microloan incentives to facilitate the adoption of climate change adaptation behaviours.

To further explore the intention-behaviour relationship we can turn to the literature on threat and coping appraisal. It is possible that the green incentive condition would have instigated threat appraisal by establishing a threat to future returns. The risks of income loss from non-adaptive investment would have outweighed the income gained via the adaptive option. The assessment of threat along with one's coping appraisal would establish one's investment decision. Coping appraisal consists of: a) response efficacy, or one's appraisal of the efficacy of the behaviour in removing threat, which in this case is represented by investment options; b) self-efficacy or one's ability to actually carry out the behaviour and lastly; c) response cost which is the assessment of the costs associated with carrying out your investment choice. As such following the introduction of the threat the green incentive condition could have also provided a reasonable solution to the threat. This is achieved by presenting a choice of investment options of which the more adaptive investment choices would have been the most desirable.

From a decision theoretic perspective, incentives should be designed such that when faced with several options with similar expected returns, the optimal choice should be that with the lowest expected outcome variance (Hodgson, Thomas, Whintle & Moilanen, 2009). Under the different incentive structures, it is reasonable to assume that one's investment decision would have yielded different cultural, monetary and reputational outcomes. In the no incentive and dynamic incentive conditions, with no prompting of environmental considerations, investment decisions would be weighted by risk taking behaviour, with monetary outcomes perhaps being the foremost focus to maximize utility of a choice. In contrast the framing of the green incentive condition would have elicited a different balance of monetary, cultural and reputational outcomes such that it could have guided ones optimal choice towards the adaptive investment option. Under prospect theory the framing of a problem would impact the heuristics people employ in subsequent decision making. Tversky and Kahneman (1981) have shown that how we present choice-problems can significantly impact outcomes. Framing the same decision problem in different ways can elicit very different responses. In the current study by drawing attention to the environmental impact of one's investment decision in the green incentive conditions could have influenced subsequent decisions.

The 'framing effect' has also been shown to be susceptible to emotional stimuli (Mano, 1994; Druckmann & McDermot, 2008). Cognitive neuropsychological studies have found that the Amygdala, a key part of the brain associated with emotional responses, is active in mediating decision biases (Adolphs, 2010; De Martino, Kumara, Seymour & Dolan, 2006; Seymour & Dolan, 2008; Dolan, 2007). The survey which preceded the choice experiment may also have had an impact on decision making. The questions related to the TPB could have primed emotional responses to subsequent investment choices.

It was also found that being of Fijian descent had a significant effect on outcomes and intrinsic motivations regardless of incentive type. Fijians had a higher probability of having positive attitudes, subjective norms and perceived behavioural control. In addition they had greater probability of choosing the more adaptive over non-adaptive investments. Looking back at threat appraisal, for Fijians the land and sea are deeply entwined into people's sense of personal and cultural identity as evident in concepts like Vanua. The latter refers to the intimate relationship people have with the land and sea (Crosby, 2002; Bricker & Kerstetter, 2006) which very much takes on a more holistic 'community of beings' worldview (Gadgil & Berkes, 1991). Here, humans are not seen to have dominion over the land, the sea and the species which populate it, but are seen as inextricably linked. Perhaps, it is this intimate relationship that draws Fijians towards adaptive investments when given the opportunity as it poses the least threat to their cultural identity. The elicitation of emotional responses through concepts such as Vanua could also incline people to adaptive investment options as it would enable them to protect their heritage. That Fijian's were more inclined to opt for adaptive investments may be promising in generalising green incentives to other SIDS, especially in Polynesian islands and their outliers where similar folklores and associations with the land and sea exist (Thaman, 1994).

We found that subjective norms were influenced positively by farm and fishing related occupations, whilst the effect was not as strong for perceived behavioural control and attitudes towards conservation. The effect of occupation on subjective norms is not surprising. Subjective norms after all consist of our perceptions of referent others beliefs regarding specific behaviour. As farmers and fishers are reliant on the land and sea for their livelihoods they can be expected to be more aware of climatic changes, and thus have more vocal opinions on how to behave in the face of such changes. That these groups believed it was important to protect their ecosystems is promising for conservation in Fiji and is evident in their traditional practices (Nainoca, 2011). We also found the probability of adaptive over non-adaptive investments was greater for farmers and fisher folk in the dynamic and green incentive conditions. For these groups, the least costly choice would have been the adaptive option, as it provides the opportunity to safeguard against the potential loss of income in the immediate future and protects livelihoods in the long-run.

Indo-Fijian's formed the majority of the remaining ethnicity group. They were less likely to choose the adaptive investment regardless of loan condition. Looking at agricultural livelihoods in Fiji, Indo-Fijians predominantly are sugarcane farmers who work on leased lands (Narayan & Prasad, 2003). For this group perhaps the nature of land as lease-hold gives them less of an incentive to conserve the resource and more of an incentive to seek profit maximisation wherever possible. Regardless of occupation, in Fiji using marine and land resources often requires permission from the indigenous landowner (Trnka, 2005) which could influence their perception of responsibility for future upkeep of the resource. In addition, whilst Fijians live in village communities, Indo-Fijians often live in extended families. In the former it may be that responsibility for a resource is shared amongst the community and may go beyond financial concerns whilst in the latter it may be that the locus of responsibility is predominantly focused on the needs of the family system.

We found that females and clan chiefs had a higher probability of positive perceptions of behavioural control. In Fiji women are very involved in the management of natural resources and have a rich tapestry of traditional ecological knowledge which may influence their control perceptions. Similarly for clan chiefs, as stewards of the land and sea, their ability to control resource use in their qoli qoli and land are reflected in their positive perceptions of behavioural control. Interestingly however when presented with a green incentive chiefs had a negative correlation to stated adaptive behaviour – such that the probability of choosing non-adaptive portfolios was greater than for adaptive. For women, under the green incentive condition the probability of choosing adaptive portfolios whilst not significant was the strongest predictor of behaviour, with the probability of choosing adaptive loans being 0.771. This may suggest that targeting women to take up adaptive investment behaviours through green incentives could be beneficial.

When looking at the frequency distributions of investment choice, we found that adaptive investments were chosen most often regardless of incentive type and lending model. The decision model that was offered to participants could be seen as decision making under risk (Damghani, Taghavifard, Moghaddam 2009). This implies that there is a level of uncertainty present and an inability to entirely control outcomes of one's investment choice. The element of risk introduced in the experiment was climate. The climate variable impacted investment returns. In the no incentive condition, the riskier mixed and non-adaptive investments would have yielded greater returns more often. Looking at the simplest form of decision making under risk – which assumes rationality, we would expect respondents to have used the information at hand to assign subjective probabilities to each investment choice under each climate event. It is assumed that a respondent would accept that investment which would maximise expected payoff – in this case the mixed loan.

That the adaptive investment was chosen most often across all conditions does raise the concern of response bias. It could be assumed respondents chose the adaptive loan as they were primed to answer in an environmentally responsible manner considering that the survey preceded the experiment. Whilst response bias is always a threat, an alternative explanation is that adaptive loans, which provide the opportunity to conserve ecosystems (most directly through the provision of mangrove seedlings) and protect livelihoods, incorporate other values. As such the choice of adaptive loans would go beyond monetary profit making decision rules and elicit a wider set of rules that are non-pecuniary in nature. Moral reasoning is also a consideration. With the possibility of the adaptive loans, our conception of the difference between right and wrong, and our understandings of justice may be engaged. As Kristiansen and Hotte (1996) state, "for moral actions, the nature of the self and the moral issue affect the process of moral reasoning and thereby value-attitude behaviour relations" (p.77). With strong cultural ties to the land and sea Pacific Islander's may have a stronger moral connection to the natural world.

Considering this, the choice of adaptive loans across all conditions could also indicate a protective mechanism against cognitive dissonance. Cognitive dissonance describes the cognitive discord which arises through holding two or more conflicting beliefs. According to Festinger (1962) we strive to minimise disharmony which arises through holding conflicting attitudes and beliefs as it leads to psychological discomfort. Therefore those who were less inclined to taking risks and/or more inclined to environmentally protective behaviours, perhaps because of cultural norms, would have been more attracted to adaptive loans regardless of the loan condition.

Whilst under prospect theory, the choice of adaptive loans could also be an indication of future profit maximisation and present loss aversion. This is in essence supporting the view that indigenous people, and in particular pacific islanders, are 'natural conservationists'. For their societies to survive, small indigenous communities with a reliance on natural resources would have developed a culture of conservation as a measure to avoid loss (Johannes, 2002). This is evident in their traditional practices, most perceptibly in those practices related to marine conservation. Further commenting on loss aversion, the sampled population were largely represented by the poor. For such a population Kahneman and

Tversky (1986) found that losses are weighted in a different manner, with all existing choices being between losses. The least costly choice is thus the most attractive. A good example of loss aversion can be seen in our finding that Fijians had a higher probability of choosing adaptive investments over non-adaptive across conditions whilst also displaying a greater positive affiliation with the natural world. For Fijians the adaptive choice would be the most attractive regardless of condition because in the long run it would be the least costly, protecting their cultural heritage and future yields whilst also reducing any stress that may arise through cognitive dissonance. In essence for this population adaptive loans may be seen as a self-protective mechanism (Li, Kenrick & Neuberg, 2012).

A current microloan increased the probability of adaptive portfolios in the absence of incentives. Whilst under dynamic incentives access to microcredit had the opposite effect. This positive effect of a current microloan on adaptive investment choice could indicate that being in receipt of a current microloan gave people the confidence to engage in investments which take into account their future income and livelihood security over short-term coping strategies. This may be supported by a study by Mosley (2001) which looked at a small sample of rural and urban microfinance institutions in Bolivia. Overall, he found that the microfinance institutions had a positive impact on income and asset levels with poor households opting for low-risk, low-return assets which delivered longer term income security.

That access to microcredit increased the probability of choosing moderately non-adaptive investment portfolios only under the dynamic incentive condition would benefit from further investigation. It may be that access to credit can help to insulate consumption patterns from income variability from shocks by allowing households to take on more risky but profitable activities as was the case in the dynamic incentive condition (Hulme & Rutherford, 2002). Within individual lending models, dynamic incentives have been shown to increase risky behaviour. Wydick (2010) found that such behaviour could be mitigated through group lending. As such a future direction could be to further investigate the incentive conditions under a properly designed joint-lending experiment.

Another important finding which links back to the previous chapter is that in the absence of information (the control treatment), the probability of non-adaptive investments was greater. This was only true though for the green and dynamic incentive conditions. It may be that these incentive structures presented a more cognitively demanding decision process. In order to simplify the decision process using the available information on returns could have weighted the non-adaptive investments as more attractive. When presented with information on climate change, the respondent's judgement of utility is repositioned by attention weights. Assuming that beliefs have intrinsic value, Golman and Lowenstein (2015) show, information can shift focus of attention and thus preference for certain choices. They show how attention weights can specify how much a person is thinking about particular beliefs and, in turn, how much those beliefs directly impact utility. This also harkens back to Bénabou and Tirole (2003b) and the notion that imperfect-information regarding one's own ability can be a factor in deciding whether to pursue a task with short-term costs and long-run payoffs.

Overall, the finding that green incentive condition did induce people to take up adaptive investments more so then other loan conditions is promising. The adoption of adaptive technologies and behaviours which protect ecosystems were incentivized by converting the loan into a partial grant. This is similar to Wetlands International's 'Bio-Rights' model (Kaiser, Hübner, & Bogner 2005) however it differs in key ways. Firstly the loans can be made to individuals over groups, secondly it does not require complete buy in from the community, and thirdly it is not limited by enforceable property rights. In collectivist communities with strong subjective norms like those in Fiji (Van Deusen, 2009; Nainoca, 2011), the adoption of green loans by one member within a village may be sufficient in driving others to do the same. Indeed in communities with a strong established desire towards conservation (as perhaps indicated in Fiji with concepts such as Vanua and the widespread use of locally managed marine protected areas (Veitayaki, 2000)) microloans with green incentives are useful in getting people started with adaptive measures.

To conclude, the case study of Viti-Levu highlights the dynamics present in the uptake of green microloans. It is the first study to look at cognitive drivers of microloan uptake in a field setting. We found that cognitive drivers are correlated with behavioural adoption which is bolstered further by incentive schemes. For Governments and conservation agencies' alike, this finding can help better devise lending conditions and adaptation initiatives. Merging environmental conditions into lending portfolios can be a cost effective way of reaching conservation and development targets in conjunction. The randomised control field experiment was instigated to generate a model for green microloans. Through replicating the study in different contexts we can better assess its generalisability. However in the SIDS context in particular it is assumed the findings will hold as these microstates share a similarity in regards to their geospatial, socio-political, and economic characteristics as well as their connection to the ecosystems which they inhabit.

Adding to the limitations from the previous chapter, the survey experiment suffered from a major failing – that of ordered effects. The study failed to randomly rotate the incentive conditions. People were presented with the no incentive condition, when they had made their investment selections under that condition, they were presented with the dynamic incentive followed by the green incentive conditions. Subsequent analysis could mitigate this by rotating conditions. However Auspurg and Jackle (2012) show that there is variability on the presence of ordered effects in choice experiments, with some showing strong effects through fixed designs.

An additional limitation is that of learning effects. By presenting people with two loan periods under each condition, they were able to learn from their first investment decision and use that to inform the next. However this could have been potentially mitigated by the presence of the random weather variable. This ensured that respondents were unaware of the returns they would get in each loan period.

Lastly the design of the incentive conditions makes it unclear as to what component of the green incentive is attributed to the uptake of adaptive investments. It could have been a) the information provided on the impact of investments on the ecosystem, b) the positive reinforcer of the partial grant for adaptive investments, c) the negative reinforce of higher interest rates for mixed and non-adaptive investments, d) or a mixture of all of these components.

The solution would have been to deign three more incentives which teased apart points *a* through to *c* which would have allowed for a control against the confounding effect of the combined incentive structures represented in the green incentive condition.

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[89] Catching mudcrubs in the urban mangroves of Suva

10.1 ABSTRACT

A multinomial logit model was used as a comparison to the path analysis in the previous chapter. The multinomial logit revealed that being Fijian, having a current microloan, and a point increase in perceived behavioural control increased the probability of choosing adaptive investment options whilst being in the control treatment had the opposite effect. This complements our findings from the path Analysis. We also found that behavioural intention predicted stated behaviour only in certain choice categories across all conditions. Specifically it was associated with lower probability of choosing moderately non-adaptive investments in the Dynamic and Green incentive conditions and increased the probability of choosing the mixed investment under the no incentive condition. The multinomial logit also revealed that farmers and fisher folk were more likely to choose moderately adaptive investments in the green incentive condition. Whilst path analysis has its limitations, the ability to simultaneously run equations to assess model fit, and its flexibility with complex models with causal structures makes it the preferred empirical method for this thesis, however multinomial logit can be a complementary method enhancing our understanding of the data.

10.2 MEDIATION ANALYSIS

The purpose of this chapter is two-fold:

- To question the current choice of our empirical model - namely mediation analysis
- To add to knowledge of first and second generation multivariate analysis methods by comparing the multinomial logit with path analysis.

The Structural Equation Modelling family of methods has gained prominence in some disciplines, allowing the flexibility of testing complex and often non-normal data through a set of indirect and direct relationships. These second generation multivariate techniques were developed as theory confirming analyses (Guarino, 2004). An alternative method to investigate categorical outcomes is multinomial logit regression. This extends binary regression to allow for more than two categories in the dependent variable. It is also flexible in that it does not assume normality, linerality, or homoscedasticity of the data.

Path Analysis sits within Structural Equation Modelling. Determining only the structural component of the causal model via observed variables. Whilst such modelling is growing in popularity in disciplines such as psychology and management, it is still approached with caution in others. The type of analysis proves attractive within these disciplines as it enables us to test more complicated models which are unable to be represented by multivariate and linear regression (Byrne, 2012). These second generation multivariate analysis methods are an extension of the multi-variables family of regression. It tests model fit by comparing the covariance structure fit of the specified model to a best possible fit covariance structure, and allows for the simultaneous analysis of variables and measurement errors not aggregated in a residual error term (Gefen, Straub & Boudreau, 2000). McDonald and Ho (2002) distinguish path equations from regression equations as by saying that the latter "are essentially predictive and correspond to conditioning on observations of explanatory variables without manipulation—actual or theoretical… residuals in a linear regression equation are uncorrelated with the independent variables by definition. The disturbances (unexplained variations) in a path equation can be correlated with the causal variables in that equation." (p.66).

Whilst mediation analysis is attractive, it is not without its critics. With such methods there can be a tendency to wrongly infer causality (MacCallum & Austin, 2000), however this can only be shown through a true experimental method (such as a randomised control trial). In addition, one of the tenets of Structural Equation Modelling is to build your model on substantive theory, this a priori imposition of structure has been questioned with some suggesting that imposing structure does not automatically make the model sensible (Davcik, 2014). If there is little theory on which to build ones model then other methods such as nonstructural or descriptive econometric models may be more appropriate.

10.3 THE RANDOM UTILITY MODEL

The random utility discrete choice model utilises the principle that a decision-maker will choose that outcome which maximises their utility. We can say: decision maker *i* can choose from a set of mutually exclusive alternatives, j=1,...J.

The decision maker will obtain a degree of utility from each alternative. Whilst we cannot observe utility gain we can observe some attributes from the alternatives. The utility can be expressed by a deterministic V_{ij} and random ε_{ij} component. As ε_{ij} is an unobserved term, we are unable to exactly predict choice – instead we can say that the probability of an outcome is derived.

We can express Utility as:

EQUATION 10-1

$$U_{ij} = V_{ij} + \varepsilon_{ij}$$

Utilising the framework of the multinomial logit regression we can model the probability if discrete outcomes. This method can enable us to measure the extent to which changes in the values of the independent variables will increase or decrease the probability of the event outcome – which in our case is respondent's investment choice. As with the structural equation modelling family of methods, multinomial logistic regression is considered an attractive analysis method for categorical data as it relaxes the assumptions of normality, linearity, and homoscedasticity.

10.3.1 EMPIRICAL METHOD

Multinomial Logit was carried out using STATA 13. Survey data was specified with the analysis clustered at the village level. With a Maximum Likelihood Multinomial Logit Model, the nature of the survey data (which specifies sampling weights) makes it difficult to test goodness-of-fit with typical measures such as the pseudo-R^2 as the assumption that observations are independently and identically distributed is not met. An F-statistic however is given as a test of the null hypothesis – that all the slope parameters are jointly equal to zero. A significant F-statistic tells us that the relationship between the regressors and our dependent variable are significant and that we can reject the null hypothesis.

So to look at the direct effects of the predictors on the outcome variable of investment choice by incentive type, the multinomial logit regression model for categorical outcomes can be specified as follows:

EQUATION 10-2

$$P_{ij} = \frac{e^{\beta'{}_j x_{ij}}}{\sum_{J=1}^{q} e^{\beta'{}_j x_{ij}}}, for\ j = 1,2, \dots, q$$

This study introduced the incentive choice of respondents Yi into the framework of the equation above. We defined investment choice for the *j* for the *ith* respondent as:

$$Y_i = \begin{cases} 1 & Adaptive \\ 2 & Moderately\ Adaptive \\ 3 & Mixed \\ 4 & Moderately\ Non-Adaptive \\ 5 & Non-Adaptive \end{cases} \Bigg\}$$

One category was normalised in order to estimate the multinomial logit model. This category represents the reference state. The reference state in this approach is category 1: the choice of a purely adaptive portfolio. The normalised model is given by:

EQUATION 10-3

$$\Pr\left(Y_i = 1\right) = P_{ij} = \frac{1}{1 + \sum_{J=1}^{q} e^{\beta' j^{x\, ij}}}, for\ j = 1$$

Here the alternative outcomes are represented by j. i denotes the individual, β is the vector parameter, x_{ij} is the vector of explanatory variables.

The X explanatory variables consist of the direct mediators of behaviour (behavioural intention and perceived behavioural control) and the following factors: gender, ethnicity, income, occupation, prior microcredit participation, and current microloan. In order to interpret the results marginal effects were also estimated through the predicted probabilities of the categorical outcomes. The equation for marginal effects is given by:

EQUATION 10-4

$$\frac{\partial P_{ij}}{\partial x_i} = p_{ij}\left[\beta_j - \sum_{J=3}^{q} p \quad {}_j\beta_j\right] = p_{ij}\left(\beta_j - \bar{\beta}\right)$$

Where $\bar{\beta}$ is the probability weighted average of the β_j. The log likelihood estimation to examine the probability of categorical membership is given by:

EQUATION 10-5

$$In\ L = \sum_{i=l}^{N} \quad \sum_{i=0}^{q} \quad n_j\ In\ P_{ij}$$

Here n_j is the number of individuals who choose an outcome j.

The multinomial logit was repeated for the different incentive conditions – namely, no incentive, dynamic incentive, and green incentive.

Another multinomial logit model was specified for behavioural intention. Using the same set of equations, the behavioural intention choice set was defined as:

$$Yi = \begin{Bmatrix} 1 & Negative \\ 2 & Moderate \\ 3 & Positive \end{Bmatrix}$$

With X explanatory variables consisting of attitudes towards conservation, subjective norms, and perceived behavioural control.

10.4 RESULTS

The ensuing results are in line with the Independence from Irrelevant Alternatives (IIA) hypothesis that is implicitly assumed at the outset of the estimating model. The IIA assumption was checked by running the Hausman-McFadden test. The associated test-statistic is distributed as a χ^2, and was found to be not significant. Following Hausman and MacFadden (1984), we take this as evidence in favour of the null hypothesis of equality of parameters, suggesting that the IIA holds and, ultimately, that the multinomial logit model is unbiased. The F-statistic was significant across all multinomial logit models (*Moderators of Intention*: F(6, 183)=9.72, p>F=0; Hausman χ^2 (3)=0.17, p=0.983; *No incentive*: F(40, 149)=9.09, p<0.001; Hausman χ^2 (10)=0.11, p=1; *Dynamic incentive*: F(40, 149)=10.01, p<0.001; Hausman χ^2 (10)=0.02, p=1; *Green incentive*: F(40, 149)=2.35, p<0.001; Hausman χ^2 (10)=0.12, p=1, telling us that we can reject the null hypothesis that all the slope parameters are jointly equal to zero.

When looking at stated behaviour, in general the marginal effects were quite small, with probabilities below 10% for the most part. However ethnicity was found to be the most significant predictor of stated behaviour.

10.4.1 ANTECEDENTS OF BEHAVIOURAL INTENTION

To start we looked at the relationship between the constructs of the Theory of Planned Behaviour and behavioural intention. As hypothesised and consistent with the path model we found that the probability of positive behavioural intention increased with a one point increase in attitudes, subjective norms, and perceived behavioural control by 0.067, 0.139, and 0.140 respectively.

TABLE 10-1: MARGINAL EFFECTS OF INDEPENDENT VARIABLES ON BEHAVIOURAL INTENTION

Behavioural Intention		ME	S.E	z	p	
Negative	Attitudes Towards Conservation	-0.017	0.013	-1.330	0.183	
	Subjective Norms	-0.015	0.014	-1.140	0.254	
	Perceived Behavioural Control	-0.002	0.009	-0.160	0.871	
Moderate	Attitudes Towards Conservation	-0.049	0.040	-1.230	0.219	
	Subjective Norms	-0.123	0.042	-2.930	0.003	**
	Perceived Behavioural Control	-0.139	0.043	-3.250	0.001	***
Positive	Attitudes Towards Conservation	0.066	0.039	1.700	0.089	*
	Subjective Norms	0.139	0.041	3.360	0.001	***
	Perceived Behavioural Control	0.140	0.042	3.350	0.001	***

ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001

10.4.2 ADAPTIVE PORTFOLIO

Holding everything else constant, in the *no incentive condition*, the conditional probability of choosing an adaptive portfolio in the control treatment significantly decreased by 0.128, whilst access to credit significantly increased the probability of choosing this portfolio by 0.271.

TABLE 10-2: MARGINAL EFFECTS - ADAPTIVE PORTFOLIO UNDER THE NO INCENTIVE CONDITION

Adaptive	ME	S.E	z	P	
Behavioural Intention	-0.072	0.070	-1.020	0.309	
Perceived Behavioural Control	0.022	0.056	0.400	0.690	
Control Group	-0.128	0.063	-2.040	0.042	**
Farmer/Fisher	0.107	0.075	1.420	0.156	
Female	-0.013	0.065	-0.200	0.839	
Fijian	0.143	0.088	1.630	0.104	
Chief	-0.023	0.119	-0.190	0.846	
Y<F$10	0.041	0.064	0.640	0.521	
Access to Credit	0.271	0.066	4.110	0.000	***
Current Microloan	-0.006	0.030	-0.190	0.848	
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

In the *dynamic incentive condition* the probability of choosing an adaptive portfolio increased by 0.235 for Fijians and by 0.109 if one had access to microcredit. The control treatment significantly decreased the probability of choosing an adaptive investment portfolio by 0.142 as did having a current microloan by 0.108.

TABLE 10-3: MARGINAL EFFECTS - ADAPTIVE PORTFOLIO UNDER THE DYNAMIC INCENTIVE CONDITION

Adaptive	ME	S.E	z	P	
Behavioural Intention	0.061	0.076	0.800	0.423	
Perceived Behavioural Control	0.003	0.042	0.060	0.952	
Control Group	-0.142	0.050	-2.850	0.004	**
Farmer/Fisher	0.026	0.069	0.380	0.705	
Female	0.050	0.051	0.980	0.327	
Fijian	0.235	0.048	4.890	0.000	*
Chief	0.050	0.106	0.470	0.636	
Y<F$10	-0.046	0.050	-0.920	0.355	
Access to Credit	0.109	0.060	1.830	0.068	*
Current Microloan	-0.108	0.050	-2.180	0.029	
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

We see that in *the green incentive condition*, being in the control treatment significantly decreased the conditional probability of an adaptive portfolio by 0.182 whilst being Fijian increased the probability of choosing an adaptive portfolio by 0.524.

TABLE 10-4: MARGINAL EFFECTS - ADAPTIVE PORTFOLIO UNDER THE GREEN INCENTIVE CONDITION

Adaptive	ME	S.E	z	P	
Behavioural Intention	0.072	0.068	1.060	0.290	
Perceived Behavioural Control	-0.042	0.051	-0.820	0.410	
Control Group	-0.182	0.061	-3.000	0.003	**
Farmer/Fisher	-0.103	0.076	-1.360	0.173	
Female	0.091	0.063	1.450	0.148	
Fijian	0.524	0.057	9.270	0.000	***
Chief	-0.048	0.124	-0.390	0.700	
Y<F$10	-0.018	0.061	-0.300	0.768	
Access to Credit	0.115	0.078	1.480	0.139	
Current Microloan	-0.031	0.039	-0.790	0.427	
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

10.4.3 MODERATELY ADAPTIVE PORTFOLIO

In the *no incentive condition*, being Fijian increased the probability of this choice by 0.308.

TABLE 10-5: MARGINAL EFFECTS - MODERATELY-ADAPTIVE PORTFOLIO UNDER THE NO INCENTIVE CONDITION

Moderately Adaptive	ME	S.E	z	P	
Behavioural Intention	-0.007	0.073	-0.090	0.926	
Perceived Behavioural Control	0.012	0.053	0.230	0.819	
Control Group	0.060	0.067	0.900	0.370	
Farmer/Fisher	-0.127	0.087	-1.470	0.142	
Female	0.011	0.066	0.160	0.874	
Fijian	0.308	0.057	5.390	0.000	**
Chief	0.188	0.130	1.440	0.149	
Y<F$10	0.055	0.067	0.820	0.413	
Access to Credit	-0.013	0.076	-0.170	0.862	
Current Microloan	-0.040	0.038	-1.050	0.295	
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

In the *dynamic incentive condition*, the control treatment significantly decreased the choice of the moderately adaptive portfolio by 0.110 whilst being Fijian increased the choice by 0.329.

TABLE 10-6: MARGINAL EFFECTS - MODERATELY-ADAPTIVE PORTFOLIO UNDER THE DYNAMIC INCENTIVE CONDITION

Moderately Adaptive	ME	S.E	z	P	
Behavioural Intention	0.032	0.071	0.450	0.655	
Perceived Behavioural Control	-0.038	0.056	-0.690	0.492	
Control Group	-0.110	0.061	-1.810	0.070	*
Farmer/Fisher	0.045	0.085	0.530	0.594	
Female	0.005	0.064	0.070	0.942	
Fijian	0.329	0.055	5.990	0.000	*
Chief	-0.101	0.104	-0.980	0.329	
Y<F$10	-0.018	0.063	-0.280	0.776	
Access to Credit	-0.098	0.071	-1.390	0.165	
Current Microloan	0.062	0.037	1.680	0.093	*

ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001

In the *green incentive condition*, occupation as a farmer or fisher increased the choice of moderately adaptive portfolio by a probability of 0.121, and being a chief significantly decreased by 0.188.

TABLE 10-7: MARGINAL EFFECTS - MODERATELY-ADAPTIVE PORTFOLIO UNDER THE GREEN INCENTIVE CONDITION

Moderately Adaptive	ME	S.E	z	P	
Behavioural Intention	0.038	0.069	0.540	0.588	
Perceived Behavioural Control	0.043	0.054	0.800	0.423	
Control Group	0.028	0.064	0.440	0.662	
Farmer/Fisher	0.132	0.068	1.930	0.053	*
Female	-0.061	0.063	-0.980	0.327	
Fijian	0.062	0.082	0.760	0.449	
Chief	-0.188	0.075	-2.500	0.012	*
Y<F$10	-0.008	0.063	-0.120	0.905	
Access to Credit	-0.039	0.074	-0.520	0.601	
Current Microloan	-0.002	0.042	-0.050	0.960	

ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001

In the *no incentive condition*, as behavioural intention increased, the probability of choosing the mixed portfolio increased by 0.125. Whilst access to microcredit decreased the probability of this choice by 0.143.

TABLE 10-8: MARGINAL EFFECTS - MIXED PORTFOLIO UNDER THE NO INCENTIVE CONDITION

Mixed	ME	S.E	z	P	
Behavioural Intention	0.125	0.069	1.800	0.071	*
Perceived Behavioural Control	0.008	0.051	0.160	0.875	
Control Group	0.062	0.052	1.190	0.233	
Farmer/Fisher	-0.057	0.077	-0.740	0.457	
Female	-0.051	0.052	-0.980	0.326	
Fijian	0.037	0.085	0.430	0.665	
Chief	-0.086	0.075	-1.140	0.252	
Y<F$10	-0.074	0.055	-1.360	0.175	
Access to Credit	-0.143	0.076	-1.870	0.061	*
Current Microloan	0.021	0.031	0.680	0.499	
ME=Marginal Effects; p=0.9705; p<0.10*, p<0.05**, p<0.001					

In the *dynamic incentive condition*, being in the control treatment increased the probability of choosing this portfolio by 0.145.

TABLE 10-9: MARGINAL EFFECTS - MIXED PORTFOLIO UNDER THE DYNAMIC INCENTIVE CONDITION

Mixed	ME	S.E	z	P	
Behavioural Intention	-0.005	0.074	-0.070	0.947	
Perceived Behavioural Control	-0.016	0.062	-0.260	0.795	
Control Group	0.145	0.059	2.440	0.015	**
Farmer/Fisher	-0.040	0.076	-0.530	0.596	
Female	-0.061	0.062	-0.980	0.325	
Fijian	0.007	0.080	0.090	0.931	
Chief	0.098	0.132	0.740	0.460	
Y<F$10	0.069	0.063	1.100	0.270	
Access to Credit	0.062	0.070	0.880	0.379	
Current Microloan	0.033	0.038	0.870	0.382	
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

In the *green incentive condition*, there was no significant effect of the treatment group however a one unit increase in behavioural intention decreased the probability of choosing the same portfolio by 0.079.

TABLE 10-10: MARGINAL EFFECTS - MIXED PORTFOLIO UNDER THE GREEN INCENTIVE CONDITION

Mixed	ME	S.E	z	P	
Behavioural Intention	-0.079	0.046	-1.700	0.089	*
Perceived Behavioural Control	0.032	0.044	0.730	0.468	
Control Group	-0.001	0.045	-0.020	0.980	
Farmer/Fisher	0.015	0.047	0.310	0.753	
Female	-0.042	0.041	-1.030	0.303	
Fijian	-0.085	0.067	-1.270	0.206	
Chief	0.185	0.128	1.440	0.149	
Y<F$10	-0.052	0.044	-1.180	0.239	
Access to Credit	-0.044	0.057	-0.780	0.436	
Current Microloan	-0.033	0.025	-1.290	0.198	
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

10.4.5 MODERATELY NON-ADAPTIVE PORTFOLIO

In the *no incentive condition*, being Fijian significantly decreased the probability of choosing the moderately non-adaptive portfolio by 0.363.

TABLE 10-11: MARGINAL EFFECTS - MODERATELY NON-ADAPTIVE PORTFOLIO UNDER THE NO INCENTIVE CONDITION

Moderately Non-Adaptive	ME	S.E	z	P	
Behavioural Intention	-0.055	0.047	-1.160	0.244	
Perceived Behavioural Control	-0.015	0.049	-0.310	0.758	
Control Group	0.011	0.051	0.220	0.823	
Farmer/Fisher	0.060	0.047	1.280	0.199	
Female	0.041	0.049	0.830	0.409	
Fijian	-0.363	0.132	-2.760	0.006	***
Chief	-0.058	0.113	-0.520	0.606	
Y<F$10	-0.043	0.053	-0.800	0.425	
Access to Credit	-0.063	0.067	-0.950	0.343	
Current Microloan	0.026	0.026	0.990	0.324	
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

In the *dynamic incentive condition*, a one unit increase in behavioural intention, and being Fijian decreased the probability of choosing this portfolio by 0.152, and 0.430 respectively. Whilst being in the control treatment, and having a current microloan significantly increased the probability of choosing this portfolio by 0.144, and 0.060

respectively – though the marginal effect was quite weak in the latter. Perceived behavioural control increased the probability of moderately non-adaptive portfolio by 0.116.

TABLE 10-12: MARGINAL EFFECTS - MODERATELY NON-ADAPTIVE PORTFOLIO UNDER THE DYNAMIC INCENTIVE CONDITION

Moderately Non-Adaptive	ME	S.E	z	P	
Behavioural Intention	-0.152	0.056	-2.740	0.006	**
Perceived Behavioural Control	0.116	0.049	2.370	0.018	
Control Group	0.144	0.053	2.730	0.006	**
Farmer/Fisher	-0.048	0.080	-0.610	0.545	
Female	-0.003	0.055	-0.060	0.950	
Fijian	-0.430	0.087	-4.950	0.000	***
Chief	0.013	0.097	0.130	0.895	
Y<F$10	-0.029	0.055	-0.530	0.596	
Access to Credit	-0.092	0.069	-1.320	0.186	
Current Microloan	0.060	0.026	2.280	0.023	**
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

In the *green incentive condition*, as behavioural intention increased the probability of choosing moderately non-adaptive portfolio significantly decreased by 0.084, similarly being Fijian decreased the probability of the same portfolio by 0.422 whilst being in the control treatment, and to a lesser extent earning less than $10 a day, and having a current microloan increased the probability of choosing this portfolio by 0.110, 0.075, and 0.048 respectively.

TABLE 10-13: MARGINAL EFFECTS - MODERATELY NON-ADAPTIVE PORTFOLIO UNDER THE GREEN INCENTIVE CONDITION

Moderately Non-Adaptive	ME	S.E	z	P	
Behavioural Intention	-0.084	0.031	-2.660	0.008	**
Perceived Behavioural Control	0.042	0.032	1.280	0.200	
Control Group	0.110	0.043	2.570	0.010	**
Farmer/Fisher	-0.007	0.047	-0.140	0.888	
Female	-0.029	0.043	-0.690	0.491	
Fijian	-0.422	0.085	-4.960	0.000	***
Chief	-0.107	0.044	-2.440	0.015	
Y<F$10	0.075	0.041	1.820	0.068	*
Access to Credit	0.024	0.040	0.600	0.548	
Current Microloan	0.048	0.013	3.780	0.000	***
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

10.4.6 NON-ADAPTIVE PORTFOLIO

In the *no incentive condition*, as perceptions of behavioural control increased the probability of choosing this portfolio decreased by 0.027. Similarly being Fijian led to a decrease in choosing this portfolio by 0.021.

TABLE 10-14: MARGINAL EFFECTS - NON-ADAPTIVE PORTFOLIO UNDER THE NO INCENTIVE CONDITION

Non-Adaptive	ME	S.E	z	P	
Behavioural Intention	0.008	0.015	0.520	0.605	
Perceived Behavioural Control	-0.027	0.012	-2.360	0.018	**
Control Group	-0.006	0.022	-0.280	0.776	
Farmer/Fisher	0.018	0.015	1.150	0.251	
Female	0.014	0.026	0.530	0.598	
Fijian	-0.021	0.009	-2.350	0.019	**
Chief	-0.183	0.144	-1.270	0.204	
Y<F$10	0.021	0.033	0.630	0.532	
Access to Credit	-0.052	0.037	-1.410	0.159	
Current Microloan	-0.001	0.002	-0.330	0.739	
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

In the *dynamic incentive condition*, having a current microloan significantly increased the choice of the non adaptive portfolio by 0.065. Whilst an increase in behavioural intention, perceived behavioural control, and being Fijian significantly decreased the likelihood of choosing this portfolio by 0.046, 0.064, and 0.149 respectively.

TABLE 10-15: MARGINAL EFFECTS - NON-ADAPTIVE PORTFOLIO UNDER THE DYNAMIC INCENTIVE CONDITION

Non-Adaptive	ME	S.E	z	P	
Behavioural Intention	-0.046	0.027	-1.720	0.086	*
Perceived Behavioural Control	-0.064	0.030	-2.110	0.035	**
Control Group	-0.038	0.031	-1.200	0.231	
Farmer/Fisher	0.017	0.027	0.630	0.529	
Female	0.010	0.031	0.310	0.756	
Fijian	-0.140	0.050	-2.810	0.005	***
Chief	-0.059	0.014	-4.120	0.000	
Y<F$10	0.024	0.026	0.910	0.363	
Access to Credit	0.019	0.040	0.470	0.638	
Current Microloan	0.065	0.037	1.770	0.077	*
ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001					

In the *green incentive condition*, an increase in intention, and being Fijian significantly decreased the probability of choosing a non-adaptive portfolio by 0.074, and 0.079 respectively. Whilst a one unit increase in perceived behavioural control significantly increased the probability of this choice by 0.053

TABLE 10-16: MARGINAL EFFECTS - NON-ADAPTIVE PORTFOLIO UNDER THE GREEN INCENTIVE CONDITION

Non-Adaptive	ME	S.E	z	P	
Behavioural Intention	-0.074	0.039	-1.900	0.057	*
Perceived Behavioural Control	0.053	0.030	1.750	0.081	*
Control Group	0.045	0.027	1.690	0.092	
Farmer/Fisher	-0.037	0.035	-1.070	0.287	
Female	0.042	0.039	1.090	0.277	
Fijian	-0.079	0.046	-1.720	0.085	*
Chief	0.158	0.123	1.280	0.201	
Y<F$10	0.003	0.030	0.090	0.926	
Access to Credit	-0.056	0.034	-1.640	0.102	
Current Microloan	0.018	0.006	2.790	0.005	**

ME=Marginal Effects; p<0.10*, p<0.05**, p<0.001

10.5 DISCUSSION AND CONCLUDING REMARKS

It has been suggested that the piecemeal method of analyzing moderation and mediation by estimating separate multinomial logit models, cannot provide information on unique incremental relationships between a system of variables, nor can it reveal mediated effects (Edwards & Lambert, 2007). As Duncan (1966) argues, the contribution of path analysis over the conventional regression framework is that it provides a calculus for indirect effects which become evident through the explicit representation of a causal scheme. We cannot do a full comparison of results (for instance by comparing the difference in probabilities) as we would expect the multinomial logit and the path analysis to differ.

One reason why discrepancies in results between the two methods would arise is due to the types of estimators employed. In Mplus with categorical variables, weighted means and variance adjusted least square (WLSMV) estimator is employed. Asparouhov (2005) compared this estimator with and without the weights and found that there was a bias when the weights were omitted, showing substantial selection bias arises if the weights are not incorporated in the analysis. The estimator used in mutinomial logit is Maximum Likelihood (ML), Beauducel and Herzberg (2006) compared ML to WLSMV and found that the latter is better for smaller samples (*N*=250) and for outcomes with two or three categories. They note that the over rejection of correct models has been found for WLSMV estimation when based on variables with five and six categories and the same for ML estimation based on variables with five and six categories. Li (2014) also found that structural coefficients under ML outperformed WLSMV under symmetric data conditions but under asymmetric (as our study is) WLSMV was better and the robust standard errors of structural coefficients were also more precise.

In path analysis, once path coefficients are estimated they are used to calculate the reproduced correlations through path decomposition. This process of computing all the underlying correlations between variables (i.e. indirect and direct effects) and is used to assess how closely the specified model fits with the empirical data. Path analysis can add a causal relationship structure which multinomial logit cannot. It has been shown that there can be a substantial difference between the direct effect and the total effect including indirect effect (Ahn, 2002). In addition, another factor to consider is that the coefficients estimated by Mplus for categorical/nominal outcomes are probit rather than logit coefficients.

Lastly, in mediated models the correlations between variables is decomposed into their direct and indirect effects. If income directly affects investment choice and indirectly through its affect on attitudes then there will also be a correlation between perceived behavioural control and investment choice which will also reflect the influence of income on perceived behavioural control which enables you to account for spurious relationships.

However we did find similarities in both model predictions. We found that behavioural intention did play a role in subsequent stated behaviour for certain choice sets. Comparing the multinomial logit and the path analysis from the previous chapter we find the direction of effect to be similar when examining the antecedents of behavioural intention. Meaning positive attitudes, subjective norms and perceived behavioural control significantly predicted positive behavioural intention.

In addition we found that as intention increased it decreased probability of choosing the moderately non-adaptive portfolio under dynamic incentives and decreased the probability of mixed and non-adaptive portfolios in green incentive conditions. An increase in intention also increased the probability of choosing the mixed portfolio in the no incentive condition. Perceived behavioural control also was found to reduce the probability of choosing the non-adaptive portfolios across all but the green incentive condition for the choice of a non-adaptive portfolio. The results relating to intention, specifically across the green incentive condition are congruent with the path analysis and the hypothesis that incentives do not crowd-out internal drivers to act.

As we saw in the path analysis, not receiving climate change information (i.e being in the control treatment) increased the probability of choosing non-adaptive investment options, whilst across both models, being Fijian also increased the probability of choosing adaptive investments. Ethnicity was the strongest predictor of stated behaviour.

The multinomial logit was able to add to our understanding of the path analysis data. For example, looking at the impact of access to credit and being a current microcredit participant, in the path analysis under the dynamic and no incentive conditions, access to credit was positively correlated with more adaptive investments, whilst holding a current microloan was negatively correlated with more adaptive investments. Whilst we cannot compare the probabilities because of their different functional forms, we can see that the probabilities of choosing across the different investments share directionality.

One way to test these findings would be to execute the multinomial logit with the WLSMV estimator, which we went on to do (albeit a multinomial probit) and the results of which can be found in Appendix F. As Stata does not enable you to choose between estimators, this was done through MPlus where the WLSMV link with clustered data is a probit function. The results were less pronounced then the path analysis regarding the difference in probabilities across variables. We also found that the effect of intention on behaviour, which we previously saw in the green incentive condition as a mediated effect, was no longer evident as a significant mediator of stated behaviour. Under our theoretical model, it has been shown that intention alone is not a sufficient determinate of behaviour (Kiriakidis, 2015; Armitage & Conner, 2001). Thus path analysis would seem the more appropriate analysis method for this thesis as it allows us to simultaneously decompose parameters and get more unbiased coefficients and error terms which may arise from model misspecification (Swamy et al, 2010).

Whilst in the path analysis income was a significant predictor of stated behaviour in the dynamic incentive condition, increasing the probability of non-adaptive investment choices, that effect was found here for the green incentive condition for the moderately non-adaptive investment choice. In addition, in the multinomial logit we found that within the green incentive condition, occupation as a farmer or fisher increased the choice of the moderately adaptive portfolio. As this is our target population, this tells us that the green incentive condition was engaging farmers and fisher folk to take on more adaptive investments. Why this effect was not found in the path analysis requires further investigation as this can be a potentially useful finding for policymakers. The green incentive condition was allowing famers and fisher folk to take up the moderately adaptive strategy as the equilibrium outcome. Enabling these groups to take up adaptive strategies through microloans with green incentives in Small Island Developing States can contribute to food and livelihood security.

One of the benefits of multinomial logit is that it can tell us how the probability of an outcome significantly changes at each choice level. However by not considering the additive and multiplicative transitions in the variance and covariances of the variables the results may over or under-represent some effects (Alavifar, Karimimalayer & Anuar, 2012). In addition in the next chapter we opt for a more complex model as Schwab (2002) offers sample size guidelines for multinomial logistic regression as a minimum of 10 cases per independent variable, the small sample size of the data in this thesis means that the model specified utilising multinomial logit and varieties of structural equation modelling is limited in its complexity.

We justify the use of path analysis because of:

- Its flexibility with more complex models (can model multiple outcomes at once and can have levels of independent and dependent variables whereas this is not the case in multinomial logit you can have only a dependent variable and a set of independents)

- Model specification is based on theory and specifies relations a priori which suits the nature of this thesis, which test the established Theory of Planned Behaviour

- It is a multivariate technique. Parameter estimates and overall fit statistics are determined by solving multiple related equations simultaneously. For this thesis, where we are testing the theoretical framework of the theory of planned behaviour, the ability to determine how well the overall model and data match is main reason for choosing path analysis over multinomial logit. In the latter we can only assess fit in a piecemeal fashion.

- Path analysis also recognises the imperfect nature of measures by specifying residual error terms which reflects unexplained variance and measurement error of variables (Suhr, 2008).

- Path analysis is estimated using the Means and Variance Adjusted Weighted Least Squares Estimator which is more robust to non-normal data and small sample sizes.

- The graphical language of path analysis is a simple way to present complex relationships

Path analysis is by no means the perfect empirical method, it has its limitations in that it does not imply causality, and can have interpretation difficulties. In addition we are unable to assess the marginal effects of predictors on each level of the outcome variable as in multinomial logit. In addition Cole and Preacher (2014) argue that path analysis with fallible measures can lead to measurement error and the over or under-estimation of coefficients, though this is true for multinomial regression as well. As both strategies have their merits and failing, our understanding of the data is ameliorated by the use of both techniques.

10.6 REFERENCES

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11 THE EFFECT OF SHOCKS[90], RESOURCE DEEPENDENCE AND PERCEIVED SEVERITY ENVIRONMENTAL AND SOCIAL ISSUES ON THE INTERNAL DRIVERS OF BEHAVIOUR, AND STATED ADAPTIVE INVESTMENT BEHAVIOUR


[91]

[90] Perceived shocks and perceived threats are used interchangeably in this chapter.
[91] Pine forests in Nausori Highlands by a sugar cane plantation. The pine trees are blackened by soot from slash and burn agricultural practices.

11.1 ABSTRACT

Climate change adaptation is of vital importance for Small Island Developing States. To motivate uptake of climate adaptive investments, we must attempt to identify the broader set of motives which may drive the stated investment behaviour. Through the framework of the Theory of Planned Behaviour this study attempts to understand the moderators of behaviour by exploring resource dependence, perceived shocks, socio-demographic, and environmental and social issues which people may face. Using path analysis, it was found that perceived threats, and resource dependence could significantly impact cognitive antecedents of behaviour – negatively impacting perceived behavioural control in particular. Perceived severity and the aforementioned also moderated subsequent stated behaviour, with greater variability between between adaptive and non-adaptive investment choices under the no incentive and dynamic incentive conditions. The latter had a greater probablity of agents choosing non-adaptive over adaptive investments whilst in the former the opposite was true.

11.2 INTRODUCTION

The longevity and success of Homo sapiens sapiens over other hominin species can be told of as a story of successful biological and behavioural adaptation. In the relatively small space of time we have existed, we have faced drastic climatic events which have gone on to shape us, by enabling the evolution of behaviours to ensure our survival. This ability to adapt and to change the environment to meet our needs is also a cause for our current predicament. Anthropogenic climate change, associated with carbon emissions and land-use change, is distinct from natural climate variability, and can possibly be framed as the result of maladaptive behaviours. The ability of humanity to adapt is not in question. We have a long track record of successful attempts. Instead the question becomes how we can facilitate the most efficient adaptation to the current and future pressures of climate change.

In the preceding chapters, under the framework of the theory of planned behaviour, the possibility of risk and threat exposure impacting adaptive behaviour was discussed. This chapter examines this by looking at how resource dependence, exposure to global and local shocks, and perceived severity of environmental and other socio-economic issues impact the antecedents of behaviour and subsequent stated behaviour. The purpose of this study is to better understand the mediators and moderators of behaviour, and its antecedents, to identify some of the barriers that may arise in the adoption of stated climate change adaptive investments under different microloan incentive conditions by asking:

Are threat appraisal and resource dependence moderators of the cognitive antecedents of behaviour as specified by the Theory of Planned Behaviour?

- Where threat appraisal is defined as exposure to shocks - according to the Protection Motivation Theory when a threshold level of threat is experienced it instigates coping appraisal (or our efficacy to deal with the threat) which then mediates intention to act on the threat. In Fiji, with flooding and cyclones increasing in severity and frequency our alternative hypothesis is that schocks and resource dependence will impact the cognitive antecedents of behaviour.

Do global and local shock exposure, resource dependence, and the perceived severity of environmental and socio-political issues pose a barrier to the adoption of stated adaptive investment behaviour under different microloan incentive conditions?

- The response options available to people will form their coping response which will be reflected in their choice of investment portfolios as either maladative or adaptive investments.
- We hypothesis that the different incentive conditions will influence coping response. If people have positive internal motivations (which is reflected in behavioural intention), then we hypothesise that a) people will take on an adaptive coping response in congruence with their internal motivations when faced with shocks and perceived severity of issues and b) that this effect will be strongest under green incentives which will facilitate adaptive coping response.

To the best of the author's knowledge this is the first experimental study to look at exposure to shocks, perceived severity of environmental and socio-economic issues and the cognitive antecedents of stated adaptive investment behaviour. The study contributes to our understanding of the external (dependence on resources, climate and other risk exposure) and internal (attitudes, perceived behavioural control, subjective norms and perceived importance of environmental and social issues) factors that influence adaptive decisions. In doing so, it contributes to the literature on drivers of environmentally protective behaviour and how they affect the investment decisions of people living by or near fragile ecosystem through the case study of a Small Island Developing State (SIDS), namely the island of Viti-Levu in Fiji.

11.2.1 WIDER MODERATORS OF BEHAVIOUR

In the previous chapters we have explored the Theory of Planned Behaviour (TPB). Whilst we have found that our data has supported the theoretical model, it is by no means a perfect theory of behaviour. For one, to test it we must rely on self-reported measures of attitudes, subjective norms, perceived behavioural control, which can cast doubt on the conclusions you can draw. Secondly the TPB conjectures that internal factors (like attitudes) are most important. However external factors – such as climate and other socio-economic threats can be important too. The TPB cannot identify wider moderators or barriers which may influence subsequent behaviour. This can limit its real world utility (Ejeta, Ardalan, & Paton , 2014).

We wish to examine how some of these factors may moderate the constructs within the theory of planned behaviour and subsequent stated investment behaviour especially as studies have shown exposure to a disaster can influence subsequent behaviour. For instance personal physical exposure to natural disaster was shown to lead to a temporary decrease in observed risk aversion, especially for older adults and the poor, with the effect increasing with the severity of the event (Ingwersen, 2014). Whilst threats to livelihoods such as crop damage and livestock predation have been shown to negatively influence conservation attitudes as has resource dependence (Baral & Heinen, 2007; Mir, Noor, & Khan, 2015).

Chokor's (2004) investigation into environmental concerns and resource values of the rural poor living by the Niger Delta is one study which shows how important it is to understand the different moderating factors of common pool resource use in rural populations. He assessed perceptions of severity of environmental issues utilising a scale that has been adapted for the Fiji context in this study. He found that in acutely deprived, communities there was no sharp separation between the anthropocentric and ecocentric bases of people's environmental concerns and that with poor farmers the severity of issues could influence subsequent behaviour. For instance, he found that soil fertility losses, declining yields and land scarcity had led people to have less confidence in more traditional environmentally friendly processes. He found that these groups are environmentally rational however their lack of assets and resources meant that they were less able to embrace traditional environmental conservation measures.

11.2.2 THE PROTECTION MOTIVATION THEORY (PMT)

A competing theory to the TPB is that of Protection Motivation Theory (PMT). It is a particularly attractive model when looking at environmental behaviours because of its inclusion of two types of cognitive appraisals which we undergo in the face of environmental or interpersonal cues. These are threat and coping appraisal. Threat appraisal refers to one's assessment of the severity of threat presented and one's vulnerability to said threat. Threat appraisal can lead to fear appeal, or the affective state of fear (Maddux & Rogers, 1983). For example, for a person living in London, if we perceive the severity of the Ebola virus to be quite high but do not expect to be effected by this threat then levels of fear are also low and no steps may be taken in protecting oneself against infection. If however we lived in Sierra Leone, we may assess Ebola to be a severe threat and one that we are particularly vulnerable to. As one's level of fear increases, it may prompt a greater protective mechanism. Once a threshold level of threat is experienced, coping appraisal is elicited. As such how we protect ourselves is a direct response to threat appraisal and involves coping appraisal (Maddux & Rogers, 1983).

Coping appraisal is quite simply the appraisal of the relative (to our own beliefs and capabilities) coping mechanisms available to us. It consists of response efficacy, self efficacy and response costs. Response efficacy refers to our assessment of the effectiveness of the coping behaviour under consideration to neutralise the threat. Self efficacy is the assessment of our own ability to carry out the coping behaviour whilst response costs refer to the costs, both tangible and intangible, in carrying out the behaviour. Coping appraisal is similar to the concept of perceived behavioural control in the TPB. Both are related to Bandura's (1982) self-efficacy concept, which refers to perceptions of personal ability. However perceived control allows for the addition of external factors (such as anticipated resources) which may influence our ability to carry out an action. In the PMT, high threat appraisal, positive response and self efficacy can induce greater adoption of a protective behaviour, however if the behaviour carries high costs then adoption will be negatively affected (Maddux & Rogers, 1983).

The PMT has been widely applied to health protective behaviours (Milne, Sheeran & Orbell, 2000). In a meta-analysis, Milne and colleagues (2000) found that the PMT was effective in predicting current over future behaviour and the threat and coping components of the model were of utility in predicting behavioural intentions. They also found that risk perception was positively correlated with maladaptive health protective behaviours, indicating that high levels of perceived threat elicit a coping mechanism which may not necessarily be adaptive.

The perception of threat posed by anthropogenic climate change is complex. The climate movement which begun to take root in the early seventies with the first United Nations Conference on the Human Environment, presented a far reaching and highly complex global problem which would require collective action across scales to secure the earth for future generations. It presented a threat where the costs of action could be high and where impacts would only slowly play out in an uncertain future. It could be that for people for whom the effects of climate change are not pertinent no threat response is evoked and thus no coping strategy deployed. In addition, the media's portrayal of climate change, which generally appeals to fear motives and the distinct lack of useful information on adaptive and mitigative behaviours could also be a reason for maladaptive behaviours (Moser, 2010; Meneses, 2010). These behaviours can be as simple as denial, and taking on a business as usual stance.

The PMT has been gaining prominence in the study of climate change adaptation behaviours but remains limited in scope with only a handful of studies available (Grothmann and Patt, 2005; Grothmann & Reusswig 2006; Osberghaus, Finkel & Pohl, 2010; Dang, Li, Nuberg & Bruwer, 2014; Menzel & Scarpa, 2005). Grothmann and Patt (2005) adjusted the PMT to create a 'socio-cognitive model of proactive private adaptation to climate change impacts'. In their model when a significant level of threat is detected, coping appraisal is activated. This in turn can lead to either adaptive or maladaptive coping responses. In the case of adaptive responses, intention to carry out the behaviour is formed. Intention can lead to actual behaviour if objective adaptive capacity is sufficient. The latter refers to things like adequate resources, support, knowledge, and money. Grothmann and Patt (2005) found support for their model through two distinct case studies: one looking at flood protection in Germany through private precautionary measures (Grothmann & Reusswig, 2006) and the other looking at subsistence farmer's adaptive behaviour in Zimbabwe (Grothmann & Patt, 2005). In the former, they found that the socio-cognitive model elicited greater explanatory power then the socio-economic model where income in particular failed to show significance in relation to adaptation. The qualitative Zimbabwe case study found that despite having the resources at hand (namely more resilient seeds) to adapt, a lack of intention was limiting the use of adaptive actions. This lack of intention was shown to arise from low risk perception, despite climate information to the contrary, and the assessment of the utility of adaptive actions which were unfavourably perceived.

In another German study, Osberghaus, Finkel and Pohl (2010) presented locally and globally focused information on climate change to a sample of people in Mannheim. They found that increased perceived personal risk was associated with a higher need to adapt to the climate change impacts. However information was not a significant factor in the desire to engage in adaptive behaviour. They note that factors such as subjective norms could act as a barrier to behavioural change. In contrast, Dang and colleagues (2014) conducted face-to-face interviews with 598 farm households across 13 provinces in the Mekong delta to investigate farmer's assessment of climate change adaptation measures through the framework of the PMT. Through detailed questionnaires they explored perceived self-efficacy, perceived adaptation efficacy and perceived adaptation costs. They found that belief in climate change, access to information and the usefulness and ease of access to objective resources, such as credit and agricultural extension, particularly influenced farmer's assessment of adaptive measures.

Lastly Scarpa & Menzel (2005) applied the constructs of the PMT to a contingent valuation study in an attempt to identify the primary sources of preferences that lead to a German samples willingness to pay for biodiversity conservation in developing countries. They provide a deeper understanding for the finite heterogeneity in preferences and supplement the preferred rational agent models that prevail economic theory with psychological rationality. They found that the application of PMT to payments for biodiversity protection revealed different forms of perceived realism for stated willingness to pay. For instance they found that problem focused people who perceived biodiversity can be protected, and believed that their payment could make a positive difference, also had a higher willingness to pay.

To recap, in the PMT threat appraisal moderates coping appraisal which is akin to perceived behavioural control. With an adaptive coping response, intention to carry out the response in formed. By looking at exposure to shocks and resource dependence we add a dimension of threat appraisal to the framework of the TPB. We add severity of threats as moderators of behaviour as we cannot be sure of the causal path between the antecedents of behaviour and perceptions of severity in our study.

We hypothesize that threat appraisal will moderate attitudes and subjective norms in addition to perceived behavioural control. Studies have shown that for adaption to climate change in farmers particularly is significantly influenced by perceptions and attitudes (Evans, Storer & Wardell-Johnson, 2010), whilst Dang (2014) noted that within the framework of the PMT subjective norms was a significant predictor of climate change adaptive behaviours in rice farmers in the Mekong delta.

11.2.3 COLLECTIVE-RISK SOCIAL DILEMMA

It is clear that anthropogenic climate change places a very real threat to the wellbeing of human and non-human species globally. In chapter 1 we saw that protecting the global climate, forests and the oceans requires collective action (Dietz & Ostrom, 2003). For individuals to not pollute rivers, to not overfish, to not burn forests and to not completely deplete natural resources places one in a social dilemma known as the tragedy of the commons (Hardin, 1968). The special case of a collective-social risk dilemma arises when a group must cooperate to reach a shared goal, which may lead to negative short-term economic effects, in order to avoid the risk of a much greater collective future loss. The scale of the problem can dilute the urgency for individual action, and the temptation to free-ride on the contributions of others can become a pervasive issue. Generally we would expect the outcome of such a commons dilemma, under the lens of a rational-choice game theoretic perspective, to be the maximization of individual profits by approaching the Nash equilibrium of over-using the common-pool resource. However such a perspective cannot take into account the broad cognitive limitations (such as threat appraisal) and risk on individual decision making. By integrating cognitive models with choice experiments we may be able to better understand the cognitive pathways people employ to make decisions regarding the uptake of adaptive behaviours which would yield communal benefits in the long-run.

In Fiji, an example of a collective risk dilemma can be seen in declining marine health. With a strong culture of subsistence fishing, failing marine ecosystems would greatly impact communities. To better govern this common pool resource, a collective risk solution for marine protection was formulated. Combining traditional ecological knowledge and modern conservation practices, community managed marine protected areas with 'Tabu' or no-take zones were set-up. The desire to free-ride is in part held in check through non-pecuniary social and cultural incentives (Cinner & Aswani, 2007; Aswani, 2010).

Envisioning initiatives to address collective risk dilemmas could benefit from models of cognition (Kuruppu & Liverman, 2011) such as the PMT or the Theory of Planned Behaviour. It can identify the threat appeals which cause maladaptive or adaptive coping responses and can further indicate the utility of incentives.

Our understanding of how exposure to risk influences threat and coping appraisal in vulnerable communities and their subsequent uptake of adative behaviours is limited. As yet, no study has looked at how risk exposure impacts the uptake of adaptive investment behaviours under different incentive conditions. As such this study aims to identify the motives which may influence the uptake of adaptive measures through the framework of the Theory of Planned Behaviour.

11.3 CASE-STUDY CLIMATE RISK CHARACTERISTICS

These questions are examined by using data from a survey-based experiment and survey questionnaire carried out on a sample of 205 people living in or near fragile ecosystems on the island of Viti-Levu in Fiji between November 2012 and January 2013. The selected case-study is of relevance as Small Island Developing States (SIDS) are generally amongst the most vulnerable to the pressures of climate change with high risk and low adaptive capacity (Pelling & Uitto, 2001). In addition the South Pacific has the additional stressors of El Niño Southern Oscillation (ENSO) impacts.

Strong natural variability across timescales is characteristic of our earth's climate. Internal chaotic nonlinear dynamics of the oceans and the atmosphere coupled with the interactions between them generate variability across timescales. Events such as ENSO is an example of internal climatic forcing. External forcing can also influence the climate system.

Anthropogenic climate change can be seen as an external force. At present, climate models are uncertain of the effects such external forcing has on ENSO events but regardless we do know that together these two influences on the climate system can result in more extreme climate events (Latif & Keenlyside, 2009). In 2012 the Fiji meteorological service established 13 new rainfall and 14 new temperature extremes. Two major floods occurred in January and March, with the March floods being the worst recorded in Nadi at that time. A severe tropical cyclone (Evan) affected Fiji in December 2012, with very strong and destructive storm, gales and hurricane force winds. Earlier tropical disturbances within the South Pacific also indirectly affected Fiji in 2012 (Fiji Meteorological Service, 2013). Since the end of 2012, Fiji has continued to experience uncharacteristic and extreme climate events such as September 2014's drought (Fiji Meteorological Service, 2014) and the devastating Cyclone Winston in February 2016. Whilst Fiji has always been affected by ENSO, the impacts of anthropogenic climate change which include ocean acidification, sea level rise, increasing temperatures, and more intense cyclones, are becoming more prevalent in recent decades (Kumar, Stephens & Weir, 2014; Banholzer, Kossin & Donner, 2014).

Generally, disaster risk exposure (natural, economic crisis, and war) is a greater threat to the poor then for other population groups as they by and large experience greater exposure to the threats and have a lower risk bearing capacity (Pantoja, 2002). The uptake of adaptive measures becomes ever more important in order to increase the risk bearing capacity of these vulnerable groups. As we have seen information and the availiablity of resources such as credit can influence one's assesment of adaptive measures. Indeed access to microfinance can be an important tool in reducing risk taking behaviour by providing a safety net following a disaster (Arnold, 2008), which give people the tools through which to take up adaptive behaviours (Hammill, Matthew & McCarter, 2008), and empowering them in their daily lives (Odek et al, 2009).

The compounding social, political, economic (Siikala, 2014; Prasad, 2014), and environmental concerns (Brooks & Adger, 2013) which are evident in Fiji make it an ideal site to explore what kind of threats influence the uptake of climate adaptive investment behaviours. The study contributes to our understanding of the drivers behind climate adaptive investment decisions, and in particular the influence of threats on such decisions. In addition it contributes to policy development and best practice for engaging people to take up adaptive investments by conceiving of ways in which to miminise threats.

11.4 RESEARCH AND EMPIRICAL METHOD

The survey preceded the framed field experiment and consisted of general demographic questions, resources use questions, perception of severity of socio-economic and environmental issues, risk exposure in the past year and psychological questions relating to subjective norms, perceived behavioural control and attitudes.

The psychological and demographic constructs were the same as in the previous study. The survey also asked questions pertaining to global and local risk exposure, resource dependence, and the perceived severity of environmental and socio-economic issues. The division of global and local risk consists of climate shocks experienced by many (Global) and shocks which may be more localised, pertaining to individuals. The severity of environmental and socio-economic issues were informed by Chokor (2004) who created a scale of environmental problems in rural Nigeria. Only those items relevant to Fiji were included and these were

The same experimental method was employed as in the previous chapter. Using Mplus Version 6 (Muthen & Muthen 2011), a Path Analysis with Means and Variance Adjusted Weighted Least Square Estimator was specified.

The Equations of the path model can be expressed as:

EQUATION 11-1

$$X_{1-3} = \alpha + \sum (\gamma_{i\,Demographics}) \left(\gamma_{i\,Resource\,Dependence}\right)(\gamma_{i\,Percived\,Threats})\ \epsilon_i$$

Where: *Y_1(Attitudes), Y_2(Subjective Norms), Y_3(Perceived Behavioural Control)*

$$Y_{1\,Behavioural\,Intention} = \alpha + \beta_{xi} + \zeta_1$$

$$U_{1-3} = \alpha + \sum (\beta_{yi})\ (\beta_{xi})\ (\gamma_{i\,Information}) \left(\gamma_{i\,Resource\,Dependence}\right)$$

$$(\gamma_{i\,Percived\,Threats})(\gamma_{i\,Demographics})\ \zeta_i$$

Where: *U_1(No Incentive Investment Choice), U_2(Dynamic Incentive Investment Choice),U_3(Green Incentive Investment Choice), and β_x is perceived behavioural control.*

With conditional probabilities given by:

EQUATION 11-2

$$Pr(U_i = 1|x_i) = \Phi(\tau_1 - b_1x_2 - b_2x_2 \ldots)$$

$$Pr(U_i = 2|x_i) = \Phi(\tau_2 - b_1x_2 - b_2x_2 \ldots) - \Phi(\tau_1 - b_1x_2 - b_2x_2 \ldots)$$

$$Pr(U_i = 3|x_i) = \Phi(\tau_3 - b_1x_2 - b_2x_2 \ldots) - \Phi(\tau_2 - b_1x_2 - b_2x_2 \ldots)$$

$$Pr(U_i = 4|x_i) = \Phi(\tau_4 - b_1x_2 - b_2x_2 \ldots) - \Phi(\tau_3 - b_1x_2 - b_2x_2 \ldots)$$

$$Pr(U_i = 5|x_i) = \Phi(-\tau_5 + b_1x_2 + b_2x_2 \ldots)$$

Keeping in mind that U_i investment choice consisted of the following categories:

$$Investment\ Choice \quad = \begin{cases} 1 & Adaptive \\ 2 & Moderately\ Adaptive \\ 3 & Mixed \\ 4 & Moderately\ Non-Adaptive \\ 5 & Non-Adaptive \end{cases}$$

11.5 RESULTS

11.5.1 DESCRIPTIVES

The same demographic characteristics apply as in the preceding chapter. Looking at the frequency distribution of perceived negative climate events we see that the majority of respondents did report experiencing the global shocks of floods (63.90%) and cyclones (90.24%; Table 5.3). This is in line with actual climate data for the year 2012 when Viti-Levu was hit by flash floods in January and March. In addition cyclone Evan was making its way through Viti-Levu in December, during the period of data collection. These constituted the most reported shocks, followed by local shock of crop disease (29.27%). Respondents were most reliant on marine and non-agricultural forest products in the dry season (60.97% and 60.49% respectively). Cost of living (68.29%), water pollution (78%), forest destruction (36.59%), crime (32.68%), and soil infertility (29.27%) were cited as severe issues that people in Fiji faced.

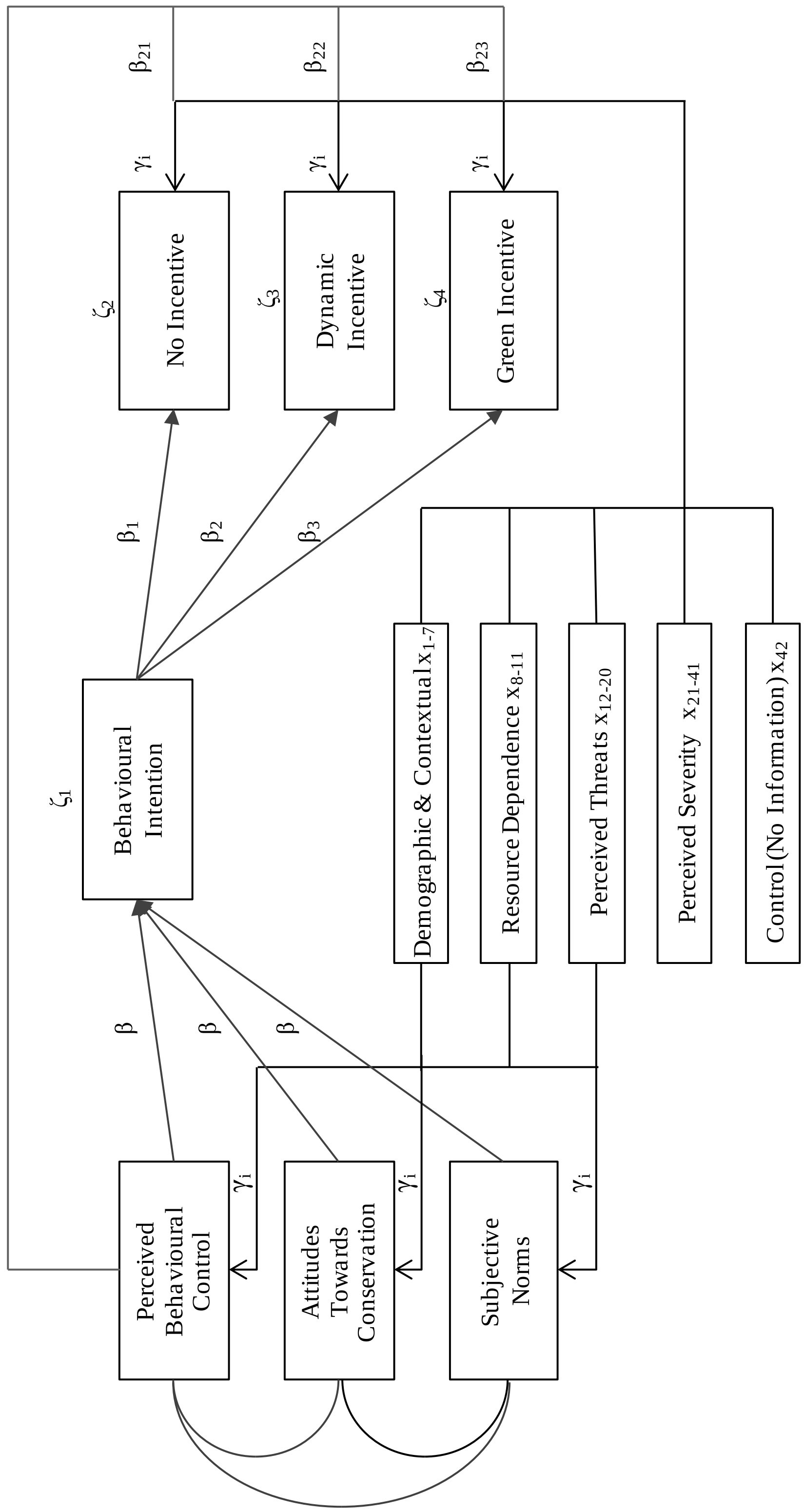
TABLE 11-1: FREQUENCY AND DESCRIPTIVE STATISTICS FOR DEMOGRAPHIC VARIABLES, RESOURCE DEPENDENCE, PERCEIVED THREATS AND SEVERITY OF ENVIRONMENTAL AND OTHER ISSUES

						Frequency		
	Variables	Mean	sd	Min	Max	0	1	%
	Demographic and Contextual							
X_1	Y<F$10	0.356	0.480	0	1	132	73	35.610
X_2	Chief	0.073	0.261	0	1	190	15	7.317
X_3	Fijian	0.751	0.433	0	1	51	154	75.122
X_4	Female	0.424	0.495	0	1	118	87	42.439
X_5	Farmer/Fisher	0.776	0.418	0	1	46	159	77.561
X_6	Access to Credit	0.717	0.444	0	1	124	81	39.512
X_7	Current Microloan	0.200	0.405	0	1	163	42	20.488

	Variables	Mean	sd	Min	Max	Freq High*	%
	Resource Dependence by Season						
X_8	Non-agricultural Forest Products, Wet	2.746	1.345	1	5	57	27.805
X_9	Non-agricultural Forest Products, Dry	3.707	1.117	1	5	124	60.488
X_{10}	Marine, Dry	3.790	1.150	1	5	125	60.976
X_{11}	Marine, Wet	3.249	1.189	1	5	74	36.098
	Description: Can you describe how reliant you are on Z10-14? (1-5 where 1=No reliance, 5=Very Reliant)*Frequency of high dependence on resources obtained by summing upper bounds on Likert Scale (4+5)						
	Perceived Threats	Mean	sd	Min	Max	Freq Yes	%
X_{12}	Flood	0.640	0.481	0	1	131	63.902
X_{13}	Drought	0.141	0.349	0	1	28	13.659
X_{14}	Season Late	0.141	0.349	0	1	29	14.146
X_{15}	Season Early	0.078	0.269	0	1	16	7.805
X_{16}	Cyclone	0.900	0.297	0	1	185	90.244
X_{17}	Hurricane	0.059	0.235	0	1	12	5.854
X_{18}	Disease, Plants	0.293	0.456	0	1	60	29.268
X_{19}	Disease, Animals	0.063	0.244	0	1	13	6.341
X_{20}	Illness, Human	0.146	0.354	0	1	30	14.634
	Description: In the last year have you experienced... (0=No, 1=Yes)						
	Perceived Severity of Local and Global Issues	Mean	sd	Min	Max	Freq Yes	%
X_{21}	Land Division	0.205	0.405	0	1	42	20.488
X_{22}	Land Scarcity	0.156	0.364	0	1	32	15.610
X_{23}	Water Scarcity	0.146	0.354	0	1	30	14.634
X_{24}	Drought	0.107	0.310	0	1	22	10.732
X_{25}	Human/Animal Conflict	0.283	0.452	0	1	58	28.293
X_{26}	Land Conflict	0.200	0.401	0	1	41	20.000
X_{27}	Infertile Soil	0.293	0.456	0	1	60	29.268
X_{28}	Forest Destruction	0.366	0.483	0	1	75	36.585
X_{29}	Air Pollution	0.190	0.393	0	1	39	19.024
X_{30}	Water Pollution	0.380	0.487	0	1	78	38.049
X_{31}	Land Pollution	0.288	0.454	0	1	59	28.780
X_{32}	Forest Fires	0.151	0.359	0	1	31	15.122
X_{33}	Flooding	0.288	0.454	0	1	59	28.780
X_{34}	Reduced Crop Yield	0.220	0.415	0	1	45	21.951
X_{35}	Plant Disease	0.205	0.405	0	1	42	20.488
X_{36}	Monocropping	0.044	0.205	0	1	9	4.390
X_{37}	Housing	0.141	0.349	0	1	29	14.146
X_{38}	Sickness	0.185	0.390	0	1	38	18.537
X_{39}	Cost of Living	0.683	0.466	0	1	140	68.293
X_{40}	Crime	0.327	0.470	0	1	67	32.683
X_{41}	Poverty	0.166	0.373	0	1	34	16.585
	Description: Do you think Z15-19 is a severe issue? (0=No, 1=Yes)						

11.5.2 PATH ANALYSIS

FIGURE 11-1: PATH DIAGRAM



The resulting path model had excellent fit statistics (RMSEA=0.006, CFI=0.982). No constraints were imposed as in the previous path models. Our construct validity was very good, with the data fitting the theoretical model very well. The RMSEA shows that we can reject our null hypothesis of a poor fit of the data to the model, whilst the CFI tells us that 98.2% of the covariation in the data can be explained by our model. The model is depicted in Figure 11.1 and the path coefficients and probabilities are found in Tables 11.3 through to 11.8.

We found that perceived behavioural control (B=0.475, p=0.111), attitudes (B=0.373, p=0.037) and subjective norms (B=0.707, p=0.048) positively moderated behavioural intention, with the effect being significant for attitudes and subjective norms. However this effect was not as strong as found in previous chapters. Holding all other variables at their mean, positive attitudes increased the probability of medium intentions (0.991). Positive subjective norms increased the probability of medium and strong intentions (1 and 0.990 respectively), as did positive perceived behavioural control (1 and 0.857 respectively).

TABLE 11-2: COEFFICIENTS AND PREDICTED PROBABLITY - ANTECEDENTS OF INTENTION

							Predicted Probability		
			β	S.E.	P		Nega-tive	Mode-rate	Posit-ive
Behavioural Intention	←	Attitudes Towards Conservation	0.373	0.235	0.037	**	0.135	0.991	0.165
	←	Subjective Norms	0.707	0.233	0.048	**	0.582	1.000	0.990
	←	Perceived Behavioural Control	0.475	0.221	0.111		0.627	1.000	0.857

R2: Attitudes=0.318; Subjective Norms=0.169; Perceived Behavioural Control=0.294; Behavioural Intention=0.62; *p<0.1, **p<0.05, ***p<0.001

Next we look at how demographic factors, shock exposure, resource dependence, and perceived severity of issues moderate attitudes, subjective norms and perceived behavioural control. Generally we found that there was a greater probability of medium and positive subjective norms when people perceived shocks and as resource dependence increased. The opposite effect was found for attitudes and perceived behavioural control.

The factors which significantly affected attitudes were ethnicity and the global shock of cyclones and the local shock of illness. Fijians had a greater probability of positive attitudes (0.752), whilst the shock of illness in the past year increased the probability of moderate to negative attitudes towards conservation (0.806, 0.311 respectively). Exposure to cyclones increased the probability of negative (0.649) and moderate attitudes towards conservation (0.996). Irrespective of significance, resource dependence and shocks were correlated with negative and neutral attitudes whilst the demographic variables varied, income of less than $10/day had a higher probability of negative (0.518) attitudes then positive (0.482), as did females (negative= 0.570, positive= 0.430). The remainder were correlated with positive attitudes.

TABLE 11-3: COEFFICIENTS AND PREDICTED PROBABLITY - MODERATORS OF ATTITUDES

							Predicted Probability		
			β	S.E.	P-Value		Negative	Moderate	Positive
Attitudes Towards Conservation	←	y<F$10	0.06	0.267	0.821		0.518	0.974	0.482
	←	Chief	0.433	0.611	0.478		0.371	0.884	0.629
	←	Fijian	0.787	0.318	0.013	**	0.248	0.687	0.752
	←	Female	-0.071	0.132	0.589		0.570	0.986	0.430
	←	Farmer/Fisher	0.157	0.241	0.514		0.479	0.960	0.521
Resource Dependence	←	Forest Reliance - Dry Season	-0.099	0.068	0.146		0.581	0.988	0.012
	←	Forest Reliance - Wet Season	0.081	0.132	0.543		0.510	0.971	0.019
	←	Marine Reliance - Dry Season	0.074	0.122	0.545		0.512	0.972	0.018
	←	Marine Reliance - Wet Season	-0.004	0.108	0.971		0.543	0.981	0.015
Perceived Threats	←	Flood	0.055	0.221	0.804		0.520	0.974	0.017
	←	Drought	0.268	0.371	0.47		0.435	0.936	0.029
	←	Season Came Late	-0.453	0.314	0.15		0.712	0.998	0.004
	←	Season Came Early	0.474	0.627	0.449		0.356	0.867	0.045
	←	Cyclone	-0.277	0.314	0.043	**	0.649	0.996	0.007
	←	Plant Disease	0.371	0.258	0.151		0.395	0.906	0.036
	←	Animal Disease	-0.168	0.496	0.735		0.608	0.992	0.010
	←	Illness	0.598	0.271	0.028	**	0.311	0.806	0.058

*p<0.1, **p<0.05, ***p<0.001

The shock of cyclones decreased the probability of high levels of subjective norms and increased that of medium (0.999) and low (0.325) levels of subjective norms. The arrival of a late season had the opposite effect with the probability of medium levels of subjective norm being 0.705 and high levels being 0.558. In general shocks and resource dependence were correlated with positive and neutral subjective norms as were the demographic variables. With Fijians (0.484), chiefs (0.453) and farmer/fishers (0.441) with the greatest probability of positive subjective norms.

TABLE 11-4: COEFFICIENTS AND PREDICTED PROBABLITY - MODERATORS OF SUBJECTIVE NORMS

							Predicted Probability		
			β	S.E.	P-Value	Sig	Low	Medium	High
Subjective Norms	←	y<F$10	-0.265	0.21	0.207		0.153	0.989	0.235
		Chief	0.338	0.551	0.54		0.052	0.857	0.453
		Fijian	0.415	0.524	0.428		0.044	0.820	0.484
		Female	-0.132	0.178	0.459		0.124	0.978	0.278
		Farmer/Fisher	0.308	0.264	0.243		0.055	0.870	0.441
Resource Dependence		Forest Reliance - Dry Season	-0.01	0.069	0.88		0.101	0.961	0.321
		Forest Reliance - Wet Season	0.013	0.114	0.91		0.097	0.957	0.329
		Marine Reliance - Dry Season	0.077	0.093	0.408		0.086	0.944	0.352
		Marine Reliance - Wet Season	-0.061	0.125	0.625		0.110	0.969	0.303
Perceived Threats		Flood	0.055	0.326	0.867		0.090	0.949	0.344
		Drought	0.206	0.272	0.449		0.068	0.909	0.401
		Season Came Late	0.602	0.349	0.085	*	0.029	0.705	0.558
		Season Came Early	-0.357	0.324	0.27		0.176	0.993	0.208
		Cyclone	-0.833	0.496	0.093	*	0.325	1.000	0.099
		Plant Disease	0.09	0.296	0.761		0.084	0.941	0.357
		Animal Disease	-0.117	0.467	0.802		0.121	0.976	0.283
		Illness	0.206	0.36	0.567		0.068	0.909	0.401

*p<0.1, **p<0.05, ***p<0.001

Perceived behavioural control was significantly and positively moderated by demographic variables of status as chief, and being a female. Probability of neutral to positive perceptions behavioural control were influenced by status as chief (neutral=0.709, positive=0.197) and being a female (neutral=0.881, positive=0.122). Neutral to negative perceptions were influenced by the remaining demographic variables and most strongly for income (negative perceptions=0.169) and occupation as a farmer or fisher (negative perceptions=0.211) As with attitudes, the experience of shocks and resource dependence increased the probability of low and medium levels of perceived behavioural control.

TABLE 11-5: COEFFICIENTS AND PREDICTED PROBABLITY - MODERATORS OF PERCEIVED BEHAVIOURAL CONTROL

							Predicted Probability		
			β	S.E.	P-Value	Sig	Low	Medium	High
Perceived Behavioural Control	←	y<F$10	0.344	0.307	0.264		0.169	0.955	0.077
		Chief	0.918	0.291	0.002	**	0.063	0.709	0.197
		Fijian	0.451	0.595	0.448		0.143	0.931	0.093
		Female	0.604	0.373	0.106	**	0.111	0.881	0.122
		Farmer/Fisher	0.188	0.26	0.471		0.211	0.978	0.057
Resource Dependence		Forest Reliance - Dry Season	-0.144	0.106	0.174		0.318	0.996	0.028
		Forest Reliance - Wet Season	0.059	0.134	0.662		0.250	0.988	0.043
		Marine Reliance - Dry Season	-0.108	0.135	0.42		0.306	0.995	0.030
		Marine Reliance - Wet Season	0.096	0.174	0.578		0.238	0.986	0.047
Perceived Threats		Flood	-0.217	0.325	0.505		0.345	0.998	0.023
		Drought	-0.68	0.592	0.25		0.526	1.000	0.007
		Season Came Late	-0.327	0.471	0.488		0.386	0.999	0.018
		Season Came Early	0.229	0.799	0.775		0.199	0.973	0.062
		Hurricane	0.096	0.844	0.909		0.238	0.986	0.047
		Plant Disease	-0.169	0.224	0.451		0.327	0.997	0.026
		Animal Disease	-0.14	0.66	0.832		0.317	0.996	0.028
		Illness	-0.506	0.44	0.25		0.456	1.000	0.011

*p<0.1, **p<0.05, ***p<0.001

Next we look at the direct effects of behavioural intention, the absence of information (treatment group), perceived behavioural control and the remaining mediators (socio-demographic variables, resource dependence, exposure to shocks, and severity of environmental and socio-economic issues) on investment decisions across the different incentive types.

11.5.2.1 NO INCENTIVE CONDITION

Firstly, holding all other variables at their mean, positive intention significantly predicted behaviour. The probability difference between choosing an adaptive over a non-adaptive portfolio was 0.335. Whilst positive perceived behavioural control increased the probability of people choosing the moderately adaptive (0.619) and moderately non-adaptive (0.779) portfolios. A similar effect was found for the absence of information.

The probability for choosing moderately adaptive was 0.462 and moderately non-adaptive was 0.644. Fijians had a greater probability of choosing adaptive portfolios (0.7204), the same was true for people holding a current microloan (probability adaptive=0.476; probability non-adaptive=0.0003).

Generally we found the probability of adaptive investments was greater than for non-adaptive when looking across resource dependence increased, perceived shocks and severity of threats. This effect was most pronounced for the following: Reliance on forest resources during the wet Season (Diff=0.173), the shock of floods (Diff=0.174), drought (Diff=0.197), early arrival of a season (Diff=0.383), animal disease (Diff=0.176), and illness (Diff=0.249). In addition to the perceiving the following as severe issues: land division (Diff=0.209), human and animal conflict (Diff=0.209), and monocropping (Diff=0.457)

Dependence on marine resources in the dry season significantly increased the probability of adaptive investments (0.109) over non-adaptive (0.013) though moderately non-adaptive portfolios had the highest probability of being chosen (0.883).

The early arrival of a season and perceiving air pollution as a severe problem facing people in Fiji saw people favor adaptive investments portfolios (0.387 and 0.390 respectively) over non-adaptive (0.0008 and 0.0007 respectively). Perceiving poverty as a severe issue increases the probability of moderately adaptive (0.504) and moderately non-adaptive (0.682) investment portfolios.

TABLE 11-6: COEFFICIENTS AND PROBABILITIES - NO INCENTIVE

						Predicted Probability				
			β	S.E.	p		Adaptive	MA	Mixed	M N-A	Non-Adaptive
No Incentive	←	Behavioural Intention	-0.206	0.078	0.008	**	0.336	0.990	0.978	0.997	0.001
		Perceived Behav Control	0.134	0.054	0.013	**	0.075	0.619	0.493	0.778	0.022
		Control	0.601	0.247	0.015	**	0.050	0.462	0.339	0.644	0.034
No Incentive	←	Y<F$10	-0.159	0.168	0.345		0.189	0.923	0.865	0.971	0.005
Demogra-phic & Contextual		Chief	-0.201	0.589	0.733		0.200	0.934	0.883	0.976	0.004
		Fijian	-1.625	0.352	0	***	0.720	1.000	1.000	1.000	0.000
		Female	0.118	0.247	0.633		0.123	0.808	0.709	0.909	0.011
		Farmer/Fisher	-0.112	0.256	0.66		0.176	0.908	0.844	0.964	0.006
		Access to Microcredit	0.313	0.307	0.308		0.088	0.685	0.564	0.828	0.017
		Current Microloan	-0.98	0.243	0	***	0.476	0.999	0.997	1.000	0.000

		β	S.E.	p		Predicted Probability Adaptive	MA	Mixed	M N-A	Non-Adaptive
No Incentive ← *Resource Dependence*	Forest Reliance - Dry Season	0.028	0.043	0.522		0.143	0.853	0.768	0.935	0.008
	Forest Reliance - Wet Season	-0.118	0.113	0.295		0.178	0.910	0.847	0.965	0.006
	Marine Reliance - Dry Season	0.19	0.092	0.038	**	0.109	0.766	0.658	0.883	0.013
	Marine Reliance - Wet Season	0.13	0.104	0.212		0.121	0.802	0.701	0.905	0.011
No Incentive ← *Perceived Threats*	Flood	-0.123	0.4	0.759		0.179	0.912	0.849	0.965	0.005
	Drought	-0.204	0.297	0.493		0.201	0.935	0.884	0.976	0.004
	Season Came Late	0.369	0.396	0.352		0.079	0.644	0.520	0.798	0.020
	Season Came Early	-0.745	0.3	0.013	**	0.384	0.995	0.989	0.999	0.001
	Cyclone	0.385	0.32	0.228		0.077	0.632	0.507	0.788	0.021
	Plant Disease	0.098	0.292	0.737		0.127	0.819	0.723	0.915	0.010
	Animal Disease	-0.132	0.439	0.764		0.182	0.915	0.853	0.967	0.005
	Illness	-0.373	0.264	0.158		0.252	0.968	0.937	0.990	0.003
No Incentive ← *Perceived Severity of Issues*	Land Division	-0.244	0.447	0.586		0.213	0.945	0.899	0.980	0.004
	Land Scarcity	0.511	0.468	0.274		0.060	0.534	0.407	0.708	0.028
	Water Scarcity	0.014	0.373	0.97		0.146	0.860	0.776	0.939	0.008
	Drought*	0.026	0.37	0.945		0.143	0.854	0.769	0.936	0.008
	Human Animal	-0.241	0.204	0.238		0.212	0.944	0.898	0.980	0.004
	Land Conflict	0.173	0.349	0.62		0.112	0.777	0.670	0.890	0.012
	Infertile Soil	-0.096	0.329	0.771		0.172	0.903	0.836	0.961	0.006
	Forest Destruction	0.028	0.41	0.946		0.143	0.853	0.768	0.935	0.008
	Air Pollution	-0.761	0.341	0.025	**	0.390	0.996	0.990	0.999	0.001
	Water Pollution	-0.204	0.26	0.432		0.201	0.935	0.884	0.976	0.004
	Land Pollution	0.129	0.36	0.72		0.121	0.802	0.702	0.905	0.011
	Forest Fire	-0.006	0.425	0.99		0.150	0.868	0.788	0.943	0.008
	Flooding	-0.033	0.327	0.921		0.157	0.880	0.803	0.949	0.007
	Crop Yield	-0.149	0.365	0.683		0.186	0.920	0.861	0.969	0.005
	Plant Disease	0.183	0.518	0.724		0.110	0.771	0.663	0.886	0.013
	Monocropping	-0.935	0.854	0.273		0.458	0.999	0.996	1.000	0.000
	Housing	-0.066	0.321	0.838		0.165	0.892	0.821	0.956	0.006
	Sickness	0.124	0.369	0.737		0.122	0.805	0.705	0.907	0.011
	Cost of Living	-0.204	0.209	0.33		0.201	0.935	0.884	0.976	0.004
	Crime	-0.095	0.296	0.75		0.172	0.903	0.836	0.961	0.006
	Poverty	0.548	0.279	0.05	**	0.056	0.504	0.379	0.683	0.030

No Incentive R2=0.421; *p<0.1, **p<0.05, ***p<0.001; M A= Moderately Adaptive, M N-A= Moderately Non-Adaptive

11.5.2.2 DYNAMIC INCENTIVE CONDITION

Behavioural intention did not significantly predict investment behaviour (B=0.04, p=0.643) however perceived behavioural control (B=-0.226, p=0.058) and the absence of climate change information (B=0.68, p=0.004) did. For the latter the probability of choosing the moderately non-adaptive portfolio was greatest (0.576). There was a greater probability of choosing the moderately adaptive, mixed and moderately non-adaptive portfolios with high levels of perceived behavioural control. The same was true for those with access to credit (B=-0.503, p=0.036), and viewing lower crop yields (B=-0.571, p=0.034) as a severe issue.

Earning less than $10 a day and perceiving sickness as a severe issue increased the probability of choosing the moderately non-adaptive (0.824, 0.335 respectively) and non-adaptive portfolios (0.1, 0.273 respectively) over the moderately adaptive (0.767, 0.255 respectively) and adaptive portfolios (0.008, 0.0005 respectively). Generally we found there to be a very small difference in the probability of choosing non-adaptive investments compared to for adaptive when looking across resource dependence, perceived shocks and severity of threats.

Fijians had a higher probability of choosing adaptive (0.243) over non-adaptive (0.0007) investment portfolios. This is similar to our findings from previous chapters.

TABLE 11-7: COEFFICIENTS AND PROBABILITIES – DYNAMIC INCENTIVE

							Predicted Probability				
			β	S.E.	p		Adaptive	MA	Mixed	M N-A	Non-Adaptive
Dynamic Incentive	←	Behavioural Intention	0.04	0.087	0.643		0.008	0.859	0.780	0.905	0.071
		Perceived Behavioural Control	-0.226	0.119	0.058	*	0.054	0.996	0.991	0.998	0.012
		Control	0.68	0.238	0.004	**	0.001	0.483	0.364	0.576	0.181
Dynamic Incentive *Demographic & Contextual*	←	y<F$10	0.311	0.186	0.093	*	0.005	0.756	0.652	0.824	0.100
		Chief	-0.016	0.308	0.959		0.012	0.911	0.852	0.943	0.054
		Fijian	-1.593	0.405	0	***	0.243	1.000	1.000	1.000	0.001
		Female	-0.013	0.281	0.964		0.011	0.910	0.850	0.943	0.054
		Farmer/Fisher	-0.077	0.23	0.737		0.013	0.929	0.878	0.956	0.048
		Access to Microcredit	0.636	0.256	0.013	**	0.002	0.518	0.397	0.610	0.170
		Current Microloan	-0.503	0.24	0.036	**	0.037	0.990	0.978	0.995	0.018

							Predicted Probability				
			β	S.E.	p		Adaptive	MA	Mixed	M N-A	Non-Adaptive
Dynamic Incentive *Resource Dependence*	←	Forest Reliance - Dry Season	-0.022	0.1	0.828		0.012	0.913	0.855	0.945	0.053
		Forest Reliance - Wet Season	-0.048	0.094	0.611		0.013	0.921	0.866	0.950	0.051
		Marine Reliance - Dry Season	-0.117	0.152	0.441		0.015	0.940	0.894	0.963	0.044
		Marine Reliance - Wet Season	0.121	0.135	0.369		0.008	0.859	0.779	0.905	0.071
Dynamic Incentive *Perceived Threats*	←	Flood	-0.127	0.239	0.595		0.015	0.942	0.897	0.964	0.043
		Drought	-0.443	0.315	0.159		0.032	0.986	0.971	0.993	0.021
		Season Came Late	-0.202	0.453	0.656		0.018	0.957	0.922	0.975	0.036
		Season Came Early	-0.356	0.524	0.497		0.027	0.979	0.958	0.988	0.026
		Cyclone	0.625	0.267	0.019	**	0.002	0.527	0.406	0.618	0.167
		Plant Disease	-0.521	0.386	0.177		0.039	0.991	0.980	0.995	0.017
		Animal Disease	-0.08	0.541	0.883		0.014	0.930	0.879	0.956	0.047
		Illness	-0.356	0.332	0.284		0.027	0.979	0.958	0.988	0.026
Dynamic Incentive *Perceived Severity of Issues*	←	Land Division	-0.284	0.358	0.428		0.022	0.970	0.943	0.983	0.030
		Land Scarcity	0.101	0.408	0.804		0.008	0.868	0.791	0.911	0.068
		Water Scarcity	0.477	0.506	0.346		0.003	0.642	0.523	0.725	0.133
		Drought*	-0.677	0.434	0.118		0.053	0.996	0.991	0.998	0.012
		Human Animal	0.133	0.293	0.65		0.008	0.853	0.772	0.901	0.072
		Land Conflict	0.152	0.361	0.675		0.007	0.844	0.761	0.894	0.075
		Infertile Soil	0.178	0.208	0.393		0.007	0.832	0.744	0.884	0.079
		Forest Destruction	0.362	0.3	0.227		0.004	0.723	0.613	0.796	0.110
		Air Pollution	-0.634	0.395	0.109		0.049	0.995	0.989	0.998	0.013
		Water Pollution	-0.219	0.285	0.443		0.019	0.960	0.926	0.977	0.035
		Land Pollution	-0.382	0.325	0.241		0.028	0.981	0.962	0.990	0.024
		Forest Fire	0.31	0.269	0.249		0.005	0.757	0.652	0.824	0.100
		Flooding	0.149	0.235	0.524		0.007	0.846	0.762	0.895	0.075
		Crop Yield	-0.571	0.269	0.034	**	0.043	0.993	0.984	0.996	0.015
		Plant Disease	-0.201	0.489	0.681		0.018	0.957	0.921	0.975	0.037
		Monocropping	-0.677	0.596	0.256		0.053	0.996	0.991	0.998	0.012
		Housing	0.482	0.331	0.146		0.003	0.638	0.519	0.721	0.134
		Sickness	0.988	0.232	0	***	0.001	0.255	0.168	0.335	0.273
		Cost of Living	-0.043	0.21	0.836		0.012	0.920	0.864	0.949	0.051
		Crime	-0.101	0.223	0.651		0.014	0.936	0.888	0.960	0.045
		Poverty	-0.223	0.283	0.431		0.019	0.961	0.928	0.977	0.035

Dynamic Incentive R2=0.559; *p<0.1, **p<0.05, ***p<0.001; M A= Moderately Adaptive, M N-A= Moderately Non-Adaptive

11.5.2.3 GREEN INCENTIVE CONDITION

The green incentive condition presented some interesting results. Firstly behavioural intention did significantly moderate behaviour (B=-0.214, p=0.086), and the probability of choosing adaptive loans (0.196) was greater than non-adaptive (0.012) with positive intentions to conserve the forest and river ecosystems.

Perceived behavioural control, which was a significant predictor in the last two conditions, was not under the green incentive condition (B=-0.058, p=0.494), however as with the last two conditions an increase in perceived behavioural control, increased the probability of choosing the moderately adaptive/non-adaptive and mixed portfolios. The absence of climate change information increased the probability of choosing non-adaptive investments (0.333), as did being a chief (moderately non-adaptive: 0.29; non-adaptive: 0.253), and perceiving water scarcity as a severe issue (moderately non-adaptive: 0.349; non-adaptive: 0.227).

Fijians had a greater probability of choosing adaptive (0.688) over non-adaptive (0.0001) investments as did those who experienced the shock of a drought (Diff=0.163), the early arrival of a season (Diff=0.223), illness (Diff=0.165) and the perceived severity of air pollution (Diff=0.169) and monocropping (Diff=0.198) as a major problem that the people of Fiji face. As we found with the no incentive condition, generally, we found there to be a greater probability of choosing adaptive investments compared to non-adaptive when looking across resource dependence, perceived shocks and severity of threats.

FIGURE 11-2: COEFFICIENTS AND PROBABILITIES – GREEN INCENTIVE

							Predicted Probability				
			β	S.E.	p		Adaptive	MA	Mixed	M N-A	Non-Adaptive
Green Incentive	←	Behavioural Intention	-0.214	0.125	0.086	**	0.196	0.991	0.973	0.997	0.011
		Perceived Behavioural Control	-0.058	0.084	0.494		0.093	0.923	0.841	0.962	0.034
		Control	1.221	0.303	0	***	0.003	0.086	0.037	0.154	0.333
Green Incentive *Demographic & Contextual*	←	y<F$10	0.318	0.27	0.24		0.035	0.671	0.506	0.784	0.091
		Chief	0.987	0.481	0.04	**	0.006	0.185	0.093	0.290	0.253
		Fijian	-1.988	0.367	0	***	0.688	1.000	1.000	1.000	0.000
		Female	0.112	0.286	0.696		0.054	0.803	0.665	0.884	0.062
		Farmer/Fisher	0.018	0.349	0.958		0.065	0.851	0.730	0.917	0.051
		Access to Microcredit	-0.183	0.52	0.725		0.094	0.926	0.845	0.963	0.033
		Current Microloan	-0.356	0.359	0.321		0.127	0.963	0.913	0.984	0.022

			β	S.E.	p		Predicted Probability Adaptive	MA	Mixed	M N-A	Non-Adaptive
Green Incentive *Perceived Threats*	←	Forest Reliance - Dry Season	-0.083	0.091	0.363		0.079	0.893	0.793	0.944	0.041
		Forest Reliance - Wet Season	-0.102	0.15	0.495		0.082	0.900	0.803	0.948	0.040
		Marine Reliance - Dry Season	-0.133	0.118	0.262		0.086	0.911	0.820	0.954	0.037
		Marine Reliance - Wet Season	0.023	0.109	0.83		0.064	0.849	0.727	0.915	0.052
		Flood	-0.341	0.292	0.244		0.124	0.961	0.909	0.982	0.023
		Drought	-0.567	0.308	0.066	**	0.176	0.987	0.963	0.995	0.013
		Season Came Late	0.655	0.46	0.155		0.016	0.408	0.255	0.544	0.159
		Season Came Early	-0.76	0.459	0.098	*	0.231	0.995	0.985	0.998	0.008
		Cyclone	0.176	0.412	0.67		0.021	0.445	0.322	0.377	0.435
		Plant Disease	0.134	0.22	0.541		0.051	0.791	0.649	0.876	0.065
		Animal Disease	0.339	0.498	0.496		0.033	0.655	0.489	0.771	0.095
		Illness	-0.573	0.348	0.1		0.178	0.987	0.964	0.995	0.013
Green Incentive *Perceived Severity of Issues*	←	Land Division	0.171	0.475	0.718		0.048	0.769	0.621	0.860	0.069
		Land Scarcity	-0.169	0.411	0.68		0.092	0.922	0.838	0.961	0.034
		Water Scarcity	0.904	0.381	0.018	**	0.008	0.233	0.123	0.349	0.227
		Drought*	-0.283	0.47	0.546		0.112	0.950	0.888	0.977	0.026
		Human Animal Conflict	-0.211	0.435	0.629		0.099	0.933	0.858	0.967	0.031
		Land Conflict	-0.012	0.291	0.967		0.069	0.865	0.750	0.926	0.048
		Infertile Soil	-0.143	0.212	0.499		0.088	0.914	0.825	0.956	0.036
		Forest Destruction	0.156	0.277	0.573		0.049	0.778	0.632	0.866	0.067
		Air Pollution	-0.588	0.337	0.081	*	0.182	0.988	0.966	0.995	0.013
		Water Pollution	-0.341	0.244	0.163		0.124	0.961	0.909	0.982	0.023
		Land Pollution	-0.2	0.325	0.538		0.097	0.930	0.853	0.966	0.032
		Forest Fire	-0.057	0.399	0.886		0.075	0.883	0.778	0.938	0.044
		Flooding	-0.505	0.319	0.113		0.161	0.982	0.952	0.992	0.016
		Crop Yield	-0.492	0.39	0.207		0.157	0.980	0.949	0.992	0.016
		Plant Disease	0.144	0.362	0.691		0.050	0.785	0.641	0.871	0.066
		Monocropping	-0.682	0.542	0.208		0.208	0.993	0.978	0.997	0.010
		Housing	0.248	0.432	0.566		0.040	0.720	0.561	0.823	0.080
		Sickness	-0.214	0.362	0.553		0.100	0.934	0.859	0.968	0.031
		Cost of Living	0.143	0.245	0.558		0.051	0.786	0.642	0.872	0.066
		Crime	0.312	0.336	0.353		0.035	0.675	0.510	0.787	0.090
		Poverty	0.665	0.478	0.164		0.015	0.401	0.248	0.536	0.162

Green Incentive R2=0.591; *p<0.1, **p<0.05, ***p<0.001; M A= Moderately Adaptive, M N-A= Moderately Non-Adaptive

11.6 DISCUSSION

As hypothesized, the Fiji case-study revealed perceived risk, resource reliance, and exposure to shocks did have a direct and indirect effect on adaptive investment decisions. Whilst overall the path analysis revealed that the data was supportive of the theoretical model, the effect of attitudes, subjective norms and perceived behavioural control on intention was weaker with no significant moderating effect of behavioural perceptions on intentions. The latter has been reported before. For instance in a systematic review of the application of behavioural theories on disaster risk reduction and preparedness, Ejeta, Ardalan, and Paton (2015) found that in studies employing the TPB, attitudes and subjective norms were mainly associated with preparedness for diverse hazards.

As hypothesized, we also found that shocks and resource dependence impacted cognitive antecedents to behaviour. Dependence of resources and the experience of shocks increased the probability of positive and medium levels of subjective norms with the opposite effect for attitudes and perceptions of behavioural control. The experience of cyclones however was correlated with weak rather than positive subjective norms. This tells us that environmentally protective beliefs and perceived self-efficacy to engage in protective behaviours are negatively affected by shocks, whilst shared norms and values may be protective to our internal motivations. However with perceived threat of cyclones subjective norms were negatively. It is possible that the threat of cyclones negatively impacts on collective identities. The destructive force of ever more severe cyclones can devastate whole villages and scatter communities away from their usual support networks and people whom they look to for norm formation.

In the framework of the PMT adaptation is assessed through the construct of coping appraisal which is akin to perceived behavioural control (or perceived self-efficacy and perceived adaptation efficacy). Coping appraisal can lead to maladaptation (for example wishful thinking or the denial of risks posed by environmental degradation and climate change) or the intention to adapt. In Chapter 7 we saw that local perceptions of climate change response were largely fatalistic. That perceived behavioural control did not moderate intention could be an indication of maladaptation in the face of threats, perceived behavioural control was negatively correlated with shocks and resource dependence as was attitudes.

The negative skew could be because of structural failures in disaster planning and response at micro and macro levels, or a reaction to the consistent loss of crops and livelihoods with more frequent and stronger cyclones or simply an artefact of a recent shock. We cannot draw conclusion without further data – such as adaptive strategies employed prior to the cyclone, loss of livelihoods, and community response.

When looking at stated behaviour we found that exposure to cyclones was a barrier to adaptive investment behaviour. In particular, under the green incentive condition there was a greater probability of choosing non-adaptive (0.435) over adaptive (0.021) investment portfolios, with a similar effect to a lesser extent under the dynamic incentive condition where the probability of non-adaptive investment portfolios was 0.167 over 0.002 for adaptive. Whilst in the absence of incentives the probability of moderately non-adaptive portfolios was the greatest (0.789).

With climate change, the frequency and severity of extreme weather events such as tropical cyclones are projected to increase (Knutson et al, 2010). The need to better understand why such shocks may lead to maladaptive and riskier behaviour warrants further investigation. It could be that negative climatic events elicit an evolutionarily evolved fear module. Such a module is activated in the presence of recurring stimuli which poses a threat to survival. Evolutionary fear-relevant stimuli such as cyclones may more readily be associated with a conditioned fear response (Öhman & Mineka, 2001), which in this case may materialize as adaptive capacity or lack thereof.

A few months before this research took place, Viti-Levu underwent major flooding following a tropical cyclone. During the research Cyclone Evan once more brought on flash floods. The increased severity and occurrence of cyclones and flooding in Viti-Levu, coupled with inadequate disaster response and planning (Nunn, 2013) could have negatively impacted internal motivations by creating a more salient, and thus more cognitively accessible memory, which could have exerted greater influence on subsequent behaviour (Lavine et al, 1996).

As with the preceding chapters Fijians were more likely to choose adaptive investments, and also it was found that the absence of information was detrimental to adaptive investment decisions across conditions. Information has been shown to be a moderator of farmer’s assessment of climate adaptive measures by Dang et al (2014) in the framework of the PMT, whilst Bizuneh (2013) found that access to weather information was a strong predictor of climate change adaptation in farmers.

In the no incentive and dynamic incentive conditions perceived behavioural control was a significant moderator of stated behaviour albeit a weak one. Having positive perceptions of behavioural control increased the probability of moderately adaptive and moderately non-adaptive loans. Under the green and no incentive conditions we found that if people perceived a sufficient threat and believed that their actions could make a viable positive difference to ecosystems, then this was reflected in subsequent adaptive investment behaviour. That intentions were not crowded-out by the absence or presence of incentives in these two conditions could indicate that: a) people stay true to their internal motivations for engaging in a behaviour regardless of incentives b) green incentives crowd-in internal motivations or b) that dynamic incentives may crowd-out our internal motivations.

In the no incentive condition, we found the probability of adaptive investments was greater than for non-adaptive when looking across resource dependence, perceived shocks and severity of threats. In the absence of incentives, this condition would have been a true reflection of peoples stated behaviour without any external manipulations. Maintaining cognitive consonance with internal motivations as reflected in behavioural mechanism employed here. We can further investigate this by looking at the effect of behavioural intention under the dynamic incentive condition. Here future earning power was constrained if non-adaptive investments were chosen. We found that behavioural intention was not correlated with subsequent stated behaviour. In addition we found that there was less of a difference between the probability of choosing non-adaptive and adaptive portfolios across perceived severity of issues, shocks, and resource dependence. Those who had been exposed to shocks or viewed threats that impacted their earning power (cyclones, lower crop yields, and sickness) could have been more inclined to choose an investment package that offered a mixed bag of goods to hedge their bets and spread risk to minimize the effect of a potential loss in future earnings. Under the same condition we also saw that those who earned below \$10 a day similarly chose foremost between the moderately adaptive and moderately non-adaptive portfolios with a skew towards the non-adaptive portfolios. Again, as this condition limited the potential for future earning if repayments were not met, it speaks of greater risk taking behaviour amongst the lower income when future earning potential is constrained.

Similarly in the no incentive condition the perception of poverty as a severe issue facing society shifted people away from adaptive investments to the moderately adaptive and moderately non-adaptive portfolios instead which would have allowed them to maximise utility whilst minimizing losses. Such a precautionary risk-spreading strategy makes sense from a rational agent stand point and under the lens of loss aversion, where the central tenet is that losses will have greater impact on preferences then gains (Tversky and Kahneman, 1991).

That intention was a significant mediator of stated investment behaviour is in line with the finding in Chapter 9. Under this condition, as under the no incentive condition, we found that there was a greater probability of choosing adaptive investments over non-adaptive even in the presence of perceived threats. So we see in the presence of rewards people's internal motivations are not drowned out, however in the presence of an additional threat (as posed by dynamic incentives) adaptive responses are negatively impacted.

If people were opting for adaptive investment in the absence of incentives, what then makes the green incentive condition attractive as an instrument to drive adaptive behaviour? As we saw in the previous chapters, looking at the distribution of choice across incentives types, we found that the green, followed by the no incentive conditions induced people to take on adaptive investments more so then the dynamic incentive condition. In addition these incentive conditions did significantly differ from each other. This tells us that the framing of the green incentive condition mattered. Here people were framed as stewards of the ecosystem, with rewards given for their protective role. In addition they were given information on the effect of their investment on the ecosystem, which would also influence their interest rate.

Whilst in the dynamic incentive condition no such framing was established nor impact information shared. Whilst we cannot state causality, we can speculate that the monetary constraints and rewards evident in the green incentive model, conditioned people away from free-riding. In the no incentive condition we would have expected respondent's choice to approach the Nash equilibrium of non-adaptive investments. However in the absence of constraints to behaviour people self-organised against free-riding. It is plausible that within a society with a strong collectivist culture and high subsistence levels, employing such a conditional cooperation strategy is important for adaptive norm development (Kameda, Takezawa & Hastie, 2003).

In summary, threat appraisal did influence the antecedents of behaviour and subsequent behaviour. We also found that perceived severity of threats influenced stated behaviour. Including shocks, resource dependence, and perceived severity of threats was a useful addition to the TPB and enabled a more fluent understanding of what drives adaptive investment preferences. Anthropogenic climate change brings with it an increasing prevalence and severity of extreme climate events. People in SIDS are at particular risk of experiencing such threats. Therefore understanding their reaction to such threats is of utmost importance. The research revealed that perceived shocks and resource dependence do influence the cognitive antecedents of behaviour. Negatively impacting attitudes and perceptions of control and increasing the probability of positive subjective norms.

In addition, as hypothesized, resource dependence, perceived shocks and perceived severity of socio-economic factors influenced adaptive investment different under the three incentive conditions. In the presence of green incentives and in the absence of incentives the factors increased the probability of adaptive over non-adaptive portfolios with the opposite found under dynamic incentives.

Regarding policy development, the research exposes the need to address the cognitive response to threats. For instance, exposure to cyclones was negatively associated with adaptive investment choice indicating that there is a need for policy and institutional development around strengthening individual and public perceptions and responses to cyclones. The study revealed the utility of green incentives in engaging adaptive coping behaviours when faced with shocks and also indicated that such incentive may be more congruent with people's internal motives to behave in an environmentally protective manner. When done right, incentives can be a powerful tool through which to engage people to positively invest in their futures. Further investigation in other contexts would benefit our understanding of how threat exposure influences cognitive coping and subsequent behaviour.

As in the previous chapters, it is important to note that we cannot infer causality. However we can say that there were correlations that fitted our theoretical model. In addition the research relied on perceived shocks and did not distinguish between surveys collected before or after the cyclone which could have confounded impact on cognitive drivers and subsequent stated behaviour. There may have been large potential changes shortly after the event which are not reflected in our results.

11.7 REFERENCES

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12 CONCLUSION

[94]

[94] Chilli vendor at Namaka Market, Nadi.

12.1 SUMMARY

Anthropogenic climate change poses the biggest threat to SIDS. In our case-study, the island of Viti-Levu in Fiji, the negative impact of climate change on agriculture alone can cost upwards of 23-52 million US$/year in damages by 2050 – or two to three percent of Fiji's GDP in current terms. In other lower lying SIDS the costs will be far greater. A no-regrets policy for climate change adaptation is already acknowledged by SIDS (UNFCCC, 2005). For the international community, protecting SIDS is critical not only from a moral standpoint – as realistically these communities have not, for the most part, caused the problem but must bear the full brunt of it – but also from the standpoint of the provision of ecosystem services. SIDS are biodiversity powerhouses, unfortunately their terrestrial and costal ecosystems are under threat from climate change and development.

Whilst such loss has negative economic impacts, at a more fundamental level, the greater loss is that to humanity. Losing a species is one thing, but the loss of a whole island ecosystem is another. Imagine, millions of year's worth of evolutionary data, extinguished within a few centuries. If biodiversity is the building blocks of life then surely there will be consequences to what scientists have termed the Anthropocene Defaunation (Dirzo et al, 2014). Over the past 500 million years scientists have been able to identify five major extinction events. After each of these events it has taken at least 10 million years for the remaining species to regain a foothold by eventually branching out and evolving to restore biodiversity. In our current age of extinction, the loss of biodiversity is occurring at an astounding rate, being 1000 to 10,000 times greater than the fossil records from prehistoric times would suggest (Suzuki, 1999). As Wilson (in Suzuki, 1999) states "what humanity is doing now in a single lifetime will impoverish our descendants for all time to come" (p. 149).

There is a theory put forth by E.O.Wilson named the Biophilia Hypothesis. In it he proposes that humans have an innate, genetically based, connection to other living organisms. Without some connection to the natural world, our subjective wellbeing is compromised. Kahn (1997) in a developmental psychology study looking at children's environmental reasoning and values in the United States and the Brazilian Amazon found support for this hypothesis. Children, regardless of economic status, shared a universal ecological value and moral reasoning. With age, they found that homocentric reasoning appeared to be embedded within a wider ecological structure (or biocentric reasoning). Since industrialisation, our ability to connect with the natural world is becoming increasingly difficult. According to the biophilia hypothesis this disconnect has significant negative consequences on our development, impacting mental and physical development, stunting both sensory and spiritual growth (Barbiero et al, 2014).

For vulnerable populations who live by fragile ecosystems, often nature forms an integral part of their identity as individuals and communities. The clouds signalling a storm, the rising tides and the monsoon rains weaves itself into the fabric of the society. It guides social practices and forms cultures deeply rooted to the land and sea. With the globalisation of society, loss of traditional practices, rapidly growing populations, and the resulting encroachment into fragile ecosystems we often see the displacement, culturally and physically, of traditional communities, often to the detriment to these ecosystems and cultures. These issues along with the problems posed by climate change, results in a multifaceted and complex dilemma. We are now in a space where we must reconnect with the ecosystems which sustain us in order to save them. The way in which society views nature at present, relative to the history of literate culture, as a commodity to be used is fairly new. It is clear our current practices are not sustainable; there is an unmistakable need to adapt our behaviour. How do we go about doing this? There is hope, not in any one solution – there are no panaceas to such a complex problem – but through novel combinations we must believe that we can create a better future.

In the preceding chapters we have initiated a case for microloans for climate change adaptation. We have seen that when used as a strategy within ecosystem-based management regimes it can be of utility in creating adaptive capacity. In this thesis we identified how design aspects of microloans may drive adaptive behaviour. When trying to change behaviour, it is important to understand its cognitive drivers as our internal cognitive motives will interact with those external to us and shape subsequent behaviour.

In the first instance, we took note of the fact that regardless of whether they have environmental goals attached or not, the role of the borrower's behaviour in the success of microloans is in itself an important research topic. It is therefore important to distinguish between cognitive-behavioural aspects that extend beyond microloans with environmental objectives and those elements that are specific to environmental objectives. We explored this through the application of the Theory of Planned Behaviour. We clearly found that positive attitudes, subjective norms, and perceived behavioural control relating to adaptation and conservation behaviour led to greater intention to perform the said behaviour. Interestingly, we found that intentions significantly moderated subsequent behaviour in the treatment group where climate change information was provided. That such a simple solution can potentitally drive the adaptive investment behaviour in the context of microloans is a promising cost-effective solution. Overall this seems to indicate that microloans nurturing the development of positive attitudes, self-efficacy, and subjective norms through information dissemination can positively influence adaptive investment behaviour.

Qualitative data was also collected on climate change perceptions of the rural and coastal poor in Fiji. We found that whilst people were vague about what climate change was (generally seen as a change in weather) they did attribute it to anthropogenic causes (pollution and GHG's). However perceived solutions and responses to climate change revealed behavioural barriers. Coping strategies for the most part could be described as maladaptive, perhaps indicating that held mental models of climate change had gaps or constraints (such as viewing God as the cause rather than men). However that information was able to influence behaviour also suggests that it can correct mental schemas and induce action. Overall the findings supported knowledge deficit theory, showing that increased knowledge can positively influence behaviour.

Next we looked at how different microloan models and incentives influenced behaviour. The mode of enquiry required a novel experimental design. Drawing on incentive and decision making theories, a green microloan incentive condition was created which effectively penalised non-adaptive behaviour and rewarded adaptive investment decisions. The reasoning behind such a design was to evoke loss aversion as people are more sensitive to losses then they are to gains (Tversky & Kahneman, 1991). In addition a control condition (which was utilised in the previous study) and a dynamic incentive condition modelled on common microlending practice was specified. Here, a prominent finding was that behavioural intention significantly mediated adaptive investment behaviour in the green incentive condition with the probability of choosing adaptive portfolios being greater the non-adaptive under this condition. Ethnicity was also a prominent determinant of the antecedents of behaviour and of subsequent stated behaviour, with Fijians having a greater probability of positive internal drivers and making adaptive investment choices.

Lastly we looked at how perceptions of threat, resource dependence, and perceived severity of environmental and other issues impacting stated behaviour and its cognitive antecedents. Again, utilising the framework of the Theory of Planned Behaviour we found that certain types of climatic threats negatively impacted internal drivers (specifically having experienced cyclones). As with the previous study we found that in the presence of green incentives positive intentions were more so congruent with stated adaptive behaviour. Furthermore exposure to risk, resource dependence and severity of socio-environmental issues all influenced subsequent behaviour in different ways depending on incentive conditions. The findings offer a perspective on the uptake of non-adaptive and adaptive investment behaviours.

To summarise we found that those with a predisposition towards adaptive and protective behaviours also intend to behave in an environmentally protective and climate adaptive manner. However intention does not always reflect behaviour. We found that through the provision of information and green incentives, behavioural intention could be translated into the choice of more adaptive over non-adaptive stated microloan investment behaviour. Whilst we found that perceived risk, resource dependence, perceived severity, and demographic factors are also determinants of subsequent stated behaviour, we ultimately conclude that microloans with environmental incentives were shown to effectively increase the probability of choosing adaptive over non-adaptive investments and as such has the potential to increase adaptive capacity by creating value around good behaviour. Indeed we can further argued that green incentives crowded-in internal motives to behaviour in an environmentally protective manner.

Wilson (1999) conceives the origin of moral instinct as rising from the dynamic relationship between cooperation and defection. At the same time our cognitive structures have evolved so that we can navigate this dynamism such that we can create future orientated mental scenarios. For some, this ability to essentially 'mentally time travel' is described as a defining trait of our species (Suddendorf & Corballis, 2007), however there is evidence that Scrub Jays may also do the same (Raby, Alexis, Dickinson & Clayton, 2007). Such a trait enables us to organise our actions so that we may reach our best possible future. From a game theoretic perspective, the prisoners dilemma would say that the best possible outcome when faced with a moral problem of defecting or not would be to cooperate.

Cooperative strategies have an evolutionary basis enabling Darwinian genetic fitness. As such genes which predispose cooperative behaviour would prevail in the cultural evolution of our species (Wilson, 1999). When seen in conjunction with our qualitative study that found mental models of climate change were not exactly accurate, it could be inferred that the introduction of green incentives and of information can re-frame climate change and conservation as a moral dilemma by putting forth defection and cooperation clauses. It does so by introducing an indication of how different investment behaviours can impact one's ecosystem, which could ultimately harm their community and the wider environment. In this study, the finding that Fijian's cognitive appraisal of environmentally protective behaviours was generally more positive and that they were more inclined to adaptive behaviours, could be an indication of such moral reasoning where cooperation (for the good of the community rather than the family unit) is perhaps viewed more so as strength. From the perspective of the 'looking glass self' (Cooley, 1902) which states that our self-representations are affected by the evaluations that others have of us, within a collectivist community as evident in Fiji, we would expect that if the cultural norm is one of conservation then there would be a strong incentive to cooperate with the norm and opt for adaptive investment options.

In addition by offering limited choice set of investment choices and green incentives could present people with simpler decision frameworks. In effect people are able to simplify choices in terms of pecuniary and non-pecuniary losses and gains (Kamenica, 2008). When viewed under loss aversion which is an innate desire to avoid situations which threaten our physical and mental wellbeing, the simplest choice becomes that which minimises present and future losses. Bénabou and Tirole (2002) note that for an intrinsically motivated person, extrinsic incentives could be a detriment to ones internal drive to engage in a behaviour. Moreover, if a person lacks self confidence in their own ability to perform a task, than a monetary reward could further impinge on their perceived ability. However we have found that if incentives are well designed, than they need not crowd-out intrinsic motivations but instead may bolster them by presenting people with effective response options.

For a complex problem like climate change, when looking at vulnerable populations in developing countries we must consider their understanding of the problem and its solutions. In our sample, we found that people's conception of solutions were generally lacking. However microloans are able to be a novel way in which to offer a constructive solution and as such increase cognitive coping schemas and adaptive capacity.

12.2 POLICY CONTRIBUTION

Gowdy (2008) notes that "climate change policy should begin with identifying the incentives for selfish behaviour in the "atmospheric commons" and then finding ways to minimize this behaviour and maximize incentives for cooperative solutions" (p637). When looking at policy recommendations, economists generally offer insights based on the rational-actor model of behaviour. In contrast, behavioural economists and psychologists would offer recommendations that start with the viewpoint that humans do not obey the laws of rational choice theory (Gowdy, 2008). Such a starting point opens the policy conversation to explore more realistic models of human behaviour as thus forming appropriate responses to climate change. Rational choice based models however have been the kindling to the irrational agent perspective. Without it, we may still be in the neo-classical position of methodological individualism.

The roots of rational choice theory are uncertain, however its position in economic theory was secured in Hobbes' (1928) Leviathan in 1651. Here we were given a solution to bring order to the chaos of human behaviour. The model has gone on to influence positive and normative political theory and remains a backbone to economic thought. In the last century however empirical tests have shown that the model is lacking (Oppenheimer, 2010) with Sen (2002) stating "it is important to reclaim for humanity the ground that has been taken from it by various arbitrarily narrow formulations of the demands of rationality" (p.51) Ostrom (1998) and her work on collective action found that the predictions of some rational thought models (namely the prisoners dilemma) did not hold. She found that individuals can achieve better than rational results through cooperative behaviour. In her behavioural theory of collective action she puts reciprocity, trust and reputation as critical elements in understanding behaviour. Her work on common property problems and institutional design has gone on to have a major impact in policy and institutional design.

In psychology, Kahneman and Tversky (1979) challenged one of the key elements of the rational agent model – that of consistency of choice. This assumed that evaluation of choices is not affected by the way in which they are presented. However in prospect theory (Kahneman & Tversky, 1979) the framing effect has shown that how a choice is presented may in fact change ones frame of reference which in turn will impact payoff decisions. Indeed we found that framing incentives in terms of environmental objectives and monetary and non-monetary incentives elicited different results. Through empirical examination, prospect theory has become a useful tool in explaining risk behaviour in different policy regimes (Levy, 1997; Mercer, 2005).

Whilst there is a growing interest in interdisciplinary research, there remains a limited application of psychological models of behaviour in the Global South regarding climate change adaptation behaviour. Applying such behavioural models within such contexts is important to better understand the drivers of the climate adaptive behaviour in the Global South. On another level, applying models such as the Theory of Planned Behaviour within such a context is important for determining external validity and ultimately widening the scope of its application. If successful, such models can be a very useful policy and project design tool when looking at climate change adaptation behaviour.

As Duflo and Banerjee (2008) state: “effective policy-making requires judgements about the efficacy of individual components of programs, without much guidance from a priori knowledge, however, it is also difficult to learn about these individual components from observation (i.e. non-experimental) data” (p.153). The research presented here employed an experimental deign to better understand the drivers of climate change adaptation microloan investment behaviour through a psychological framework. Regarding policy this research is able to give a few clues to climate change adaptation, and microlending policy. We found that:

a) Intrinsic motivation is an important determinant of behaviour and can be positively manipulated through extrinsic incentives.
b) Absolute income is not the only driver of behaviour. To change human behaviour you must consider cognitive drivers.
c) Context matters and incentives can influence the framing of reference and subsequent responses.

In addition it provides a valuable summary for policy makers on the challenges that SIDS face and an indication of some of the responses available to SIDS smallholders in becoming climate change resilient. Designing policy initiatives that are congruent with internal motives for SIDS smallholders could facilitate uptake of adaptive behaviours such as Climate Smart Agriculture. Whilst incentivised microloans could be a delivery mechanism for Climate Smart Agriculture.

12.3 LIMITATIONS AND FUTURE DIRECTIONS

A general model limitation was that of sample size (n=205). The small sample size limited subsequent analysis (the use of more complex multinomial logits and

Structural Equation Models) and generalisability of the findings to different contexts. The research was focused on SIDS, as they are a high priority area for climate change adaptation, with their unique ecosystems, remote locations and high vulnerability to the impacts of climate change. At the recent UN Conference for Small Island Developing States which was held in Apia, Samoa on September 4th, 2014, the need for action on climate change was the dominant theme. Member states reaffirmed commitments to help SIDS in achieving mitigation and adaptation targets. Critical partnerships between governments, international organisations and other major groups were forged in order to invest in and support SIDS in the vision of a sustainable future. Novel solutions such as that introduced in this thesis can be an important tool to meet such objectives whilst the insights from this thesis can be useful for policy formation.

The cultural, social, economic and environmental similarities that exist between SIDS (UNFCCC, 2005) does bode well for the external validity of the thesis. However as microloans for ecosystem-based adaptation is not limited to the context of SIDS extending the research to other contexts would be useful. A future direction could be to replicate the study at Busara experimental economics laboratory whose sample consists of residents from the Kibera slum in Nairobi. Here microloans can be focused on enhancing the capacity for climate change adaptation in slum dwellers. Honing the survey and experimental design and creating a mobile game application is another route which would be of utility to capture agent responses on the field. This would be a method to improve data collection and perhaps enable a wider sample.

In addition, it is important to note that the derivatives of Structural Equation Models, as those used within this thesis, cannot prove casual relationships without meeting the conditions of time precedence and robust relations in the presence and absence of other variables (Lei & Wu, 2007). We can instead say that our null hypothesis was rejected and that variables were correlated rather than infer causality without a true experimental design. Increasing sample size, and including longitudinal data, and real monetary consequences would be a future direction to pursue. One way this can be achieved may be through following Giné and colleagues (2010) method of setting up an experimental economics laboratory where experiments can be run over several months.

By not including real monetary consequences in survey based experiment the research cannot reflect actual behaviour. The exchange of real money at the end of each lending period would have led to better representation of real world choices and therefore could potentially have increased the validity of the research.

As with any self-report based instrument an additional concern over the three studies is that of response bias and in particular the problem of consistency motifs (Podsakoff et al, 2003). Here respondents attempt to maintain consistency by organising their responses in a consistent manner which may not be reflective of real life situations. Another common method bias could be that of item priming. It could be that by delivering the survey instrument prior to the survey-based experiment, subsequent adaptive investment behaviour was primed. These concerns could potentially be controlled through a longitudinal study design where surveys are administered on day one and the framed field experiment with real monetary consequences taking place on succeeding days.

In addition, the design of incentives would have benefited from further conditions where 1) rewards on adaptive investments are maintained however no constraints are placed on non-adaptive investments. 2) no information on ecosystem impacts is given 3) no rewards are given for adaptive investments but non-adaptive investments come with a cost. This would be an interesting future direction as it can elicit better understanding of contextual inference and loss aversion which will help develop better incentives. Without the looming prospects of a loss would people have still favoured the adaptive investment or would we have seen a different result altogether?

Lastly the mental burden of calculating returns in investment did mean that we lost some useful data. However this did not impede the quality of results as we were aware of whether returns would be negative or positive (as specified by climate elements). Whilst this thesis did not make use of this data, there remains scope for additional papers from this information. That respondent's were not comfortable with doing the calculations and preferred to make a choice based on whether returns were negative or positive would be considered in future designs.

12.4 FINAL REMARKS

We saw in Chapter 2, that SIDS and smallholders in particular are amongst the most vulnerable to the impacts of climate change. SIDS realise the uncertainties surrounding climate change projections, and that adaptation can be costly and requires a change in societal norms and behaviour. A no-regrets principle is needed in order to make effective use of the resources at hand. The UNFCCC (2005) identify weak institutional capacity and limited financial resources as key constraints to building adaptive capacity in SIDS. The lack of well-structured institutional frameworks which can implement climate change adaptation across sectors and scales will hinder adaptation. Whilst limited financial resources means that adaptation can divert development aid from other key socio-economic priorities. As such novel solutions to building adaptive capacity need to be sought. We have shown that microloans with the right design principles may be able to increase adaptive capacity.

With anthropogenic climate change, the threat to some low lying islands is that of cross-scale extinction; whole unique habitats with millions of year's worth of genetic data, and socio-cultural identities may one day only exist as memories within history books. But hopefully this will not come to pass as such a loss feels too great. However what is evident now is that these island ecosystems are already feeling the effects of climate change. More extreme climatic events not only threaten livelihoods but also can induce psychological distress (Ahern et al, 2005). To protect these vulnerable nations it is essential to pursue adaptation with vigour. The complexity of climate change requires cross-scale adaptation involving networks across different levels to work together in order to develop appropriate cross-level responses. Here we have examined microloans for ecosystem-based adaptation as one aspect of such a cross-scale response. Those of us who come from the islands are underrepresented in the global arena. We have little voices and, for the most part, shallow pockets.

During the UNFCCC 21st Conference of the Parties (COP21), which was widely acknowledged as the last opportunity to take action against anthropogenic climate change, SIDS and the Vulnerable 20 were amongst the most inspiring. With dedicated resolve they fought for nothing less than 1.5^{o}C to survive, and indeed they majority of countries (106) endorsed this target. Whilst 1.5^{o}C was not in the text, the target of well below 2^{o}C of warming with a ratcheting mechanism is better than at 2 ^{o}C or below 2.5 ^{o}C. For SIDS the reality is that they are at the forefront of climate change. As it is now, they are already experiencing an exponential increase in loss and damage. Cyclone Winston in Fiji in February 2016 is a perfect example. The cost of the cyclone is still being tallied but initial estimates are upwards of F$1 Billion with the loss of 80% of sugar cane crops in Viti-Levu (ABC News, 2016).

In these countries smallholders form the majority of farms. For agriculture to become resilient to the ever increasing pressures of climate change adaptation must be pursued with haste. At COP21, agriculture was on the agenda for the first time. Concepts like climate smart agriculture were presented as solutions – and mechanisms for financing envisioned. It was noted that whilst there are hundreds of funds operating in the agricultural sector, especially in the developed world context, most focus on large to medium-scale agriculture. The small and micro-scale farms synonymous with smallholders, and which still form the majority of rural agriculture in the developing world, is under represented by funds and often dependent on effective microfinance operations in the locality. Financing adaptation for smallholders can be troublesome with, for instance, some barriers being: land ownership, access to education and training, entrenched and sometimes unsustainable cultural practices, access to appropriate technologies and certification schemes (such as Rainforest Alliance, Fairtrade, and Organic). The focus during COP21 on agriculture and the Sustainable Development Goal's targets relating to food security and climate change has stimulated support for smallholder agriculture funds, with the largest being the FAO's ASAP fund. Alternative investment structures have also been proposed such as structured finance which brings together an array of actors, creating different risk layers to suit different investor needs and technical assistance for investees to mitigate risk. To reach the 'last mile' end of the pyramid populations microfinance and micro-insurance become important delivery mechanism for adaptation finance and initiatives such as Climate Smart Agriculture.

For SIDS moving forward from COP21 and commencing to implement adaptation strategies will be difficult. That's why looking at instruments such as microloans to reach local levels is useful. Indeed microfinance even made it into the COP21 draft Paris Outcome text of March 9th: "55[(b) Establish a financial technical panel to explore approaches for:… (ii) Providing support for microfinance initiatives]" (UNFCCC, 2015). Whilst this was not in the final text, it does show that conversations around the utility of microfinance as a delivery mechanism were being had.

The Paris Agreement and the Sustainable Development Goals are the types of multilateral commitments that usher a sea change in the way we envision our future. For SIDS such developments could not arrive a moment too soon. The urgency to adapt means that policymakers and implementers need to act with well conceived projects. To preserve the future of smallholders, to establish food security, and to protect the interests of the poorest and most vulnerable amongst them, SIDS need to create climate resilient communities.

Ill conceived initiatives may do more harm than good. For instance microfinance in its popularized Grameen form has limited utility for a countries sustainable development trajectory. When loans are used to smooth consumption or crowding the market with another untrained and unsupported entrepreneur, we are not investing in developing the human capacity needed for sustained and real growth. If done right however microloans are certainly a useful tool in the sustainable development toolkit, incentivizing desired for behaviours. The time sensitive nature of implementing adaptive measures in SIDS means that understanding the utility of such tools in driving human behaviour can lead to more efficient project designs. The psychosocial perspective presented in this thesis enables us to understand the internal motives of stated adaptive microloan investment behaviour. In doing so it offers a way in which to understand human behaviour, by retaining the human in the equation.

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13 APPENDIX A

Relevant Survey Questions

	Household Demographics
1	How many people are in your household?
2	What is your Age
3	Gender
4	Are you the head of your home?
5	Marital Status
6	Level of Education
7	Main Occupation
8	Social Status
9	Income
10	Credit Participant
11	Participation Status
12	Type of Credit
1	*No each person in the household from 1 to 20*
2	*Age= 0-110*
3	*M= Male; F= Female*
4	*1= Head of HH; all others relate to relation to HH Head: 2= Spouse; 3= Child 4=Grandchild; 5= Great Grandchild; 6= Brother/Sister; 7= Relative; 8= Boarder; 9= Other (Please explain)*
5	*1=Married; 2=Single; 3=Widowed; 4= Divorced; 5= Separated; 6= Defacto*
6	*1= No schooling; 2= Some primary school; 3= Completed primary school; 4= Some secondary school; 5= Completed secondary school; 6= Literacy campaign;* 7= Microfinance training (Please explain); 8= Other(please explain)
7	*1= Farmer or Family farm worker; 2= Domestic work (incl housewife); 3= Manual work (builder/mason/carpenter etc); 4= Tailor; 5= Weaver; 6= Craftworker; 7= Blacksmith; 8= Foodseller; 9= Driver/mechanic; 10= Skilled factory worker; 11=Teacher; 12= Health worker; 13= Govt worker; 14= Soldier; 15= Religious worker; 16= Student at school; 17= Child helping with domestic/farm work; 18= Child too young to help; 19= Not in labour force; 20= Other (Please explain)*
8	*1= Chief; 2= Clergy; 3= Other (Explain)*
9	*1= 0-10/day; 2= 11-20/day; 3= >21/day*
10	*1= no participation; 2= Participation*
11	*1= Active; 2= Non active; 3= dropout*

12	*1= Women's association; 2= NGO; 3= ROSCA; 4= Bank; 5= Cooperative; 6= Moneylender; 7=* Family/friends; 8= Other___(specify)

	Health Status	
13	Healthy	Y | N
	Malnourished	Y | N
	Dehydrated	Y | N
	Dengue Fever	Y | N
	Aids	Y | N
	Diabetes	Y | N
	Age related disability (explain)	Y | N
	Other (Please explain)	Y | N

	Land Ownership	
14	Own Land?	Y | N
15	Owned Since	
16	Rented out	Y | N
17	If rental land, When was land rented?	
18	Who from?	

14	*Circle Y or N*
15	*mm/yyyy*
16	*Circle Y or N*
17	*mm/yyyy*
18	*1=Govt; 2=Chief; 3= Indian; 4= Fijian; 5= Other (Explain)*

19 Which area do you live in?

19	*eg: Suva, Viti Levu*

	Do you live close to:	*Circle*	*Name*
20	Forest	Y | N	
21	Mangroves	Y | N	
22	Coast	Y | N	

20	*If yes then what is the name of the forest/coastal area?*

Livestock and domestic animals

	23	24	25	26	27
	Sheep	Cattle	Horse	Bees	Poultry
How many					
Annual Income					
	28	29	30		
			Other		
How many	Goat	Dogs	(explain)		
Annual Income					

23-
30 *enter amount 0 to 1000 and approx annual income $*

31 How many months did your livestock produce last season?

Crop Cultivation

32-					
43	*Circle Yes (Y) OR No (N)*	32	33	34	35
	for each crop.	Dalo	Cassava	Yaqona	Yams
32-					
43	Circle season crop cultivated	Y | N	Y | N	Y | N	Y | N
	: Dry (D) or Wet (W)	D | W	D | W	D | W	D | W
		36	37	38	39
		Vegetables	Fruits	Ginger	Root crops
		Y | N	Y | N	Y | N	Y | N
		D | W	D | W	D | W	D | W
		40	41	42	43
					Other
		Coconuts	Sugarcane	Copra	(explain)
		Y | N	Y | N	Y | N	Y | N
		D | W	D | W	D | W	D | W

Marine Fisheries

		Yes or No?	Month
44	Finfish	Y | N	
45	Beche-de-mer	Y | N	
46	Octopus	Y | N	
47	Seaweed	Y | N	
48	Lobster	Y | N	
49	Mud Crab	Y | N	

50	Bivavle Molluscs	Y | N
51	Prawn/Shrimps	Y | N
52	Corals	Y | N
53	Seaslug etc	Y | N
54	Other (state)	Y | N
55	Other (state)	Y | N
56	Other (state)	Y | N
57	Other (state)	Y | N
58	Other (state)	Y | N
44-58	*Circle Yes (Y) OR No (N) and number months caught/collected in: 1=Jan; 2=Feb; 3=Mar; etc*	

59 How many months did your food production last *(0-24)*

	Income	total Income % (0 - 100%)	Household Members responsible for income generating activity
60	Local labour		
61	Migratroy labour		
62	Sale of crops		
63	Sale of livestock		
64	Non Plant Marine life (fish, molluscs etc)		
65	Mangroves		
66	Corals		
67	Plant based marine life		
68	Sale of livestock produce		
69	Petty trade		
70	Sale of natural resources - forest plants		
71	Sale of natural resources - forest wood		
72	Sale of natural resources - forest animals (Specify)		
73	Remittances/gifts		
74	Self employment Crafts		
75	Self employment Other (specify)		
76	Other (specify)		
60-76	*Approximate percentage of total income*		
60-	*1=Home Owner; 2=Spouse; 3=Sibling; 4=Grandparents; 5=Cousin; 6=Children; 7=Other (Explain)*		

76	

A	**Reliance on non agricultural forest products by season**					
		No reliance	Very little reliance	Some reliance	Very reliant	Completely reliant
77	Dry	1	2	3	4	5
78	Wet	1	2	3	4	5

B	**Reliance on marine products by season**					
		No reliance	Very little reliance	Some reliance	Very reliant	Completely reliant
79	Dry	1	2	3	4	5
80	Wet	1	2	3	4	5

C	**Reliance on Food Aid by season**					
		No reliance	Very little reliance	Some reliance	Very reliant	Completely reliant
81	Dry	1	2	3	4	5
82	Wet	1	2	3	4	5

77-82 *ASK: On a scale of 1 to 5 with 1 being no reliance and 5 being completely reliant, can you describe how reliant you are on a,b,c?*

77-83 *circle number the best describes your reliance for each season*

	Ease of Access to Drinking Water	*Circle*
83	**Do you have access to drinking water in your home?**	Y | N
84	If yes then is it reliable	Y | N

85 **If no then where do you access water from?**

85 *1= Village tap; 2=River; 3= Pond/Pool; 4= Rain water collection; 5= Forest; 6= Mountain; 7= Underground reservoir*

Adverse Events

In the last year have you experienced:

		Circle	About when was this?
86	Flood	Y | N	
87	Drought	Y | N	
88	Season came late	Y | N	
89	Season came early	Y | N	
90	Cyclone	Y | N	
91	Hurricane	Y | N	
92	Disease (Plants)	Y | N	
93	Disease (Animals)	Y | N	
94	Illness/death (human)	Y | N	
95	Other (explain)	Y | N	
96	Other (explain)	Y | N	
97	Other (explain)	Y | N	

86-97 Circle yes or no for any event that has affected livelihood in the last year and state when it occurred (mm/yyyy)

Expenses

Approximately how much do you spend on 98-108 by month and year?

Are any paid via loans?

		$/Month	$/Year	Paid via Loan? (Y/N)
98	Food			
99	Health			
100	Farm/marine investments			
101	Microenterprise investments			
102	Housing maintenance/building			
103	Rent			
104	non religious social obligations *(investing in community)*			
105	Personal social obligations *(Marriage/birth/death etc)*			
106	Religious obligations			
107	Loans to family/friends			
108	Interest repayments			

98-108	*write approx amount by month and year, circle Yes or No for whether it is paid by loan*

Credit

These next questions ask about your access to credit

109	Do you have access to credit facilities?	Y | N
110	Name of Loaning body	
111	Type of Collateral	
112	What was loan used for?	
113	Date of loan	
114	Size of loan	
115	Borrowing limit	
116	Current loan	Y | N
117	Repayment period	
118	Loan length	
119	Repayment conditions	
120	Interest rate	
121	Access to savings	Y | N
122	Access to insurance	Y | N
123	Access to other banking services	Y | N

110	*Name*
111	*a: social; b: environment; c: assets*
112	*a: social; b: infrastructure (water, toilets etc); c: Alternative livelihoods (please explain); d: maintaining current livelihoods (please explain); e: buying food; f: medical care; g: personal spending (clothes, household items); h: education; i: repaying other loans;*
113	*mm/yyyy*
114	*F$*
115	*F$*
117	*a: weekly; b: every two weeks; c: monthly; d: other (explain)*
118	*mm/yyyy - mm/yyyy*
119	*list any conditions placed on type of activities allowed under loan*
120	*%*

Training

124	Any Training Given?	Y | N
125	Type of Training/ed	

125	*a; relating to managing loan*

b; relating to creating alternative trade based livelihoods

c; relating to other education

d; relating to sustainable use of environment

e; relating to general environmental education

Severity of Problems 'adapted from Chokor'

			Perceived Cause	Solution
128	Poor division of land	Y | N		
129	Land Scarcity	Y | N		
130	Water scarcity	Y | N		
131	Drought	Y | N		
132	Conflict between people and animals	Y | N		
133	Conflict over land	Y | N		
134	Infertile soil/land degradation	Y | N		
135	Destruction of forests	Y | N		
136	Air Pollution	Y | N		
137	Water Pollution	Y | N		
138	Land Pollution	Y | N		
139	Forest/Bush Fire	Y | N		
140	Flooding	Y | N		
141	Poor crop yields	Y | N		
142	Plant pests and disease	Y | N		
143	Monocropping - planting only one crop	Y | N		
144	Poor housing and hygiene	Y | N		
145	Sickness	Y | N		
146	High cost of living	Y | N		

147	Crime/insecurity	Y | N
148	Poverty	Y | N
128-148	*Do you think (128-148) is a severe problem facing Fiji today? What do you think is the cause of this problem? Do you have a solution? Perceived cause and solution are open questions for respondents.*	

149	Please list any species (plant and/or animal) that you think is region	at risk in your
	List:	
150	What do you think of this species?	
151	Why do you think it is at risk?	

The following questions are all recorded on a scale of 1-5. Be as honest as possible
No one will judge you AND there are no right or wrong answers.
Forests also include mangroves
1 Strongly disagree, 2 Disagree, 3 Neutral, 4 Agree, 5 Strongly Agree

Attitudes Towards Conservation (ATC)						
152	The forest/river is sacred	1	2	3	4	5
153	Taking care of the forest/river is important for future generations	1	2	3	4	5
154	The forest/river should be used by men as they see fit	1	2	3	4	5
155	The forest/river does not belong to men	1	2	3	4	5
156	It is my duty to protect the forest/river	1	2	3	4	5
157	I will not harm the forest/river species because they are protected	1	2	3	4	5
158	I would stop others from hunting/poaching the forest/river species	1	2	3	4	5
New Environmental Paradigm (NEP)						
159	The balance of nature is very delicate and easily upset	1	2	3	4	5
160	The earth is like a ship floating in space with only limited room and resources	1	2	3	4	5
161	There are limits to economic growth even for developed countries	1	2	3	4	5
Subjective Norms (SN) towards conservation						
162	My family finds it important to protect the forest/river	1	2	3	4	5
163	My community finds it important to protect the forest/river	1	2	3	4	5
164	Our neighbouring communities find it important to protect the forest/river	1	2	3	4	5
165	The authorities (government) find it important to protect the forest/river	1	2	3	4	5

166	Our elders find it important to protect the forest/river	1	2	3	4	5
167	The young find it important to protect the forest/river	1	2	3	4	5
168	My family's approval of my treatment of the forest/river is important to me	1	2	3	4	5
169	My communities approval of my treatment of the forest/river is important to me	1	2	3	4	5
170	The opinion of others outside my family/community on my use of the	1	2	3	4	5
	forest/river is important to me	1	2	3	4	5
Perceived Behavioural Control (PBC)						
171	I feel I can control the upkeep of the forest/river	1	2	3	4	5
172	I do not feel like I have any control over how to use the forest/river positively	1	2	3	4	5
(PBC) Efficacy to perform						
173	It is easy to live in a way that does not hurt the forest/river	1	2	3	4	5
174	I do not feel that I have the ability to protect the forest/river	1	2	3	4	5
175	It is easy for me to look after the forest/river	1	2	3	4	5
176	It is too great a task to survive and care for the forest/river	1	2	3	4	5
Behavioural Intention(BI)						
177	I expect to respect and sustainably use the forest/river	1	2	3	4	5
178	I want to respect and sustainably use the forest/river	1	2	3	4	5
179	I intend to respect and sustainably use the forest/river	1	2	3	4	5
Self Construal						
180	The wellbeing of my family is more important then my own	1	2	3	4	5
181	The wellbeing of my village is more important then my own and my families	1	2	3	4	5
182	The wellbeing of the earth is most important	1	2	3	4	5
183	The feel happiest when I am surrounded by nature	1	2	3	4	5
184	I feel happiest when I am surrounded by family	1	2	3	4	5
185	I feel happiest when I am surrounded by friends	1	2	3	4	5
186	I feel happiest when I am alone	1	2	3	4	5

We will now do a short exercise where we order what we think is important for well-being for humans and animals. You have a list of items infront of you, and I will go through each and explain it. Please order the items according to importance with 1 being most and 10 being least (H=Humans, O=Other Species)

Extracted from Nussbaum (2006)	RANK 1-10
Capabilities List for Non-Human Animals	H | O
1. *Life.* Being able to live a life of normal length (for that species); not dying prematurely.	|

2. *Bodily health* . Being able to have good health which includes reproductive health, adequate nourishment and adequate shelter .

3. *Bodily integrity.* Being able to move freely from place to place; being able to be secure against violent assault, including sexual assault, whilst also have the opportunity for those physical processes which come naturally to the species.

4. *Senses, imagination, thought.* Ensuring animals have access to those situations that give them pleasure, such as a pleasing, environment which implies protecting animal environments. In addition it implies banning those activities which cause unnecessary pain on non-human species, such as hunting. Being able to use the senses, to imagine, think, and reason—and to do these things in a "truly human" way, a way informed and cultivated by an adequate education. Having freedom of speech and thought.

5. *Emotions.* Realising and respecting the wide array of emotions evident in non-human species and not engaging in activities that purposefully invoke negative emotions. In humans being able to love, to grieve, to experience longing, gratitude, and justified anger.

6. *Practical reason.* Being able to engage in critical reflection about the planning of one's own life as is appropriate for the species.

7. *Affiliation.* Being able to form attachments and to form bonds and interrelationships. Being shown respect and dignity for your humanity and that of the species

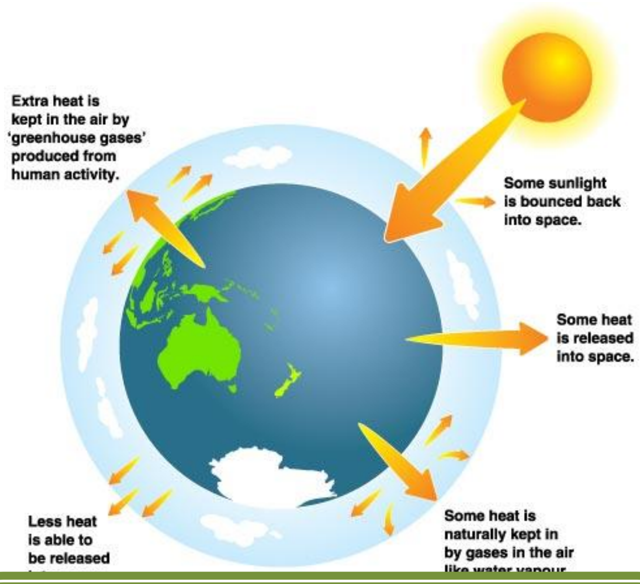
8. *Other species.* Being able to live with concern for and in relation to other animals and the natural world

9. *Play.* Being able to play, laugh and enjoy fun activities

10. *Control over one's environment.* Respecting non-human animal's territorial environments be it in a domestic or wild setting. Being able to participate in political choices, being able to own property, have property/land rights, working in with equality

Information Leaflet

Climate Change is caused by human activities like driving cars, farming, burning coal and cutting down forests. These activities produce greenhouse gases – mainly carbon dioxide, methane and nitrous oxide. These gases gather in the atmosphere wrap around the earth and trap the sun's heat. This makes the world's climate heat up, known



In Fiji you can see climate change in higher temperatures, sea level rise, ocean acidification (which kills corals and other marine life), more intense cyclones, droughts, floods, disease and less availability of fresh water.

What this WWF Climate Witness is experiencing right now

- "Water shortage has always been a part of our lives on Kabara, however **in more recent years we have noticed that our normal dry season seems to have extended and the weather during this period is far drier.** This not only affects how much water we have available to use for our daily needs, but also our gardens."
- **"...the sea is slowly eroding our coastline and spreading the sand over our fishing grounds.** The seagrass beds have also spread quickly, clogging up the natural flow of water within the fishing grounds and burying the coral."
- **"There also used to be colourful, live coral from the edge of the beach out to the reef. But now everything has gone white."**

So what can you do? You need to adapt to climate change and protect against more change by looking after the forests.

In Fiji, cutting down forests (and mangroves), slash and burn agriculture and pollution are big problems that cause water pollution, soil erosion, drought and the loss of species. Forests are important to you because they regulate climate, provide natural pest control, they make soil healthier, prevent erosion and also absorb flood water. Mangroves not only act as a natural sieves preventing rubbish from being washed out to sea but also absorbs pollution. They also are important for reef fisheries (giving species a place to grow). In addition mangroves and other types of forests are important sources of firewood and building material.

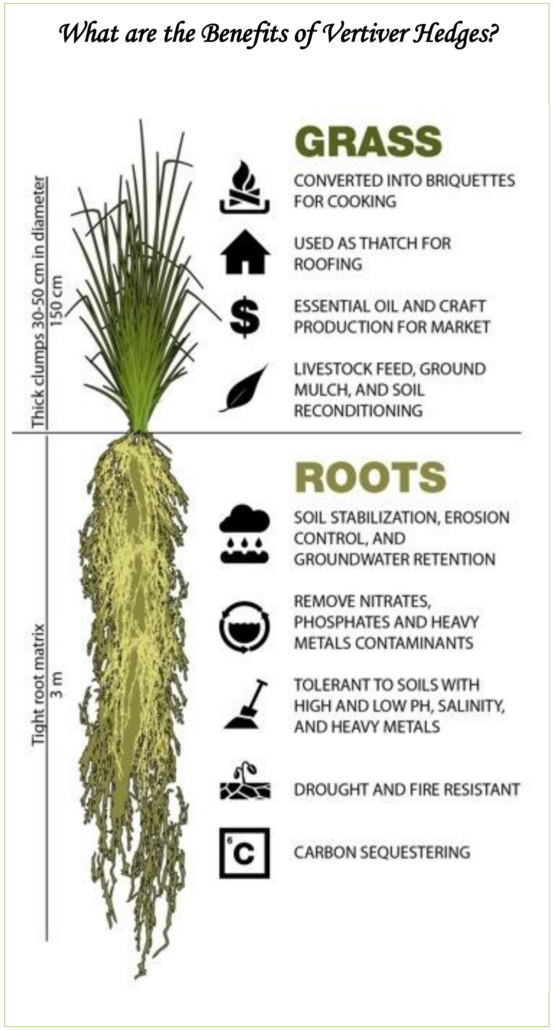
What can we do?

- Plant mangroves, and trees – to restore habitats
- Practice sustainable farming – for example, less use of chemical pesticides and fertilisers, water management, planting more then one crop, using special seeds that are able to withstand climate changes.
- Planting native species
- Planting Vertiver Grass Hedges
- Beekeeping

The following were presented as information cards to help understand investment components.

Why Mangroves?

- Home for fish and crustaceans
- Protection from coastal erosion, sea level rise, storms, floods.
- Extra income from for instance selling mudcrabs and tapas
- Tourism
- Timber and other products like dye for tapa, medicines, fish traps and nets
- Helps coral reefs and coastal forests
- Clean water



ADAPTIVE INVESTMENT

RESILIENT SEEDS	VERTIVER HEDGES	MANGROVE SEEDLINGS
Root, fruits and vegetable crops that withstand droughts and cyclones	Protects your crops and healthy soil	Protection against cyclones, floods, and provides marine resources

ORGANIC FERTILISER	BAD SEASON 4-6	GOOD SEASON 1-3
Healthier soil and plants in long run	$120	$120

THE ADAPTIVE INVESTMENT IS BETTER FOR THE ECOSYSTEM AND WILL PROTECT YOUR FORESTS AND RIVERS

ECOSYSTEM EFFECT SCORE:
6 :)

MIXED INVESTMENT

RESILIENT SEEDS	~~VERTIVER HEDGES~~	MANGROVE SEEDLINGS
Root, fruits and vegetable crops that withstand droughts and cyclones	Protects your crops and healthy soil	Protection against cyclones, floods, and provides marine resources

CHEMICAL FERTILISER	BAD SEASON 4-6	GOOD SEASON 1-3
Less healthy soil in long run but could have better yield	$75	$225

THE MIXED INVESTMENT IS NOT AS SUSTAINABLE AS THE ADAPTIVE INVESTMENT BUT CAN PROTECT YOUR NATURAL ECOSYSTEMS

ECOSYSTEM EFFECT SCORE:
3 :|

NON-ADAPTIVE INVESTMENT

RESILIENT SEEDS	~~VERTIVER HEDGES~~	~~MANGROVE SEEDLINGS~~
Root, fruits and vegetable crops that withstand droughts and cyclones	Protects your crops and healthy soil	Protection against cyclones, floods, and provides marine resources

CHEMICAL FERTILISER & PESTICIDES	BAD SEASON 4-6	GOOD SEASON 1-3
Less healthy soil in long run but could have better yield	$0	$300

THE NON-ADAPTIVE INVESTMENT IS NOT PROTECTECTIVE OF YOUR NATURAL ECOSYSTEMS

ECOSYSTEM EFFECT SCORE:
0 :(

Survey-Based Experiment




IMAGINE THAT YOU ARE A FARMER WITH THREE INVESTMENT CHOICES.

Instructions: You will play a total of 3 individual liability and 3 joint liablility games. (a two -player game) . Each game'has two periods. Each period has 8 rounds. In each period you are given a $300 microloan to invest in either A,B or C. In each round a dice is rolled to decide what type of seasonyou will have (1,2,3 = Good Season, 3,4,5 = Bad Season). Depending on the climate and your investment choice, you will make or lose money and have different impacts on the environment. Each round you must keep note of how much money you have made or lost.

Loan Size:	$300
Interest	20% (flat) = $60
Repayment schedule	Monthly over 8 months therefore: $45/month

			Return	
	You Investment Choices are: (explain in detail)	**Ecosystem Effect (EE)**	**Good Season (Dice roll 1,2,3)**	**Bad Season (Dice roll 4,5,6)**
A	Vertiver hedge, organic fertiliser and seeds (mangroves, veg, plants)	Good - 6	120	120
B	Seeds (mangroves, veg, plants), Chemical fertiliser	Average - 3	225	75
C	Chemical pesticides and fertiliser	Adverse - 0	300	0

GAME 1 - Individual Liability

Control

	CLIMATE	Investment		Repayment	= Return
	1 2 3 4 5 6	A, B or C	-	-45	
Period 1) 1					
2					
3					
4					
5					
6					
7					
8					
Period 2) 1					
2					
3					
4					
5					
6					
7					
8					

Write amount made when dice is thrown

Write investment choice

You receive a microloan of $300 with a fixed interest of 20% each period. You have to slowly pay back your loan over 8 months. A month is represented by a 'round'. This means you need to pay back $360 over eight rounds ($45 per round = £360). The lender collects $45 when you finish each round if you are able to make your payment. If you don't have enough money that round, repayment is taken at the end of the 8th round.

GAME 4 - Joint Liability

Control

	Climate	Investment	-	Repayment	= Return	Player2 Investment Type	Returns
	1 2 3 4 5 6	A, B or C	-	-45		A, B or C	
Period 1)1							
2							
3							
4							
5							
6							
7							
8							
Period 2) 1							
2							
3							
4							
5							
6							
7							
8							

This time you and I both receieve a microloan of $300 dollars each which we have to pay back by the end of the period with 20% interest. Repayment of $45 is taken at the end of each round.

GAME 2 - Dynamic Incentive

IF Repayment is less then 45 **THEN STOP PLAYING**

You receive an individual microloan as before. However this time, if can't pay $45 in a round then you cannot procede to other rounds and must start again with a new microloan of $300 in period two.

	Climate	Investment		Repayment	= Return	
	1 2 3 4 5 6	A, B or C	-	-45		<$45 (Y/N)
Period 1) 1						Y | N
2						Y | N
3						Y | N
4						Y | N
5						Y | N
6						Y | N
7						Y | N
8						Y | N
Period 2) 1						Y | N
2						Y | N
3						Y | N
4						Y | N
5						Y | N
6						Y | N
7						Y | N
8						Y | N

GAME 5 - Joint Liability Dynamic Incentive

	Climate	Investment	-	Repayment	= Return	IF YES THEN STOP PLAYING	Player2 Investment Type	IF YES THEN STOP PLAYING	Total Group Returns
	1 2 3 4 5 6	A, B or C	-	-45		< 45 (Y/N)		< 45 (Y/N)	(P1 + P2 returns)
Period 1) 1									
2									
3									
4									
5									
6									
7									
8									
Period 2)1									
2									
3									
4									
5									
6									
7									
8									

You and I receive a microloan of $300 each. If one player is unable to make their $45 repayment, then the other must cover them. If both cannot then both have to stop playing.

GAME 3 - Green Microloan

This time we include the impact of the loan on the Environment (Ecosystem effect). If your investment choice has an impact on the

	Climate	Investment		Ecosystem Effect (EE)	Less than 3	If yes then Repay	If no then REPAYMENT	
	1 2 3 4 5 6	A, B or C	-	A (6), B(3) or C(0)	Y | N	-$46.5/-$62.5	-33.75	= Return
Period 1) 1					Y | N			
2					Y | N			
3					Y | N			
4					Y | N			
5					Y | N			
6					Y | N	EE<3 repayment Due		
7					Y | N			
8					Y | N			
Period 2) 1					Y | N			
2					Y | N			
3					Y | N			
4					Y | N			
5					Y | N			
6					Y | N	EE<3 repayment Due		
7					Y | N			
8					Y | N			

This time we include the impact of the loan on the Environment (Ecosystem effect). You receive a microloan of $300 as before. If your investment choice has an impact on the environment GREATER THAN 3 then you receive an interest free loan and must pay back only 90% of your principal ($270).If it is EQUAL TO 3 then your interest rate increases to 24% (46.5/month). If your impact is LESS THAN 3 then your interest rate increases to 25% and your repayment term reduces to 6 months (repay 62.5/month)

GAME 6 - Joint Liability Green Microloan

You and I receive a microloan of $300 each. Whichever player has a positive impact on ecocystems (MORE THAN 3) recieves an interest free loan of which only 90% of the principal or $270 needs to be paid back (at 33.75/round). Whichever player has an EE <=3 will have an increase in interest to 24% on the principal (@46.5/round). If either of your impact in any other round is LESS THAN 3 then both players repayment period decreases to 6 months.

	Climate	Investment		Ecosystem Effect (EE)	<=3	If yes then Repayment	If no then REPAYMENT		Player2 EE	Less then 3	If yes then Repayment	If no then REPAYMENT	
	1 2 3 4 5 6	A, B or C		A (5), B(3) or C(0)	Y/N	-46.5	-33.75	= Return	A (5), B(3) or C(0)	Y/N	-46.5	-33.75	= Return
Period 1) 1													
2													
3													
4													
5													
6						EE<3 repayment Due	EE<3 repayment Due				EE<3 repayment	EE<3 repayment Due	
7													
8													
Period 2) 1													
2													
3													
4													
5													
6						EE<3 repayment Due	EE<3 repayment Due				EE<3 repayment	EE<3 repayment Due	
7													
8													

17 APPENDIX E

Here you will find the measurement model coefficients and their associated R^2 values for the treatment (Table 17.1) and control groups (Table 17.2) from Chapter 8. The measurement model maps the scale measures to it s theoretical constructs. We see that the measurements models were similar across groups and fit the specified latent constructs.

TABLE 17-1: MEASUREMENT MODEL COEFICCIENTS – TREATMENT GROUP

Climate			β	S.E.	p	R^2
Attitudes Towards Conservation	→	A1	0.978	0.088	0.000	0.956
		A2	0.577	0.051	0.000	0.333
		A3	-0.412	0.075	0.000	0.169
		A5	0.764	0.047	0.000	0.583
		A6	0.667	0.067	0.000	0.445
		A7	0.490	0.038	0.000	0.240
		A8	0.420	0.079	0.000	0.176
		A9	0.459	0.077	0.000	0.211
		A10	0.367	0.062	0.000	0.135
Subjective Norms	→	S1	1.087	0.136	0.000	
		S2	0.697	0.063	0.000	0.485
		S3	0.607	0.060	0.000	0.369
		S4	0.563	0.053	0.000	0.317
		S5	0.536	0.045	0.000	0.288
		S6	0.614	0.068	0.000	0.377
		S7	0.804	0.060	0.000	0.647
		S8	0.693	0.052	0.000	0.480
		S9	0.527	0.054	0.000	0.278
Perceived Behavioural Control	→	P1	1.065	0.062	0.000	
		P3	0.372	0.051	0.000	0.138
		P4	-0.023	0.022	0.287	0.001
		P5	0.284	0.051	0.000	0.080
		P6	-0.476	0.045	0.000	0.226
Behavioural Intention	→	B1	0.857	0.038	0.000	0.735
		B2	0.774	0.021	0.000	0.599
		B3	0.692	0.035	0.000	0.479

TABLE 17-2: MEASUREMENT MODEL - CONTROL GROUP

Control			β	S.E.	p	R^2
Attitudes Towards Conservation	→	A1	0.914	0.089	0.000	-
		A2	0.647	0.049	0.000	0.419
		A3	-0.436	0.057	0.000	0.190
		A5	0.688	0.039	0.000	0.474
		A6	0.536	0.060	0.000	0.287
		A7	0.500	0.043	0.000	0.250
		A8	0.394	0.064	0.000	0.156
		A9	0.425	0.073	0.000	0.181
		A10	0.373	0.067	0.000	0.139
Subjective Norms	→	S1	1.116	0.084	0.000	-
		S2	0.776	0.046	0.000	0.601
		S3	0.504	0.057	0.000	0.254
		S4	0.596	0.060	0.000	0.356
		S5	0.441	0.029	0.000	0.194
		S6	0.667	0.065	0.000	0.445
		S7	0.825	0.040	0.000	0.680
		S8	0.665	0.036	0.000	0.442
		S9	0.526	0.047	0.000	0.277
Perceived Behavioural Control	→	P1	0.928	0.072	0.000	-
		P3	0.357	0.040	0.000	0.128
		P4	-0.023	0.022	0.288	0.001
		P5	0.239	0.040	0.000	0.057
		P6	-0.501	0.048	0.000	0.251
Behavioural Intention	→	B1	1.011	0.031	0.000	-
		B2	0.788	0.030	0.000	0.621
		B3	0.911	0.041	0.000	0.829

18 APPENDIX F

This section provides the results of the Multinomial Probit with WLSM estimator that was presented in the discussion section of Chapter 10. The model was just identified $\chi 2$ test statistics equal to the degrees of freedom. This means that the 'perfect' fit statistics we get (RMSEA=0; CFI=1) does not mean that there is no discrepancy between the sample and the model-implied covariance matrix, rather that there are not enough restrictions placed on the model H_1 model making it difficult to reject $H_{o.}$

						Predicted Probabilities				
		β	S.E	p		Adaptive	M A	Mixed	M N-A	Non-Adaptive
No Incentive ←	Behavioural Intention	0.093	0.166	0.573		0.048	0.613	0.510	0.744	0.165
	Perceived Behavioural Control	-0.153	0.097	0.115		0.176	0.961	0.933	0.984	0.043
	Control Treatment	0.242	0.208	0.245		0.051	0.641	0.539	0.768	0.156
	Farmer/Fisher	-0.025	0.186	0.891		0.094	0.840	0.768	0.914	0.092
	Female	0.086	0.139	0.536		0.050	0.629	0.527	0.758	0.160
	Fijian	-1.251	0.237	0	***	0.991	1.000	1.000	1.000	0.000
	Y<$10	-0.173	0.137	0.206		0.192	0.970	0.947	0.988	0.038
	Chief	-0.166	0.446	0.71		0.186	0.967	0.943	0.986	0.040
	Access to Credit	0.303	0.219	0.167		0.011	0.165	0.108	0.273	0.365
	Current Microloan	-0.947	0.215	0	***	0.927	1.000	1.000	1.000	0.000

No Incentive R2=0.235; *p<0.1, **p<0.05, ***p<0.001; M A= Moderately Adaptive, M N-A= Moderately Non-Adaptive

						Predicted Probabilities				
		β	S.E	p		Adaptive	M A	Mixed	M N-A	Non-Adaptive
Dynamic ← Incentive	Behavioural Intention	-0.159	0.179	0.375		0.104	0.967	0.946	0.976	0.098
	Perceived Behavioural Control	-0.017	0.096	0.855		0.046	0.839	0.775	0.868	0.192
	Control Treatment	0.529	0.205	0.01	**	0.012	0.433	0.342	0.483	0.386
	Farmer/Fisher	-0.131	0.155	0.399		0.054	0.875	0.820	0.899	0.171
	Female	-0.073	0.121	0.547		0.048	0.849	0.788	0.877	0.186
	Fijian	-1.608	0.165	0	***	0.449	1.000	1.000	1.000	0.008
	Y<$10	0.159	0.071	0.025		0.029	0.716	0.631	0.757	0.255
	Chief	0.075	0.244	0.758		0.035	0.770	0.692	0.806	0.229
	Access to Credit	0.486	0.174	0.005	**	0.013	0.467	0.374	0.517	0.370
	Current Microloan	-0.441	0.182	0.015	**	0.097	0.962	0.937	0.971	0.104

Dynamic Incentive R2=0.397; *p<0.1, **p<0.05, ***p<0.001; M A= Moderately Adaptive, M N-A= Moderately Non-Adaptive

		β	S.E	p		Predicted Probabilities Adaptive	M A	Mixed	M N-A	Non-Adaptive
Green Incentive	← Behavioural Intention	-0.318	0.234	0.174		0.325	0.995	0.990	0.998	0.055
	Perceived Behavioural Control	-0.059	0.129	0.648		0.109	0.854	0.781	0.900	0.207
	Control Treatment	0.589	0.274	0.032	**	0.023	0.317	0.224	0.402	0.479
	Farmer/Fisher	-0.11	0.256	0.666		0.097	0.821	0.739	0.875	0.226
	Female	-0.053	0.172	0.757		0.088	0.790	0.701	0.850	0.244
	Fijian	-1.661	0.187	0	***	0.599	1.000	1.000	1.000	0.011
	Y<$10	0.126	0.191	0.509		0.062	0.673	0.567	0.751	0.303
	Chief	0.474	0.285	0.097		0.030	0.402	0.299	0.492	0.434
	Access to Credit	0.028	0.352	0.937		0.075	0.741	0.642	0.809	0.270
	Current Microloan	-0.346	0.298	0.246		0.144	0.918	0.867	0.947	0.162

Green Incentive R2=0.394; *p<0.1, **p<0.05, ***p<0.001; M A= Moderately Adaptive, M N-A= Moderately Non-Adaptive

The results did differ from the path analysis. We select only a few variables to base our comparison on here: in the green incentive condition, whilst not significant – adaptive over non-adaptive investments had similar probabilities in the Multinomial Probit when stated behaviour was regressed on intentions as it did in the Path analysis for the green incentive condition (path analysis adaptive= 0.346, non-adaptive= 0.012). Whilst we saw women had a greater probability of choosing adaptive investments in the path analysis under the green incentive condition (0.771), the same was not found in the probit. Probability of Fijians choosing adaptive investments was similar across the dynamic and green incentive conditions (path analysis dynamic incentive= 0.356; green incentive= 0.573). The probability of choosing non-adaptive investments was more pronounced in the dynamic and green incentive conditions when stated behaviour was regressed on high perceptions of control (compared to path analysis dynamic incentive=0.066; Green incentive=0.027) and the absence of information (compared to path analysis dynamic incentive= 0.155; Green incentive=0.125).